



# Integrating Green Skills into TVET Curricula in Polytechnics Malaysia

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DOI: <https://doi.org/10.30880/jtet.2021.13.03.002>

Received 06<sup>th</sup> January 2021; Accepted 04<sup>th</sup> May 2021; Available online 30<sup>th</sup> September 2021

**Abstract:** Green skills are very much needed by green industry. Nevertheless, many TVET institutions have not yet embedded green skill elements into the programme's curriculum because it is still unclear concerning the types of green skills demanded by the green industry. Therefore, this research was conducted to identify the green skills that should be integrated into TVET curricula from the perspective of engineering lecturers in Polytechnics. The nature of this research was descriptive in which the data were collected using self-developed questionnaire. Four Polytechnics located in the East Coast, Northern, Central, and Southern of Malaysia were involved. A total of 332 engineering lecturers from three departments of engineering (Civil, Electrical, and Mechanical Engineering) were invited to participate in this research. The findings revealed that the TVET curricular should contain some of these green skills: problem solving skill related to environmental pollution, interpretative skill on environmental phenomena, research skill on environmental issues, data collection skill, analytical skill, exploitation skill on green technology, management skill on natural resources, design skill, controlling skill on environment pollution, raw material management skill, energy saving skill, recycling skill, and reuse skill. It is suggested that Polytechnics should embed these green skills into their programme curricula in order to produce graduates who are able to meet the needs of green industry.

**Keywords:** Green skill, TVET, curriculum, polytechnics

## 1. Introduction

In the 21st century, green technology is advancing rapidly and has gained attention from the government as well as industrial sectors. In Malaysia, green growth has been outlined as one of the six thrusts in the 11th Malaysia Plan which focuses on sustainable environmental development (Rancangan Malaysia Ke-11 2016-2020, 2015). In recent years, sustainable development in almost every aspect of life has been actively discussed within the social and scientific community due to increasing awareness towards environmental protection and conservation.

Most of the previous and current economic activities do not contribute to sustainable development from social, economic and environmental aspects due to low technological and technical levels (Setiawan, 2017). Countries around the world are now experiencing the consequences of environmental pollution and facing the challenges of environmental degradation as well as climate change (ILO, 2011). Environmental pollution will result in weather changes, extreme droughts or monsoon season, sea-level rise, global warming and so on (Mousavi, Irish, Frey, Olivera, & Edge, 2011). All countries, especially the underdeveloped and developing ones, have to pay high costs due to environmental problems that will eventually affect the economic and social activities adversely (Sern, Zaime, & Foong, 2018).

In order to mitigate the environmental problems, the existing economic model should be transformed into a green economy model. The green economy model is seen as an alternative model that will be beneficial for nation development without inducing detrimental effects on the environment (Reilly, 2012). This is because the shift of the conventional economy model to a greener economy will trigger the creation of new green technologies, increase investment in the green industry, and generate more new green jobs (ILO, 2011). Green jobs require workers with green skills (Setiawan, 2017). However, the majority of graduates, especially in the field of TVET, do not have the green skills required by the green industry. This is because the elements of green skills are not emphasized in the TVET curriculum. Without green skills, workers might have difficulty accomplishing the given tasks. In line with the abovementioned arguments, the study was conducted to find out the green skills that should be incorporated into the curriculum for the engineering program offered in TVET institutions, specifically in Polytechnic because there is a large number of polytechnics in Malaysia.

Within the context of the 21<sup>st</sup> century, the green economy is seen as an economic model that serves as a potential driver for national development. Green economy does not only generate economy growth, but it also puts the focus on sustainable development which, in turn, will improve the quality of life of the people in the aspects of economy, social, and environment (OECD, 2018). Nevertheless, the benefits of green economy will not be visible without supports from the green industry. In general, the green industry means the industry that is friendly to the environment. For instance, the waste and recycling industry is considered green industry because the nature of the industry is friendly to the environment. Likewise, the construction industry can also be regarded as a green industry if the industry introduces and implements environmentally-friendly policies in its operations (Heong, Sern, Kiong, & Binti Mohamad, 2016).

The green industry will create green jobs, whereas the conventional work can be “greened” by integrating green elements into it (Sern, Zaime, & Foong, 2018). For example, the interior designer is considered a green work if the design integrates an environmentally friendly concept, such as designing a building that has natural ventilation systems or optimizing the use of natural lighting. Specifically, green jobs are any work either in agriculture, manufacturing, research and development (R & D), administration and service activities that contribute to the preservation and conservation of environmental quality (UNEP, 2008 ).

Green jobs require workers with green skills. In a broad sense, green skills are defined as the skills for sustainability in which the skills are inclusive of technical skills, knowledge, values and attitudes needed by a worker to develop and sustain the social, economic and environmental aspects (McDonald, Condon, & Riordan, 2012 ).

### 3. Methodology

The present research applied a survey technique through a quantitative approach. Four polytechnics were selected from the east coast, northern, central, and southern parts of Peninsular Malaysia.

#### 3.1 Research Sampling

A total of 332 engineering lecturers from the Department of Civil Engineering (116 lecturers), Department of Mechanical Engineering (107 lecturers), and Department of Electrical Engineering (109 lecturers) were invited to participate in this research. The research sample was composed of 60.5% (201) female lecturers and 39.5% (131) male lecturers.

#### 3.2 Instrument

The engineering lecturers’ perceptions on green skills were measured using a questionnaire which comprised 13 green skills. The measurement scale used in the questionnaire was a 5-point scale which consisted of 1 (strongly disagree), 2 (disagree), 3 (approximate), 4 (agree) and 5 (strongly agree). The validity of the instrument was determined through expert validity where three experts were selected to assess the questionnaire. Correction and refinement of items were done based on the comments and suggestions from the experts. Besides, the questionnaire has obtained a sufficient level of reliability ( $\alpha = 0.97$ ).

### 4. Findings

A total of 350 questionnaires were distributed to the polytechnic lecturers from the engineering departments. 332 respondents were responding. The percentage of questionnaires returned or feedback rate was 96%. The data were analysed by using a descriptive statistic to obtain a mean score. Table 1 shows the mean score and the standard deviation of the green skill items.

**Table 1 - Mean Score (M) and Standard Deviation (SD) for Green Skills**

<i>The following green skills should be integrated into TVET programme’s curriculum:</i>	<b>M</b>	<b>SD</b>
Problem-solving skill related to environment pollution.	4.36	0.67
Interpretative skill on environmental phenomena	4.28	0.73
Research skill on environmental issues	4.33	0.71
Data collection skill	4.27	0.77

**Table 1 - Continue**

<i>The following green skills should be integrated into TVET programme's curriculum:</i>	<b>M</b>	<b>SD</b>
Analytical skill	4.24	0.79
Exploitation skill on green technology	4.28	0.76
Management skill on natural resources	4.35	0.71
Design skill	4.36	0.74
Controlling skill on environment pollution	4.40	0.67
Raw material management skill	4.39	0.66
Energy saving skill	4.49	0.59
Recycling skill	4.51	0.63
Reuse skill	4.54	0.62

Based on the results illustrated in Table 1, in general, the mean scores for the analysed items locate between 4.24 to 4.54. This indicated that all items are at a high level. In specific, item K13 (recycling skill) has gained the highest mean (M=4.54; SP = 0.62), whereas “analytical skill”, which is represented by item K5, has yielded the lowest mean score (M=4.24; SP = 0.79).

## 5. Discussion

The findings show that, from the perspective of engineering lecturers in Polytechnics, the green skills should be embedded in the TVET curricula are problem-solving skill related to environmental pollution, interpretative skill on environmental phenomena, exploitation skill on green technology, management skill on natural resources, design skill, controlling skill on environment pollution, raw material management skill, energy-saving skill, recycling skill, and reuse skill.

Environmental pollution has brought about devastating effects to many countries. According to Steele (2010), everyone should be knowledgeable concerning the consequences of various types of environmental pollution and skillful in environmental protection. Since most of the pollutions are caused by industrial activities (e.g., emission of greenhouse gases), workers with environmental problem-solving skill are very much needed to assist industry to move to a greener working environment. In light of this reason, environmental problem-solving skills should be integrated into the TVET curricula, so that the TVET graduates are able to apply this skill to solve the environmental problems in the industry.

In addition, the interpretative skills on environmental phenomena, data collection skills and analytical skills need to be integrated into TVET curricula as well (Ibrahim et al., 2020). These three skills are inseparable as they are needed to enable graduates to perform tasks related to collect data, analyze data and make an accurate interpretation of data related to the environmental phenomena. The correct interpretation is able to generate ideas that help people understand nature profoundly, and thereby changing the perceptions and behaviour of an individual (Youngetob & Hostetler, 2015). On top of that, research skill on environmental issues is needed to be in the TVET curricula because employers start looking for graduates who can conduct research (Doyle, 2018). This research skill goes together with data collection skills and analytical skills. Indirectly, these skills are complemented with other skills such as communication skills, organizational skills, time management skills and so on.

The other relevant skill is exploitation skill on green technology. Green technology refers to the development and application of products, equipment and systems to preserve the environment and conserve natural resources while minimizing the damaging effects of industrial/human activities on humans, flora and fauna (Mohd Shafiei & Abadi, 2017). The application of Green Technology is in line with the concept of sustainable development. Therefore, the exploitation skill on green technology is vital to be included in the TVET curriculum so that TVET graduates have an adequate level of skill in applying green technology when working in the green industry.

Natural resource management skills should also be applied in the TVET curricula. Effective natural resource management can be portrayed through two terms, namely efficiency and sufficiency (Khosla, 2017). Efficiency is defined as a way of managing natural resources that can reduce wastage, wastes, pollution and misuse of natural resources, while sufficiency is the extent to which the natural resources can be utilized by present and future generations for the well-being of mankind. Besides, raw material management skill is equally important and should be part of TVET programs' curriculum. If there is no proper planning and coordination in the use of raw materials (e.g., steel in automobile production, or rubber in hand glove manufacturing), wastage in manufacturing will occur and also produce more manufacturing wastes. If those manufacturing wastes are not recycled or reused and are not appropriately disposed of, then they will certainly pose a threat to the environment (Probst, Frideres, Cambier, Solberg, & Lide, 2016). For that reason, TVET graduates who are equipped with raw material management skill is very much demanded by the green industry as they can figure out solutions with new technologies that will increase the quantity and quality of raw materials through proper planning and optimal recycle and reuse procedure.

Apart from the above, design skills should not be neglected in TVET curricula. To date, there are still a lot of industrial products produced without using eco-friendly design. Non-eco-friendly designs can affect environmental quality and become one of the major contributors to environmental degradation (Adham, Siwar, & Atan, 2012).

Therefore, eco-friendly design skills must be incorporated into the TVET curricula to provide exposure and training to graduates who will be assisting the industry to produce eco-friendly products as well as eco-friendly services by using the design skill that they learnt in the training institutions (Adham, Siwar, & Atan, 2012).

The next important green skill that should be included in the TVET curricula is controlling skills for environment pollution. Water, air and land are the three major resources that are likely to be contaminated due to industrial activities. Industrial wastes, especially chemical substances, discarded into the lakes and rivers can easily contaminate water and affect the water quality. In addition, contaminated air may pose a risk to human health (e.g., causing lung cancer) (Nichols, 2017) and induce other environmental problems (e.g., thinning of the ozone layer). Similarly, polluted land or soil destroys habitat and irrigation. Any action taken to deal with environmental pollution might not be working if the action is not followed by pragmatic control in terms of timeframe and sustainable action. Therefore, control skills for environmental pollution are needed to be included in the TVET curricula in order to control the problem solution through effective measures that can minimize environmental pollution.

Energy-saving skill is another important green skill that should be taken into account when designing a TVET curriculum. Rapid industrial development and population growth have resulted in high energy demand. Unmanaged energy consumption will cause environmental pollution problems as most of the energy generated is using unrenovable sources such as charcoal and petroleum (Syed Hussain, Ismail, & Md Noh, 2013). It is clear that energy-saving skill is necessary to reduce operating costs and, at the same time, enhance the quality of the environment.

Meanwhile, material reuse skills and materials recycling skills are also needed in the TVET curriculum. Although society, in general, has a clear idea regarding recycling and reuse of used materials, it still lacking in practical aspects. Many people do not practice “recycling” and “reuse” neither in working nor in daily life. This statement is supported by Mat Yamin (2015) who reported that a total of 33, 000 tons of solid wastes are generated on an average basis and this shows that the solid waste produced is about 12 million tons a year. At least 95 to 97 percent of the solid waste ends up at the landfill, while only three to five percent are processed at recycling factories. Therefore, both recycling and reuse skills are extremely important in reducing wastes and thereby minimizing the pollution caused by solid waste, cutting down the use of raw materials and saving energy in making products from raw materials which ultimately leads to conservation and preservation of nature (Sakawi, Ayup & Sukimi, 2017).

## 6. Conclusion

In addressing the problems related to environmental pollution and global warming, the existing economic model needs to be shifted to a more environmental-friendly economic model in order to sustain social, economic and environmental development. This economic transformation requires cooperation and supports from the industry. For instance, industrial organisations can make the changes by integrating green elements into their administrative and production operations. These changes will create green jobs and require workers with green skills.

Training institutions, such as polytechnics, play a significant role in producing workers who are able to meet the needs of the green industry. Therefore, the existing curricula in training institutions need to be revised in order to embed the element of green skills into the curricula of the program of study offered by educational institutions.

Based on the findings of the present study, several green skills should be integrated into the engineering program curriculum in Polytechnic. In specific, those green skills are problem-solving skills related to environmental pollution, interpretative skills on environmental phenomena, research skills on environmental issues, data collection skills, analytical skills, exploitation skills on green technology, management skills on natural resources, design skills, controlling skills on environment pollution, raw material management skill, energy-saving skill, recycling skill, and reuse skill. The curricula that contain the element of green skills will be able to produce those who are able to meet the industrial needs and contribute to economic, social and environmental sustainability.

## Acknowledgement

This research project is partially supported by Universiti Tun Hussein Onn Malaysia (UTHM) contract grant with vot no: H279.

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