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Engineering Technology Curriculum Development: Bridging the Gap Between Academia-Industry Through Undergraduate Final Year Project

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Abstract

The Malaysia Higher Education sector has experienced major growth in the 60 years since its independence. In order for Malaysia to keep up with the increasingly challenging and competitive global economy, higher education must be sustainably transformed. One of the key shifts highlighted in the Malaysia Higher Education Blueprint 2015-2025 is through empowering Technology, Vocational, Education and Training (TVET) programmes. Although the graduates from the Malaysian Technical University Network (MTUN) have shown significant achievements through the Graduate Employability rates, there are some pressing issues that still need to be addressed. The industry practitioners have raised concerns about graduates that does not meet employers' expectations and is not well-prepared to enter the workforce. As part of the initiative to address the gap above, the Engineering Technology Infrastructure Program (ETIM) at Universiti Malaysia Pahang (UMP) has taken the effort to appoint the industry practitioners as its Undergraduate Final Year Project (FYP) co-supervisors. These industry co-supervisors plays an important role since the beginning of the course by providing real-life industry problems for the students to propose solutions. This method have seen tremendous improvement towards students' soft skills such as problem-solving and decision-making. This helps the graduates to better prepare themselves upon entering the workforce and simultaneously fulfilling the industry needs in being exposed to real-life industry problems. The industry and academia should continuously work together to ensure that the courses and curriculum are current and in accordance to the requirements posed by the industry

Keywords: TVET, Curriculum Development, Industry Involvement, Engineering Technology, Undergraduate Program.

Introduction

Education is considered as the foundation of Malaysia's economic and social development. The evolution of education has long begun since the early 1960s, which is during the post-independence era. Major changes and improvements on education policies, systems, implementations and other aspects have been applied within the national education system through the Ministry of Education (MOE). As a result, the education sector inspires creativity and fosters innovation among the youth, and provides necessary skills to compete in the modern labour market besides providing the generations with relevant knowledge and skills that have driven Malaysia's social and economic capital.

Malaysia's higher education is currently making a significant progress in improving the overall higher education quality and system. According to the MTU-TVET Symposium on Jul 2nd, 2016, there are five global trends in higher education namely Globalized Learning Ecosystem, Globalized Benchmarking and Ranking, Shifting non-academic track towards Technical, Vocational Education and Training (TVET), Uberization of higher education and Searching for "soul" of the higher education.

Taking into considerations all the global trends and keeping up with the global pace towards becoming a higher impact nation, the MOE has produced a long-term strategic plan for fulfilling the needs to transform the higher education in Malaysia. The plan, namely "The Malaysia Education Blueprint 2015-2025" is developed to provide a comprehensive plan for a sustainable transformation to its education system until 2025. The Blueprint highlights ten main shifts that act as the umbrella for focusing list of initiatives required. Figure 1.0 illustrates the main shifts as follows:



Figure 1. Ten Shifts in The Malaysia Education Blueprint 2015-2025 (Ministry of Education Malaysia, 2018)

The ten shifts are divided into two categories, namely enablers and outcomes. The enablers are key components that contributes towards the outcomes; without enablers, the level of quality of the outcomes would not achieved as intended. The enablers of transforming the higher education comprise of (a) Empowered governance, (b) Innovative ecosystem, (c) Global prominence, (d) Globalized online learning and (e) Transforming the higher education delivery. Based on these five enablers, expected outcomes listed as part of the shifts include (1) Holistic, entrepreneurial and balanced graduates, (2) Talent excellence, (3) Nation of lifelong learners, (4) Quality TVET graduates and (5) Financial sustainability.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), TVET is defined as a branch of education that comprises learning in science and technology with proficiency in practical skills, and possess the relevant knowledge acquired to fulfil the industrial needs and workforce requirements (UNESCO, 2016). The importance of TVET and its contribution towards the national economic growth has been recognized and highlighted through initiatives done by several Ministries such as MOE and Ministry of Human Resource (MOHR).

Empowering TVET as National Agenda

The development of human capital is considered as one of the critical factors in generating and maintaining the Malaysia's economic growth. The availability of high-skilled workforce is vital in supporting all economic sectors towards knowledge-intensive activities, improving workers productivity and attracting potential investors to Malaysia. Efficient pool of labors will ensure the supply-and-demand of the workforce and enable Malaysians to take part and receive benefits from the national economic growth.

The MOHR have realized the importance of TVET towards producing high-skilled human capital as it will equip Malaysia for the final leg of its journey towards becoming a high income nation. The Eleventh Malaysia Plan (RMK-11) is a long-term development plan established by the government for five years (2016-2020) and is expected to produce and implement shifts in the current system operations in order to develop a world-class human capital that can compete in the global economy. One of the initiatives under the RMK-11 is setting the target of 1.5 million jobs by the end of 2020. From this number, 60% of it requires the knowledge-based skills and TVET trainings to drive the manufacturing sector.

According to the newly-elected Chair of Malaysia's TVET Task Force YB Nurul Izzah Anwar, it is the prime time for the government to further improves and elevates the TVET level in Malaysia through various initiatives. This is a joint effort that must involve all relevant agencies such as MOE, MOHR together with all industry players and all TVET providers (The Star Online, 24th June 2018).

TVET in Higher Education: Malaysia Technology University Network (MTUN)

In the early 2000, the Ministry of Education introduced the establishment of Malaysian Technical University Network (MTUN) that focuses on higher-level practical-oriented technical programmes. MTUN is developed with the purpose of educating, training and preparing highly skilled workforces that are talented in transforming Malaysia into an exceptional industrial nation. MTUN is perceived as a distinctive type of Higher Learning Institution (HLI) as its aspirations energies from the industry and thus, complement the present conventional education system. The MTUN comprises of four technology-based universities in Malaysia, which are Universiti Tun Hussein Onn Malaysia (UTHM), Universiti Teknikal Malaysia Melaka (UTeM), Universiti Malaysia Pahang (UMP) and Universiti Malaysia Perlis (UniMAP).

Ever since its establishments, graduates from MTUN have proven to have excellent qualities and considered as highly knowledgeable in applying theory into practical components. According to the recent Ministry of Education's Report Card, Graduate Employability (GE) in TVET has increased from 75% in 2013 to 91.4% in 2017. This indicates such a big increase, 16.4% overall). The percentage of GE from 2013 until 2017 has shown a continuous positive trend and expected to increase in the future. This proves that graduates from four MTUN universities are able to fulfill the requirements outlined by the industries. Figure 2.0 illustrates the GE trend of TVET students from 2013-2017.

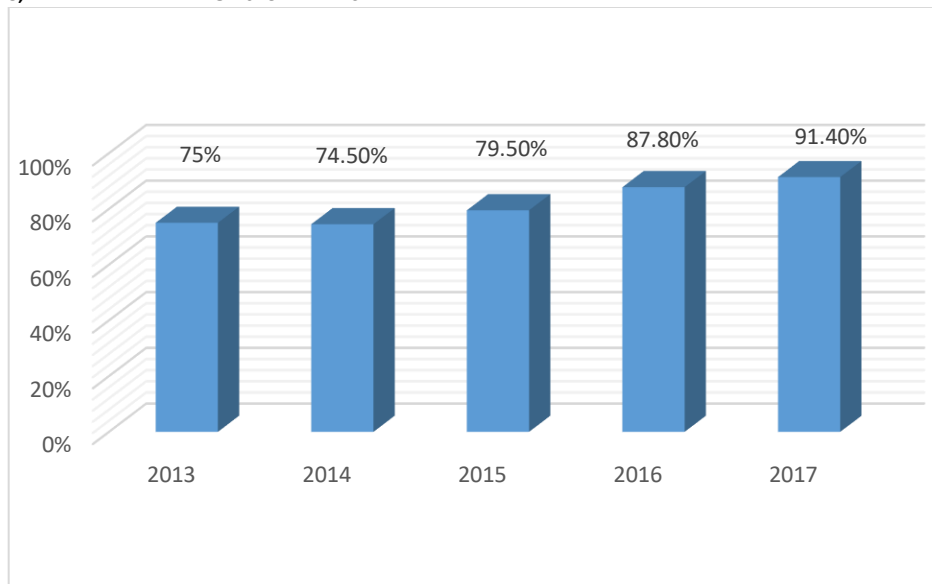


Figure 1. Graduate Employability Rates for TVET Graduates from 2013-2017 (Ministry of Education, 2018)

Expectation Gap

Despite the excellent overall achievement of TVET graduates on the national level, there are plenty of arising matters that need to be addressed. As the nation progresses in embracing the Industrial Revolution (IR) 4.0, the industry is experiencing vast changes in all areas ranging from systems to processing and also method of work/tasks performed. Technological-based changes are seen to be the most critical aspect that need to be understood by all workers, and the best way to educate, train and provide exposures is by embedding it in the university curriculum and course syllabi. This initiative is part of preparing the university graduates to become more prepared and proficient as they enter the workforce. Therefore, there is a need for both industry and academia to work together and address the fast pace challenges faced by the country due to globalization. The government and industry realize that further associations between both of them should be strategize accordingly as means to achieve the intended purpose of elevating the nation to a higher level.

In the past years, various forums and roundtable discussions that are conducted between the MOE/ HLIs with the industry practitioners have confirmed the gap that exists between the industry practitioners needs and the abilities possess by the graduates in general. Most of the companies in the industry are not so convinced on the job-readiness of the graduates. According to Daud et.al (2011), graduates from HLIs do not meet employers' expectation in the current state of Malaysia's economic standing. This resulted in employers demanding HLIs to better prepare graduates for the workforce.

Based on the expectation gap identified, drastic measures are required to ensure that better-prepared graduates are produced by HLIs. One of the initiatives highlighted by the Ministry of Education include the importance of industry and academia to become "one". This

acts as the driver for HLIs to produce graduates who are more agile, marketable, possess relevant knowledge and skills as acquire by the industry practitioners as well as to have a solid understanding on how the industry works.

Engineering Technology Programmes as the core of TVET in UMP

UMP was established in 2002 as a competency-based technical university which focus area is of science and technology. As one of the TVET provider in the East Coast region, UMP offers a variety of skills-based tertiary education programmes that focus on practical learning approaches. The nature of the curriculum offered consists a mix of theory and applications using problem-solving skills. All TVET-related programmes are placed under the Faculty of Engineering Technology, with the intention of providing high quality and competent graduates in the field of engineering technology. Currently the Engineering Technology undergraduate programmes comprises of different field of study in the area of (a) Oil, Gas and Energy, (b) Palm Oil & Rubber, (c) Electronics & Electrical, (d) Pharmaceutical Technology, (e) Safety and Health, (f) Manufacturing and (f) Civil and Infrastructure.

Undergraduate Final Year Project (FYP) in Engineering Technology Infrastructure Management (ETIM) Program

Most undergraduate programs in Malaysia have FYP courses as part of the graduation requirements upon completing a 4-year degree programme. In order to fulfill the requirements of local accreditation agencies such as Malaysia Qualification Agency (MQA), the engineering technology students are required to take up FYP courses prior to graduation similar to the conventional engineering programmes. The typical setup for the undergraduate conventional engineering FYP courses would be requiring students to perform research based on a given topic, and being supervised by a lecturer. Students are expected to understand the basics of performing academic research and conduct all procedural research activities. By the end of the semester, students will present their findings to a group of panel from different faculties or universities.

However, since the engineering technology programs are design to be more hands-on and implement more practical approach in teaching and learning, involvement from the industry seems to be more relevant. Therefore, the typical setup of FYP for the undergraduate conventional engineering programmes is no longer significant and does not synchronize with the expected outcomes of Engineering Technology graduates.

Methodology of FYP in ETIM

As part of the effort in bridging the gap between the industry and academia, ETIM FYP courses are design for students to be able to propose solutions to industrial problems. The industrial players who are appointed as co-supervisors for the students determine the scope of problems. Unlike the FYP of conventional engineering programmes, students are divided into groups with one academic supervisor and one industry co-supervisor. Both supervisors are responsible to guide and assess students throughout the course according to their own expertise. Currently there are two levels of FYP courses in ETIM programme, which are FYP I and FYP II that is offered during the third and fourth year. During the FYP I, students are required to identify the cause of the problems occurred and strengthen their basics on related theories from literatures.

The second part of the FYP will be the platform for students to perform data collection and analysis as part of the problem solving skills acquired. By the end of FYP II, students will present their proposed solutions to a panel of industry players and receive constructive comments for future improvements.

Feedback from Industry Co-Supervisors and IAP members

After two semesters of running the FYP courses together with co-supervisors from the industry, several feedbacks have been received based on the overall implementation of FYP and its approach. Currently in ETIM FYP, there are eight co-supervisors that are appointed from the industry based on their expertise and years of experience. All co-supervisors feedback is indicated as below in Table 1.0.

Table 1. Feedbacks received from ETIM FYP Co-Supervisors

No	Co-Supervisor's Expertise Area	Comments	Suggestions for Improvement
1	Structures and Materials	(a) Good effort in including industrial panel throughout the FYP process (b) Students managed to propose feasible solutions (c) Students get to think on practical solutions based on real-life problems	(a) Assessment for Co-Supervisors should be revised and tailored towards the relevant aspects for assessment (b) Invite other industry practitioners during final poster presentation
2	Water and Hydrology		
3	Project Management		
4	Geology and Geotechniques		
5	Environmental and Wastewater		
6	Building Services and Maintenance		
7	Transportation		

Overall, the co-supervisors are quite satisfied with the method of implementation for ETIM FYP I and FYP II. The involvement of industry practitioners from the beginning of the course early in the semester is appreciated by them as they get to be part of suggesting problem scopes for the students. Based on the observations made by the co-supervisors from the beginning of FYP I until the end of FYP II, it was found that the students show tremendous improvement in terms of level of knowledge, problem-solving and decision-making skills, as well as developing better soft skills.

Conclusions

As the ETIM undergraduate programme progresses in becoming one of the best TVET-based programmes offered by UMP, the needs and expectations underlined by the industry are always becoming the main focus in curriculum improvements and act as the core of ETIM's teaching and learning. The gap identified between the industry and academia should be periodically reviewed and addressed to ensure that the courses and curriculum are current and in accordance to the requirements posed by the industry. Frequent meetings and open-table

discussions with industry practitioners and ETIM's IAPs are to warrant that latest technologies, work methods and applications used in the industry is embedded in the course contents. This is in agreement with the government's initiatives and aspirations to empower TVET in higher education towards producing holistic and competent graduates to become the human capital that drives Malaysia as a high-impact nation.

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