

INTEGRATING GREEN SKILL INTO TVET CURRICULUM: A STUDY IN THE DOMAIN OF KNOWLEDGE AND ATTITUDE

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Abstract

To date, the knowledge and attitudes towards green skills have not yet been integrated into TVET curricula as those elements needed by the green industry remain unclear. Therefore, this study aimed to identify the knowledge and attitudes towards green skills that need to be integrated into TVET curricula from the perspective of engineering lecturers in Malaysia Polytechnics. The nature of this study is quantitative in which a set of questionnaires was used for data collection. The present study involved 332 polytechnic lecturers from the field of engineering (civil, electrical and mechanical). The findings of this study show that the knowledge dimension related to green skill is composed of 12 elements, such as the knowledge of energy-saving, eco-friendly design, solid waste management, and so on. Whereas the attitude dimension consists of 11 elements of attitude, such as concern and awareness for environment protection, conservation of natural resources, green growth, and so on. In conclusion, the present research has come out with a list of knowledge and attitude elements of green skills that should be incorporated into TVET curricula to produce workers who are capable of meeting the needs of green industry.

Keywords: Attitude, Green skill, Knowledge, Polytechnic, TVET curricula

Abstrak

Sehingga kini, pengetahuan dan sikap terhadap kemahiran hijau masih belum diintegrasikan ke dalam kurikulum TVET kerana elemen-elemen yang diperlukan oleh industri hijau masih belum jelas. Oleh itu, kajian ini bertujuan untuk mengenal pasti pengetahuan dan sikap terhadap kemahiran hijau yang perlu diintegrasikan ke dalam kurikulum TVET dari perspektif pensyarah kejuruteraan di Politeknik Malaysia. Sifat kajian ini adalah kuantitatif di mana satu set soal selidik telah digunakan untuk pengumpulan data. Kajian ini melibatkan 332 pensyarah politeknik dari bidang kejuruteraan (awam, elektrik dan mekanikal). Dapatan kajian ini menunjukkan bahawa dimensi pengetahuan yang berkaitan dengan kemahiran hijau terdiri daripada 12 elemen, seperti pengetahuan tentang penjimatan tenaga, reka bentuk mesra alam, pengurusan sisa pepejal, dan sebagainya. Manakala dimensi sikap terdiri daripada 11 elemen sikap, seperti keprihatinan dan kesedaran terhadap perlindungan alam sekitar, pemuliharaan sumber asli, pertumbuhan hijau, dan sebagainya. Kesimpulannya, kajian ini telah menghasilkan senarai elemen pengetahuan dan sikap kemahiran hijau yang harus digabungkan ke dalam kurikulum TVET bagi menghasilkan pekerja yang mampu memenuhi keperluan industri hijau.

Kata kunci: Kemahiran hijau, Kurikulum TVET, Pengetahuan, Politeknik, Sikap

1.0 INTRODUCTION

In order to address the problem of environmental pollution and global warming, the existing economic model needs to be transformed into a more environmentally friendly economic model in order to sustain the social, economic and environmental development (Reilly, 2012). Such economic transformation requires cooperation from the industry, which means that the industrial sector needs to change its operations by incorporating green technology and applying environmentally friendly processes. By doing so, pollution from industry can be minimized.

These changes within the green industry will create green jobs and require workers with knowledge and positive attitude within the scope of environmental protection and natural resources conservation (ILO, 2011). Training institutions, such as polytechnics, play a significant role in training and producing workers who are able to meet the needs of the green industry. In this regard, the existing curricula need to be revised so that the knowledge and attitudes elements related to green skills become part of the curricula of the educational programs offered by the TVET institutions, especially polytechnic (Setiawan, 2017).

To date, majority of graduates, especially in the field of TVET, do not have the green skill knowledge required by the green industry (Zaime, Othman, Lai, Hasan & Md. Said, 2020). In addition, positive attitudes towards environmental protection are also lacking among the graduates (Ibrahim, Lai, Zaime, Lee, & Othman, 2020). One of the main reasons for this problem is because the elements of knowledge and attitudes are not emphasized in the TVET curricula. As far as polytechnic is concerned, integrating knowledge and attitudes related to environment protection into the existing curricula is challenging because those relevant knowledge and attitudes needed by the industry remain unclear. It is still not known what kind of knowledge and attitude should be embedded into the programs offered by polytechnics.

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In line with the abovementioned arguments, the study was conducted to find out the knowledge and attitude towards green skills that should be incorporated into the for the engineering program offered in TVET institutions, specifically in Polytechnic because there is a large number of polytechnics in Malaysia.

2.0 METHODS

This study adopted a descriptive survey design. The study areas involved were the polytechnics located in Peninsular Malaysia based on four zones namely northern, central, east coast and southern part of Peninsular Malaysia.

2.1 Research Sample

The study involved 332 polytechnic lecturers from three different departments, namely the Department of Civil Engineering, Department of Electrical Engineering, and Department of Mechanical Engineering. Proportional stratification sampling approach was adopted to select the research sample. Out of 332 lecturers, 201 (60%) are female lecturers, and the rest are male lecturers (n=131; 39%). The number of lecturers in three engineering fields have not much different which range between 107 to 116. In terms of education level, majority of the respondents are master holders. Detail demographic data of respondents are shown in Table 1.

Table 1: Demographic data of respondents

Gender	Frequency (n)	Percentage (%)
Male	131	39.5
Female	201	60.5
Field of expert		
Civil Eng.	116	34.9
Mechanical Eng.	107	32.2
Electrical Eng.	109	32.8
Qualification		
Diploma	13	3.9
Bachelor	148	44.6
Master	167	50.3
PhD	4	1.2

2.2 Instrument

The instrument used in this study was a set of questionnaires. The measurement scale used was a 5-point scale, ranging from 1 (strongly disagree), 2 (disagree), 3 (somewhat agree), 4 (agree) to 5 (strongly agree). The validity of the instrument was determined through expert validation in which three experts were selected to evaluate the questionnaire. The items were refined and improved based on the comments and suggestions from the experts. The questionnaire yielded a good reliability level, $\alpha = 0.97$.

The collected data were analyzed using descriptive statistics (mean score and standard deviation) because the purpose of this research only focused on investigating lecturers' perception or agreement on the items in the questionnaire. No inferential statistics

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was used since this article did not aim to make comparison and relationship between the variables.

3.0 RESULTS AND DISCUSSION

A total of 350 questionnaires were distributed to polytechnic lecturers from the Engineering Department. There were 332 respondents. Percentage of questionnaire returned, or response rate was recorded as 96%.

3.1 Integrating Environmental Knowledge in TVET

Table 2 shows the Mean and Standard Deviation of the items related to knowledge aspect of green skill. There are 12 items analyzed in this section.

Table 2: Mean (M) and Standard Deviation (SD) for the Knowledge Aspect

Item	Environmental Knowledge	Mean	SD
P1	Knowledge of energy saving	4.59	0.55
P2	Knowledge related to eco-friendly design in engineering fields (Civil, Electrical or Mechanical Engineering)	4.36	0.70
P3	Knowledge of environmental pollution	4.47	0.65
P4	Knowledge related to solid waste management and recycling practices	4.43	0.64
P5	Knowledge related to the use of water	4.53	0.57
P6	Knowledge of renewable energy sources	4.41	0.69
P7	Knowledge related to natural resource management that lead to the environment conservation	4.36	0.68
P8	Knowledge of sustainable lifestyle	4.27	0.71
P9	Knowledge of biodiversity	4.23	0.75

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P10	Knowledge related to laws of environmental protection	4.23	0.77
P11	Knowledge of environmental friendly production processes	4.29	0.73
P12	Knowledge of ecological systems	4.27	0.71
Overall mean		4.37	0.68

Based on Table 2, the results show an overall mean score of 4.37 (SD = 0.68). The overall mean score clearly indicates that the majority of lecturers agreed that the knowledge of green skills expressed in all knowledge-related items need to be incorporated into the TVET curricula. In addition, the highest mean score is 4.59 (SD = 0.55), which belongs to item P1 (*knowledge about energy savings helps in environment protection*). Meanwhile, the lowest mean score was 4.23 which involved two items namely "knowledge of biodiversity" (SD = 0.75) and "knowledge related to laws of environmental protection" (SD = 0.77). Although these items are at the lowest mean score, they are still at a high level of agreement.

All in all, the result of the analysis found that knowledge aspect of green skills that need to be applied in the TVET curricula are knowledge related to energy saving, environmental friendly design, environmental pollution, solid waste management, water usage, renewable energy resources, natural resource management, sustainable living style, biodiversity, environmental law, eco-friendly production processes and ecological systems.

The knowledge of energy-saving needs to be incorporated into the polytechnic curricula in order to allow the graduates to assist companies to plan and implement more energy efficient operation. According to Syed Hussain, Ismail and Md Noh (2013), inefficient energy management has become a major challenge to every country in the world. The challenge could be resolved collectively and effectively if we are equipped with knowledge on energy-saving methods. In addition, the knowledge related to environmental pollution also needs to be incorporated into the TVET curricula so that graduates can clearly understand

human behavior or activities that are harmful to the environment. One of the causes of environmental pollution is due to unplanned human activity. If this activity is not well managed, it will affect the quality of human life and the environment.

Knowledge of eco-friendly design also needs to be incorporated into the TVET so that graduates can come up with ideas for designing products that are environmentally friendly and can be diplomatic in industry. Only an eco-friendly design can reduce environmental pollution, which is no longer a new issue in the country. Thus, eco-friendly design will produce eco-friendly products. In the meantime, several approaches need to be taken to ensure that the environmentally friendly production process is implemented well. One is to provide understanding and instill interest in this concept (Ibrahim, 2011). Therefore, knowledge elements of environmentally friendly production processes should be incorporated into the TVET so that graduates can promote the concept of environmentally friendly production processes and further encourage industry to practice in their respective industries to ensure environmental sustainability (Baharum & Md.Saad, 2011).

Further, the element that needs to be incorporated into the TVET curricula is the knowledge related to solid waste management and recycling practices. It is particularly critical for graduates to acquire the knowledge of solid waste management and recycling practices as Malaysia is now facing solid waste disposal problem where 2.3 million tonnes of waste are dumped into the landfill once a year. This problem can be partially solved through recycling practices, however only 17.39% of Malaysians engage in recycling activities (Mat Yamin, 2016). In addition, TVET curricula should include knowledge on water assumption and conservation so that future graduates can assist management in dealing with the water crisis. UNESCO estimates that by 2025, an estimated 1.800 million people of the world will have to deal with water scarcity, and nearly two-thirds of the world's population will face water shortages (UNESCO, 2012). Prudent use of water is crucial to ensure a sustainable water supply in the future.

Knowledge on renewable energy resource management is also an element that needs to be incorporated into the TVET curricula in order to educate graduates on the threat of fossil energy shortages and provide insights into ways to acquire renewable energy sources in the future. The existing TVET curricula also needs to be revised by incorporating elements such as knowledge of efficient natural resources management and conservation to ensure continued use of natural resources (Er, Mohamad Awal & Shamsudin, 2015). Effective management of natural resources is determined by the level of community involvement and the extent to which the practice is applied to conserve society (Morris, 2017). The management of natural resources that society should pursue nowadays is by balancing the environmental, social and economic values of planning and decision making. Therefore, this role should be applied to younger generations as they are more vulnerable to environmental-related activities (Er et al., 2015).

The present findings also reveal that knowledge of sustainable lifestyles should be incorporated into the TVET to create graduates who can save the environment from further contamination, which will, in turn, improve the quality of life in general and health and safety in particular (Zamhari & Perumal, 2016). Some of the sustainable lifestyles that can be practiced are tree planting, efficient use of electrical appliances, and avoiding open burning (Binder & Blankenberg, 2017). In addition, knowledge of biodiversity and ecological systems is also included as one of the elements that needs to be incorporated into the TVET. The importance of biodiversity and ecological systems should be given attention to prevent climate change and natural disasters such as landslides, floods and drought (Evans, 2017). The responsibility of preserving biodiversity and the ecological system depends not only on the government but on the shoulder of people from all walks of life.

In the meantime, the government needs to enforce more stringent environmental laws at the federal, state or district levels. Environmental laws play an important role in environmental management. Nonetheless, implementation and enforcement of environmental

laws alone will not be effective without providing comprehensive understanding and education to industry and society (Erhabora & Don, 2016). Therefore, it is important to integrate the elements of knowledge related to environment protection laws into the TVET curricula so that future graduates have sufficient knowledge to develop economy without violating the environmental laws and taking environment sustainability for granted.

These findings are consistent with recent reviews of the Malaysian TVET landscape, which similarly conclude that environmental knowledge components such as energy efficiency, eco-design, waste management and resource conservation remain underrepresented in formal curricula despite being recognized as core requirements for the green economy (Chinedu, Saleem, & Wan Muda, 2023). Research findings from Lai, Baharom, Lee, Wan Muda, and Ana (2021) further confirm that knowledge-based elements, including environmental pollution control, renewable energy and natural resource management, continue to be identified as priority areas that require explicit curricular embedding rather than incidental coverage. At the international level, European experience shows that embedding environmental literacy directly into technical apprenticeships, rather than treating it as an add-on module, produces more consistent acquisition of green knowledge among vocational learners (Persson Thunqvist, Gustavsson, & Halvarsson Lundqvist, 2023). This reinforces the present study's argument that the twelve knowledge elements identified should be mainstreamed throughout the engineering syllabus structure of Malaysian polytechnics, rather than confined to a single standalone subject.

3.2 Integrating Attitude towards Green Skills into TVET Curricula

There are 11 items related to attitude that need to be applied in the TVET. Table 3 shows the results of the data analysis using mean and standard deviation.

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Table 3: Mean (M) and Standard Deviation (SD) for Attitude Aspect

Item	Attitude Aspect	Mean	SD
S1	Concern towards the environment	4.60	0.57
S2	Concern about the conservation of natural resources	4.54	0.60
S3	Concern about environmental protection	4.59	0.58
S4	Awareness of solid waste management through recycling practices	4.59	0.52
S5	Awareness of the importance of the ecological system	4.48	0.66
S6	Concern about the sustainability of nature/environment	4.50	0.61
S7	Awareness of energy-saving	4.62	0.50
S8	Concern about green growth in line with environment protection	4.55	0.58
S9	Concern about the climate change	4.50	0.63
S10	Awareness of recycling practices	4.61	0.51
S11	Awareness of the reuse of materials	4.62	0.52
Overall Mean		4.56	0.57

Based on Table 3, Both item S7 “awareness of the importance of energy saving” (SD = 0.50) and item S11 “awareness of the reuse of materials” (SD = 0.52) gained the highest mean score (M=4.62). The lowest mean score is item S5 “awareness of the importance of the ecological system” which yielded mean score of 4.48 (SD = 0.66). All in all, the overall mean score is 4.56 (SD = 0.57).

In general, the attitude related to green skills that need to be applied in the TVET curricula are concern and awareness towards environment protection, conservation of the natural resources, solid waste management, ecological systems, environmental sustainability, energy-saving, green growth, climate change, recycling practices, and reuse of material.

A study by Johar (2013) shows that individual attitude is one of the factors contributing to environmental problems. Given the increasing environmental concerns, the need to produce a generation and community that is aware of the responsibility to care for the environment is crucial (Johar, 2013). As such, education is seen as the best way to create a generation with positive attitude and concern towards environment protection (Ahmad, Mustafa, Abd Hamid & Abd Wahab, 2011). Through education, various information can be conveyed, such as current issues on the environment, research conducted, and the latest green technology where these pieces of information will alter our attitude/concern (Fabrigar, Petty, Smith & Crites, 2006). In short, the concern for environment protection should be incorporated into the TVET curricula so that graduates will appreciate the environment.

In addition, the behavior of concern for the conservation of natural resources and ecological systems must also be integrated into the TVET curricula so that graduates are aware and able to work together with authorities or any organization to deal with the problems related to natural resource conservation and ecological system protection. The disturbance of natural balance of ecological system will induce many problems such as global warming, floods and reduction of food supply (UdoInyang & Edem, 2020). Therefore, concerns for natural resources and ecological system conservation should be instilled in every individual through TVET. This is because natural resources and ecological system are usually affected by industrial activities and as such, TVET can be a channel to nurture industrial workers with high level of concern about natural resources ecological system conservation.

On top of that, it has been put forward by Zamhari and Perumal (2016) that in order to reduce the problem related to depletion of natural resources, the recycle practices should be introduced through TVET curricula. This is to ensure the TVET graduate have positive attitude towards recycling practices when they are working in the industry. In addition, awareness of solid waste management based on recycling practices is also important for TVET curricula. Disposal of solid waste through recycling practices can reduce disposal costs (Jereme, Alam

& Siwar, 2015). The concept of 3R (Reduce-Recycle-Reuse) is often used as a solution in the effort to dispose of solid waste (David, Thangavel & Sankriti, 2019). Most of the people know about the 3R concept, however the awareness to practice it is still lacking. This is supported by Sakawi, Ayup & Sukimi (2017) who stated that community involvement in issues related to the environment is still at a low level even when approaches such as mass media campaigns have been implemented. Therefore, the existing TVET needs to be revised by incorporating solid waste management awareness elements, recycling and reuse of materials to instill awareness among graduates.

The element of energy-saving awareness is also no exception to the TVET curricula. One of the example activities that promotes energy-saving awareness is the “Earth Hour” that has been celebrated as an annual event by millions of people from more than 190 countries and territories (Earth Hour, 2021). It has not been measured how much energy was saved during the event, however, it is important to note that there are more and more people aware of the importance of energy-saving that has huge impact on the environment. Energy-saving awareness is not just limited to during Earth Hours, it must be continuously practiced in order to sustain the earth. In fact, the behavior and awareness of energy-saving it should be inculcated and practiced in everyday life. Given the importance of energy-saving to environment, the energy saving awareness should be applied in TVET curricula.

Based on the present findings, climate change awareness is another important element for TVET curricula as the awareness of climate change is still low (Meyer, 2014). Climate change can cause severe natural phenomena or disasters. The climate change not only affects the ecosystem on earth but also affects human health and mental health (Hayes, Blashki, Wiseman, Burke, & Reifels, 2018; Luber & Prudent, 2009). Efforts to resolve climate change issues should be addressed through a comprehensive educational process.

Concerns in favor of green growth can sustain the environment. Green growth is not a substitute for sustainable development. Instead, it provides a practical and flexible approach

to achieving measurable progress in environmental, economic and social aspects (OECD, 2018). Therefore, awareness of the importance of green growth should be emphasized and strengthened through education where TVET institutions play a role in implementing this agenda (Mustapha, 2016).

The present study's emphasis on cultivating positive environmental attitudes through TVET aligns with the broader conceptualization of green skills as encompassing not only technical competence but also values, motivation and willingness to act sustainably in the workplace (Cabral & Dhar, 2019). At the policy level, the European Training Foundation has likewise argued that attitudinal readiness for the green transition, including awareness of climate change, resource conservation and sustainable consumption, must be deliberately cultivated through vocational curricula rather than assumed to develop spontaneously through technical training alone (ETF, 2021). Additionally, according to Yunus, Mohamad, Bahari, and Ngadimin, (2024), affective elements, such as environmental concern and willingness to adopt sustainable practices, are increasingly treated as core graduate attributes alongside technical knowledge, particularly as industries respond to national low-carbon targets. Taken together, these findings strengthen the justification for embedding the eleven attitude elements identified in this study as explicit, assessable learning outcomes within TVET programs, rather than as implicit values conveyed only through informal exposure

4.0 CONCLUSION

The results of this study show that the knowledge aspect related to green skills that need to be integrated into the TVET curriculum in Polytechnic are energy saving, environmentally friendly design, environmental pollution, solid waste management, water usage, renewable energy resources, natural resource management, sustainable living style, biodiversity, environmental law, eco-friendly production processes, and ecological systems. Whereas the attitude aspects pertain to the concern and awareness towards environmental protection,

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conservation of natural resources, solid waste management, ecological systems, environmental sustainability, energy savings, green growth, climate change, recycling practices, and reuse of material. With the knowledge and attitude elements of green skills embedded in the TVET curricula, the better-quality graduates will be able to meet the needs of the green industry and thus contribute to sustainable economic, social and environmental development.

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