



Sustainable Design & Product and Health & Safety Awareness among Public University Students

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Abstract

In this article, the focus is on understanding the awareness of sustainable design & product and health & safety among engineering and architectural students at university levels as these young graduates are representative of the workforce. This survey was conducted at five public universities in Peninsular Malaysia. On average, the majority of respondents provided positive responses (more than 80%) on the needs of sustainable design & product and health & safety aspects in their workplaces. These figures bode well for such an ambitious country to be on par with developed countries. It is also noteworthy to highlight that a significant portion who are not comfortable with investing with sustainable features.

Keywords: Sustainable Design & Products; Health and Safety (H&S)

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1.0 Introduction

This article is the third part of a survey at five public universities in Peninsular Malaysia on ethics, science, technology, engineering and mathematics (STEM), health & safety and technological advancement issues. In the first article, ethics and its consequences in modernisation and technological advancement issues have been discussed (Harun et al., 2016). In the second article, the low level of STEM awareness was the worrying trend among university students (Harun et al., 2018). In this article, sustainable design & product and health & safety (H&S) is the focus. Sustainability affects many aspects of the human world, from business to technology, to the environment and the social sciences. Politicians, governments, business community, employers & workers alike, the society at large and even university graduates discuss the matter at great lengths. Sudden policy changes on sustainable development sometimes cause economic and social unrest. One definition of 'sustainability' is how natural systems work, remain diverse and produce everything it needs for the environment to remain in balance. It also acknowledges that people consume resources to sustain their lives. A sustainable way of life is a central goal for our civilisation. Another definition of sustainable design, according to The Philosophy of Sustainable Design by McLennan (2004), designers should "eliminate negative environmental impact through skilful,

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sensitive design and others. While sustainable products were defined as products that provide ecological, social, and economic benefits while protecting public health and environment over their whole life cycle, from the extraction of raw materials until the final disposal. Developing a sustainable future requires an integrated, systems-level holistic relook of our culture. Cultural transitions, need to occur through an evolutionary process to stimulate and seed this evolutionary relook of the existing culture to achieve global sustainability (Beddoe et al., 2009).

In a local context, despite achieving a moderate and yet healthy economic expansion of about 5% a year for the past two decades, Malaysia rapid growth rate has been attributed mainly in its ability to exploit its minerals, successful agricultural activities on its fertile lands and stable political environment suitable for businesses. There have been active discussions and activities were analysing the issues, barriers, and opportunities of environmental approaches, formulation of national policies and responsible authorities including implementation agencies, challenges and the role of the country in tackling ecological issues (Mokhtsim et al., 2014). The workforce, as well as the public need to put more remarkable initiatives in sustainable design and product in their daily lives. For example, although the country is blessed with massive rainfalls, water shortage to households seems unavoidable, especially in urban areas. This can be observed in any two-weeks dry spell, and a municipality will announce a water rationing. This can be avoided if households install rainwater harvesting systems at their houses. The government must encourage people to install the scenario by offering a discount on bills for installed rainwater systems and by regulating water tariffs for those who have the systems installed. An installed rainwater harvesting does not only reduce household monthly water bills in the short run, but it also helps the government to reduce its burden in ensuring sufficient water supply, usually done by constructing dams or transferring water from nearby states with an excess of water. Both of the options are very expensive.

A call in a holistic review in the health and safety (H&S) implementation is equally important as it is also aligned with Malaysia's quest to achieve a developed-economy status by the end of the decade. The World Health Organization (WHO) has estimated that close to a quarter of global disease is attributed to environmental exposures, with over 13 million fatalities annually due to environmental causes, nearly a third of fatalities and disease in the least developed regions. Occupational Safety and Health (OSH) of Malaysia is concerned with preserving and protecting human and facility resources in the workplace. OSH is also a field wherein professionals attempt to prevent catastrophic losses. Economically and socially, OSH has become an important issue (Environmental Technology, 2007). As Malaysia embarks upon high-technology applications such as building large ports, undergrounds and underwater tunnels, and huge reservoirs to support water supply and hydroelectricity generations, the needs of proper H&S procedures at all levels have become increasingly important. This is to ensure that no catastrophic accidents exacerbate to a huge economic loss to take place in a relatively small country. The presence of health and safety officers (HSO) can improve organisational safety culture by creating more and better safety-related interactions both within the HSO and between HSO members and the workshop (Nielsen, 2014). An earlier study has shown that the culture of H&S such as company policy have big impacts on (Chinda and Mohamed, 2008; Hale et. al., 2010), such as reduced accidents, etc.

Nurturing the attitude and values, commitment and skills needed to preserve and protect the environment start at an early level. Hence educators play an influential role in developing new patterns of behaviours for individuals (Mat Said, et. al., 2013). A proper teaching method could significantly increase students' understanding of H&S issues (Harun et. al., 2015). Therefore, if institutions of higher learning could incorporate proper H&S elements in their curriculum, graduates entering job markets would have sufficient training to ensure a culture adhering to H&S requirements.

2.0 Methodology

Discussions on the type and nature of questions have been held among researchers from selected public universities. A survey has been conducted at five public universities in Peninsular Malaysia. These universities were Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), Universiti Teknologi Malaysia (UTM), Universiti Teknologi MARA (UiTM) and Universiti Malaysia Pahang (UMP). Since the volume of participation was large, an internet-based method was used to simplify the works. Co-researchers at a selected university was expected to promote the survey links to students. Since sustainable design issues are usually embedded in cornerstone and capstone courses as well as in the final year project (FYP), only advanced students i.e. year three and four students were invited to participate. Moreover, year one and two students might have not finished safety topics usually in laboratories-based courses. Out of 568 students who participated, the biggest participation was from UKM (54.2%). This was followed by USM (18.1%), and then by UiTM (16.2), UMP (9.7%) and UTM (1.8%). It is important to note that since this is a study on safety, the students were not here asked specifically at their workplaces (where this might be the most appropriate location). The online system allowed the students to access and participate in the survey as long as the student had an internet access. Nevertheless, all students have at least enrolled in compulsory laboratory-related courses which were in the first and second years of engineering programmes at UKM. These were the questions asked:

1. Do you understand about design and product sustainability?
2. Design and product sustainability is important to me.
3. Would you adopt sustainable design and product although such an approach incurs higher costs at the start?
4. Do you understand the requirements of health and safety (H&S)?
5. Are H&S requirements important to your daily life?
6. Do you understand PPE?
7. Do the laboratories or workshops you use practice H&S rules?

3.0 Results and Discussion

The first set of questions to be discussed here is on students' understanding of sustainable design & product. The first response in Fig.1 is on the question "Do you understand about design and product sustainability?" 21.1% and 49.5% of students chose strongly agree and agree respectively. This adds up to a total of 70.6% who strongly agree and agree. The same survey question was conducted among UKM year-three engineering students only to test students' response to a set of project on techniques suggested to be effective in embedding education for sustainable development (ESD) in sustainability topics (Coral, 2009; Holmberg et. al., 2008) such as the use of environmental issues as the basis for experiments or exercises and discussion among lecturers. 71.4% of students chose to agree in that study, however, after the topics complying with ESD techniques were introduced in one of the courses, the same response rose to 77.7% suggesting the effectiveness of the techniques (Harun et al., 2015). It is worth mentioning that the existing study (subjects consisted of the bigger population from five universities) yields similar results as in the previous studies (subjects consists of the student from UKM) i.e. 70.6% in the existing and 71.4% in the previous studies who chose strongly agree and agree to this question.

Fig.1 also shows responses to the question "design and product sustainability is important to me". 38.4% and 46.8% chose strongly agree and agree respectively, or a total of 85.2%. Not all students who positively responded to the importance of design and product sustainability were prepared to implement this, as only 64.9% chose strongly agree and agree on the next question "would you adopt sustainable design and product although such approach incurs higher costs at the start?". The percentage of students who chose neutral increased by 15.7% (from 13.9% to 29.6%). The shift from strongly agree and agree to neutral might suggest a wait-and-see attitude among students because of the high costs associated with implementing sustainability features.

We compare the results here to sustainable features in property development projects in Malaysia as properties constitute a large share of resources and energy. Owning properties is on average one of the largest burden among younger generation Malaysians. The type of house one lives in also reflect the quality of life. Using content analysis, company websites and annual reports, the level of sustainable practices among property companies is low, although increasing (Razali and Mohd Adnan, 2015). One of the initiatives is to encourage housing developers in Malaysia to "go green" by incorporating renewable energy technology into buildings, opting for passive designs, and improving the shading and positioning of the building to reduce cooling costs.

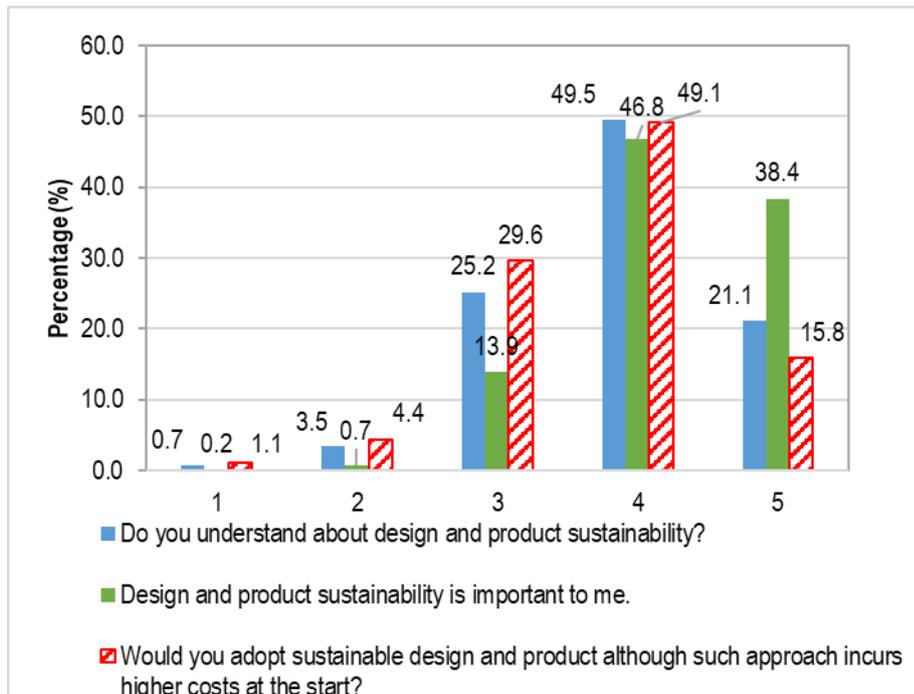


Fig.1: Questions on product & design sustainability.

Based on the ranking of 16 attributes (such as *sustainable concept mentioned*), there were only several public-listed property companies in Malaysia such as Mah Sing Group, Encorp Berhad, Sunway Group, KLCC Property Holdings, Country Heights and KLCC Property Holdings, demonstrated leadership in sustainability practices through their projects. These achievements were still far below those of international players in other countries such as in Singapore, Australia, and the UK. The authors in that study attributed the low level of implementations of sustainable features due to skeptics especially on the profit-and-cost factors among the aforementioned companies.

The next half of the article is on student understanding of H&S. A significantly large number of students chose strongly agree (43.7%) and agree (43.0%) to question "do you understand the requirements of H&S?" These results are shown in Fig.2. This makes

the total number of strongly agree and agree with 86.7%, a slightly higher percentage than the previous study conducted at UKM alone (Harun *et al.*, 2016).

Fig.2 also shows the results for the question “are H&S requirements important in your daily lives?” 55.1% and 37.1% chose strongly agree and agree respectively. The total percentage of agree and strongly agree stood at 92.2%. The very positive numbers here are indications that the country would have graduates who are ready to observe a high level of H&S practices at their workplaces.

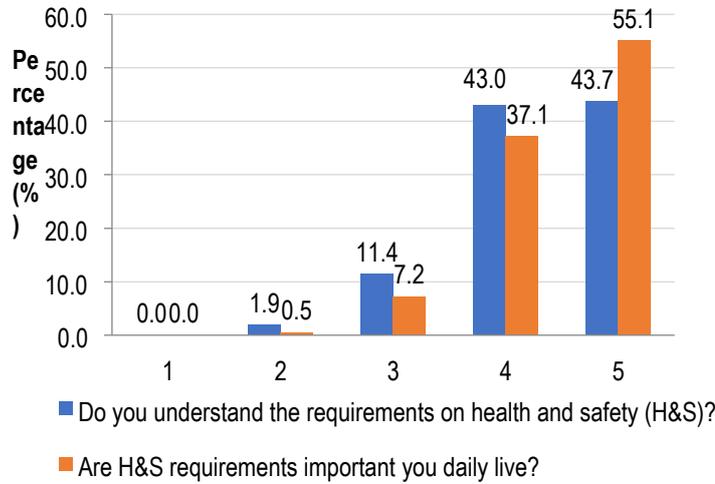


Fig.2: General question on understanding of health & safety (H&S)

Fig.3 shows the responses on understanding one of the requirements in H&S i.e. personal protective equipment or PPE. PPE is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Most technical students will have to wear at least three or four PPEs in the entire usually 4-year engineering programme or 5-year architectural programme. For example, a mechanical student will have to wear a pair of gloves, goggles and safety shoes when using a lathe machine in a workshop. Interestingly, a significantly large number of students chose strongly disagree (11.8%) and disagree (16.5) to question “do you understand PPE?”. In the previous study, performed among UKM engineering and architectural students only, the low scores among students who understood PPE could be improved after a lecture consisting of H&S were held (Harun *et al.*, 2016). Students who chose strongly agree and agree to this question made 55.7%. The median stood at neutral and this is not good news if these students are hired by companies and assigned to critical areas requiring stringent H&S requirements without another round of H&S training.

The next question is “do the laboratories or workshop you use practice H&S rules?” 82.4% of respondents chose strongly agree and agree to this question. The positive response here is expected because of stringent requirements by the accreditation bodies, for example, the Engineering Accreditation Council (EAC) and Architectural Examination Council (AEC), two bodies delegated by the authorities i.e. Board of Engineers Malaysia and Board of Architects Malaysia respectively.

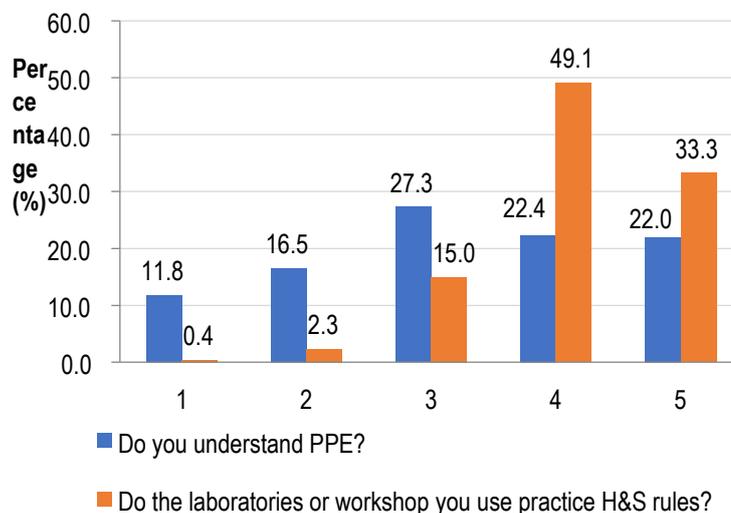


Fig.3: The practice and implementations of H&S

4.0 Conclusion

A survey on students' awareness of sustainable design & product and health & safety has been successfully conducted at five public universities in Peninsular Malaysia. The survey results show positive responses among students bode well for the nation as it prepares to be a developed-nation by 2025. Despite the results, the government and employer alike shall observe the reluctance of graduates to implement design and product sustainability costly features. There are always costs implications for large-scale sustainable projects such as hydroelectricity to replace hydrocarbon fuels for electricity generations and rolling out new fuels and vehicles to comply with internationally recognized emission standards. Likewise, students inability to recognize the word PPE shall also be addressed with precautions. It might take a cultural change at university levels because the concept of safety culture is still vague and not easily translated into actions (Nielsen, 2014).

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References

- Harun, Z., Mansor, S., Mahmud, A. S., Hashim H., Mohamed, Z. and Ahmad, K. A. (2016). A Survey on Engineering Ethics and Technological Advancement among Malaysian Public University Students. *IEEE 8th International Conference on Engineering Education (ICEED)*, 56-59.
- Harun, Z., Rasani, M. R., Wan Mahmood, W. M. F. and Hashim, H. (2019). Analysis of STEM Understanding among Engineering Students in Selected Public Universities in Malaysia, submitted to *Journal of Advanced Manufacturing Technology*.
- McLennan J. F. (2004). *The Philosophy of Sustainable Design*. Ecotone Publishing.
- Beddoe, R., Costanza, R., Farley, J., Garza, E., Kent, J., Kubiszewski, I., Martinez, L., McCowen, T., Murphy, K., Myers, N., Ogden, Z., Stapleton, K. and Woodward, J. (2009). Overcoming Systemic Roadblocks to Sustainability: The Evolutionary Redesign of Worldviews, Institutions, and Technologies. *Proceedings of the National Academy of Sciences*, 106(8), 2483-2489.
- Mokhtsim N. and Salleh, K. O. (2014). Malaysia's Efforts Toward Achieving a Sustainable Development: Issues, Challenges and Prospects. *Procedia-Social and Behavioral Sciences*, 120, 299-307.
- Abdulrazak S. R. and Ahmad, F. S. (2014). Sustainable Development: A Malaysian Perspective. *Procedia-Social and Behavioral Sciences*, 164, 237-241.
- Environmental Technology, Occupational Safety and Health: Workers and Industrial Safety Monitoring For Sustainable Work Environment Development, (2013). <https://www.envirotech-online.com/article/health-and-safety/10/universitun/occupational-safety-and-health-workers-and-industrial-safety-monitoring-forsustainable-workenvironment-development/1414>, Retrieved 29 June 2017.
- Nielsen. K. J. (2014). Improving Safety Culture Through the Health And Safety Organization: A Case Study. *Journal of Safety Research*, 48, 7–17.
- Chinda, T. and Mohamed, S. (2008). "Structural Equation Model Of Construction Safety Culture, *Engineering, Construction and Architectural Management*, 15(2), 114-131.
- Hale, A. R., Guldenmund, F. W., van Loenhout, P. L. C. H. and Oh. J. I. H. (2010). Evaluating Safety Management And Culture Interventions to Improve Safety: Effective Intervention Strategies. *Safety Science*, 48, 1026–1035.
- Mat Said, A., Ahmadun F., Paim, L. and Masud, J. (2013). Environmental Concerns, Knowledge And Practices Gap among Malaysian Teachers. *International Journal of Sustainability in Higher Education*, 4(4), 305-313.
- Harun, Z., Hashim, H., Saibani, N. and Wan Mahmood, W. M. F. (2015). Effectiveness Of Teaching Technics In Sustainability topics, *Journal of Engineering Science and Technology*, Special Issue on UKM Teaching and Learning Congress, 61-67.
- Coral. J. S. (2009). *Engineering Education for a Sustainable Future*, PhD thesis, Universtat Politecnica de Catalunya, Barcelona.
- Holmberg, J., Svanström, M., Peet, D. J., Mulder, K., Ferrer-Balas, D. and Segalás, J. (2008) Embedding Sustainability In Higher Education Through Interaction with Lecturers: Case Studies from Three European Technical Universities. *European Journal of Engineering Education*, 33(3), 271-282.
- Razali, M. N. and Mohd Adnan, Y. (2015). Sustainable Property Development By Malaysian Property Companies. *Property Management*, 33(15), 451-477.
- Harun, Z., Arshad, I., Yaakob, Z., Nordin, R. and Hashim. H. (2016). The Effectiveness of Health and Safety Topics in an Engineering Course Syllabus, *Pertanika Journal Of Social Science And Humanities*, 24, 155-166.