

ENHANCING GRADUATE EMPLOYABILITY THROUGH WORK-BASED LEARNING (WBL) APPROACH IN CIVIL ENGINEERING TECHNOLOGY PROGRAMME

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Abstract: With the increasing number of graduate year after year coupled with the challenging economic climate, the possibility of getting a job upon graduation appears challenging and has become a main concern for parents and students alike. Thus graduate employability has become a priority for the Ministry of Higher Education of Malaysia, and together with the Higher Education Institutions (HEIs) and the industries, they are working to ensure that graduates meet the requirements of the job market. Among the initiatives that have been planned and are continuously carried out include industry involved curriculum, value infused talent, intervention programmes, internship programmes and work-based learning programmes to increase graduate employability. This paper presents the experiences in developing and implementing a 40-week structured on-the-job training or Work-based Learning (WBL) approach for the Bachelor in Civil Engineering Technology (BCT) programme offered by Politeknik Ungku Omar with partnership from the nation's key-industry players in civil engineering and construction sector. The aims of WBL approach is to provide a real-life work environment and facilitate structured and experiential learning for BCT Year 4 students before they graduate and join the work force. This paper is explaining about WBL approach that contributed to the efficacy of graduate's employability. This paper presents the outcomes of WBL approach of BCT students, through feedback received from the industry partners, on students' performance. Graduate employment has significantly improved and BCT graduates are well accepted by the industries. The graduate has been recognized to be more industry-ready and confident in facing the challenges in the construction industry. However, the interaction with recent graduates and industry partners indicates that there are still gaps in BCT graduates' skill sets and actions to address these gaps are discussed.

Keywords: Work-based learning, Experiential Learning, Graduate Employability

1. Introduction

The rapid advancement of technology, including the internet of things (IoT), Industry 4.0, and sustainable cities, revealed an overabundance need for work-ready graduates. It is expected that a work-ready graduate is technically competent and possess personal and interpersonal skills acquired via the experiential learning incorporated into the curriculum. According to Thirunavukarasu, G. et al. (2020), having an industry-based co-designed curriculum for engineering students is identified as the major critical factor influencing graduate employability. Other critical factors identified to have an influence in the graduate employability include learning through capstone or final year projects, career counselling, professional memberships, involvement in social responsibility and extra-curricular activities, industrial networking events and social media networks.

Graduate employability is one of the main agendas of the Ministry of Higher Education of Malaysia and it has become the key performance indicator of every Higher Education

Institutions (HEIs) to achieve the targeted 90% graduate employability six months after graduation. The ministry together with the HEIs and the industry are working to ensure graduates meet the requirements of the job market. The Department of Polytechnic Education on the other hand has embarked an initiative in 2013 by undertaking an attempt in addressing the gap between the engineering education curriculum and graduate employability by initiating a work-based learning approach into the curriculum of Polytechnics' Bachelor of Engineering Technology programmes. The Bachelor in Civil Engineering Technology (BCT) programme offered by Politeknik Ungku Omar (PUO) adapted the innovative engineering education framework of Conceive-Design-Implement-Operate (CDIO) principles and guidelines (Crawley, E.F., et.al., 2014) focusing on Standard 7: Integrated Learning Experiences and Standard 8: Active Experiential Learning which are implemented through Work-based Learning (WBL) with partnership from the nation's key-industry players. The aim of WBL is to provide a real-life work environment and facilitate experiential learning for Final Year BCT students to ensure graduates produced are aligned with industry's needs.

Work-based learning (WBL) is an educational strategy which provides students with real life work experiences. Through WBL, students are able to put into practice the theories they have learnt in the classroom. Indirectly, while performing the task assigned at the work place, students will also develop their personal and interpersonal skills. This process helps to build the inner strength of polytechnic students to face the challengers of the 21st century learning and the demands of 4th Industrial Revolution.

2. Methodology

2.1 Work-based Learning

Work-based Learning (WBL) is a learning approach in which polytechnics and industries work together to conduct teaching and learning process (Boud, Solomon & Symes, 2001). According to the Engineering Technology Accreditation Council Standard (BEM, 2020), WBL is an industrial training approach that provides students with authentic context for learning and real-life work experiences in an engineering environment. It is essential that the engineering environment must fulfil the aims and learning outcomes of the programme. Thus BCT's WBL is designed as a well-structured on-the-job training (OJT) programme developed together with BCT's industry partners to meet the training needs of an industry and to provide a real-life work environment. It has been designed as a structured internship programme with core discipline courses incorporated in the learning track for BCT Year 4.

Through the experiential learning, students can further deepen their competencies for occupational skills, transferable workplace skills and personal effectiveness skills. Students were able to carry out internships in several related project management practices within the construction projects and gained valuable experience in the project delivery of the construction industry. The WBL is implemented in the final year of the programme which is in the 7th and 8th semester, covering 20 weeks per semester. In total, students will be attached to the industry for 40 weeks or equivalent to 1600 hours of OJT. At the same time, there are three core discipline courses offered in the 7th semester; BCT7264 – Research Method and Pre-Project, BCT7275 - Technology and Innovation Management and BCT7288 - Sustainable Construction Technology with a total of 17 credit hours. Meanwhile, in the 8th semester, two core discipline courses are offered: BCT8297 - Project Management and BCT83010 - Final Year Project totalled 17 credit hours.

2.2 Constructive Alignment

Figure 1 illustrates the constructive alignment which was adapted from Biggs (2003) for the course BCT7264 – Research Method and Pre-Project as an example for the constructive alignment implemented for BCT programme. Students construct meaning through relevant and authentic learning activities at the workplace. Lecturers and industry mentors facilitate the learning of the student by creating learning activities and assessments that are aligned with the learning outcomes to determine what student learns and what the educator does. The alignment component refers to what the educators do to create a learning environment that includes learning activities and assessments that the learning outcomes desire.

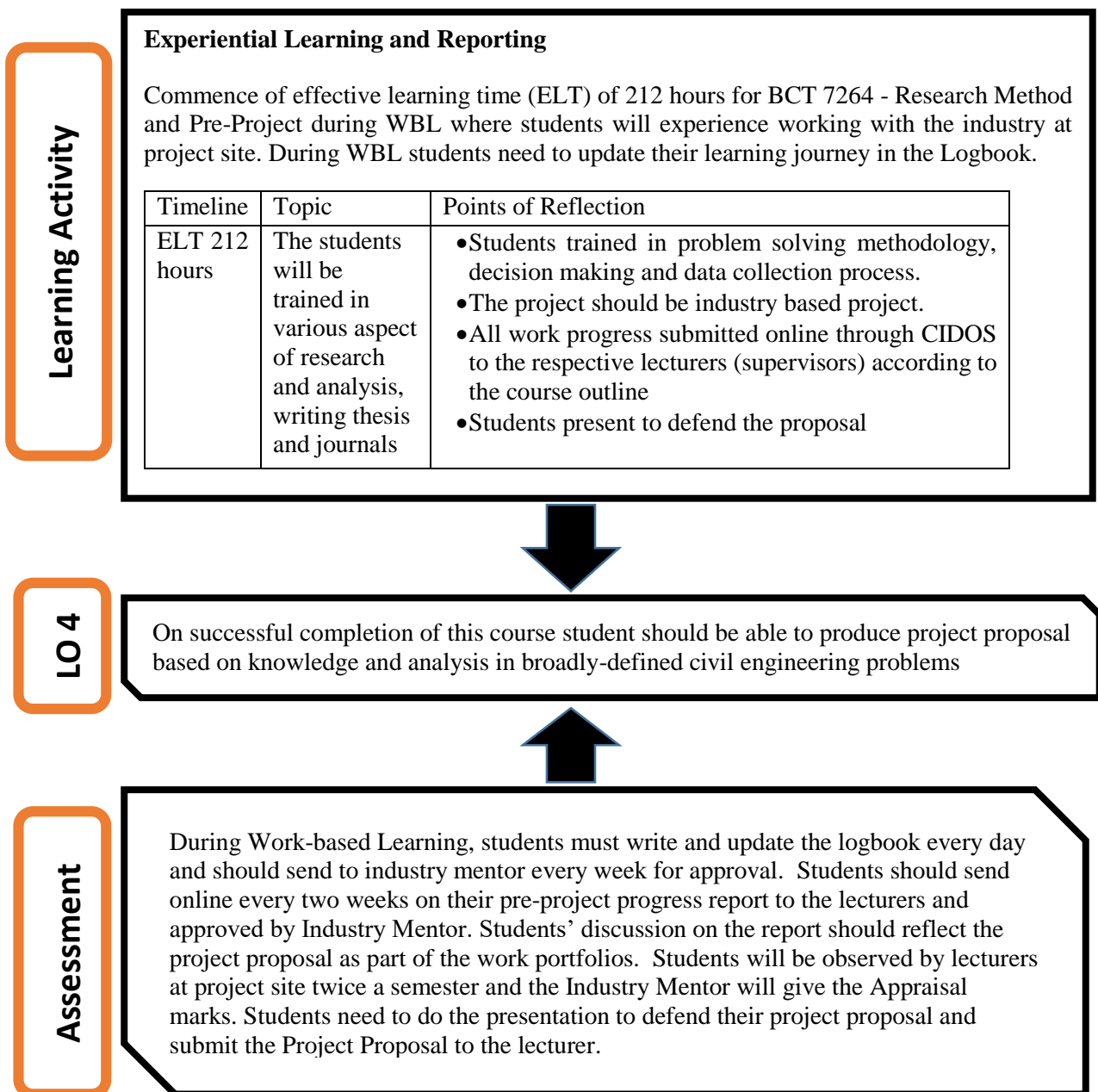


Figure 1- BCT 7264 Research Method and Pre-Project Constructive Alignment

2.3 WBL Implementation

In facilitating the student's learning process, PUO lecturers and industry mentors use learning activities, learning environment and assessments that align with the learning outcomes (Biggs, 2003). To assist the industry mentors, a team-teaching approach consisting of two or more lecturers teaching the same course are paired-up with the industry mentors (Buckley, 2000). The team-teaching from both PUO and industry will enable them to share ideas and convey knowledge to the students. This can shape the value of teamwork among lecturers and industry mentors in delivering teaching and learning (T&L). The industry mentors oversee the practical aspects of the course whilst the theoretical aspects are led by the PUO lecturers. The team T&L can be in a blended learning format using e-Learning approach. E-Learning refers to the use of information and communication technology to facilitate the process of T&L (Department of Higher Education, Ministry of Higher Education, 2011). A combination of 70:30 online learning mode and face-to-face of the course content is employed in this WBL T&L. The implementation of blended learning method refers to the course having a mix of online mode learning approaches with face-to-face learning mode where 30% - 70% of course content is delivered online whether it supports or replaces teaching face to face.

The chart in Figure 2, summarizes the implementation of PUO BCT-WBL programme. It begins with a meeting with Master Builders Association Malaysia (MBAM), one of the leading body representing the construction industry and services sector in Malaysia. PUO Management Team, MBAM Education Team and several MBAM members have agreed to work together in the structured on the job training (OJT) programme known as work-based learning (WBL). Students will be attached to the companies and undergo an Induction Session at the companies. While attached at the company, these students will be assigned industrial task on site based upon the agreed curriculum by their mentor. At the same time students are required to register their courses online, and they will be given tasks accordingly to be completed by the end of the semester.

In assessing the WBL, appointed lecturers will carry out an observation at the company premise scheduled by the PUO WBL coordinator. The observation will be conducted at the site twice throughout their OJT by the lecturers. The discussion is also made with the industry mentor during the observation session. This is followed by a discussion with MBAM Education Team and respective participating companies on students' performance and Continual Quality Improvement (CQI) of the programme. Finally, the results will be processed and analyzed according to the course learning outcomes (CLO).

The continuous assessments, appraisal and feedback from the industry mentors will be gathered during these observation visit. Eventually, the result will be presented to the industry at the end of the WBL period. The feedback and suggestions received is used to improve the future T&L process.

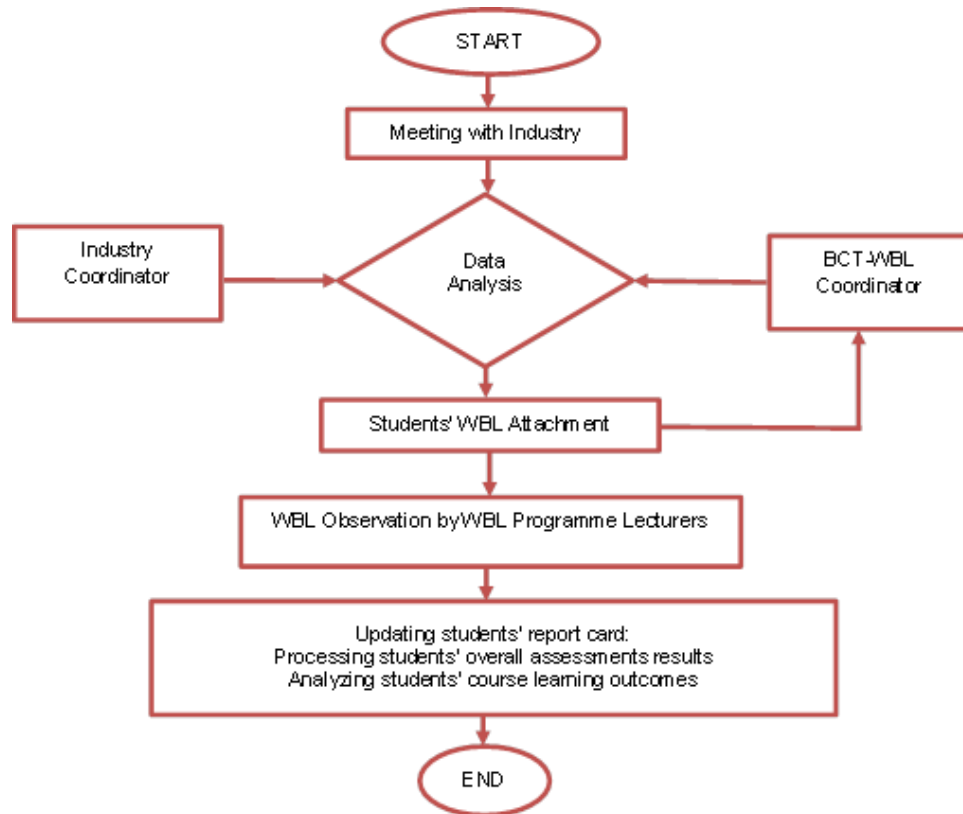


Figure 2 - PUO BCT-WBL Implementation Flow Chart

3. Result

PUO BCT programme collaborates with Master Builders Association Malaysia (MBAM) and its participating companies and University Malaysia Pahang Holdings (UMPH) with its subsidiaries companies in implementing WBL since 2016. The WBL learning process in BCT context requires students to sit for several courses while undergoing the internship. These courses are monitored and assessed directly by lecturers of the polytechnic. Concurrently, students will be assessed by the industry mentors appointed for projects or work assigned at the workplace. Primarily, the industry mentors will supervise all practical work while student's academic achievement will be assessed by polytechnic lecturers at the workplace. Therefore, these students will be observed by polytechnic lecturers from time to time as scheduled in their learning process.

The collaboration between PUO and the leading construction industry has had a positive impact on the marketability of BCT graduates. Students become more competent and enhanced their personal and inter-personal skills in critical thinking, problem solving, communication, teamwork, leadership, and creative thinking. Table 1 below shows the list of companies collaborating with PUO in the implementation of BCT-WBL.

Table 1. List of companies collaborating with PUO

No.	Company	Collaboration Since
1	Master Builders Association Malaysia	2015
2	Sunway Construction Sdn Bhd	2015
3	Bina Puri Sdn Bhd	2015
4	TRC Synergy Berhad	2015
5	Putra Perdana Construction Sdn Bhd	2015
6	MITC Engineering Sdn Bhd	2015
7	Premier Construction Sdn Bhd	2015
8	Mudajaya Corporation Berhad	2015
9	Rimbun Prima Sdn Bhd	2015
10	UMP-Ecopest Sdn Bhd	2015
11	UMP Services Sdn Bhd	2015
12	UMP Green Technology Sdn Bhd	2015
13	UMP Innovest Sdn Bhd	2015
14	Syarikat Pembinaan Yeoh Tiong Lay Sdn	2017
15	Fajarbaru Builder Sdn Bhd	2017
16	Ocned Water Technology Sdn Bhd	2017
17	Pembinaan Mitrajaya Sdn Bhd	2017
18	Trans Elite Group Sdn Bhd	2018
19	Bauer (Malaysia) Sdn Bhd	2018
20	Rosha Dynamic Sdn Bhd	2019
21	DMIA Group	2019
22	IJM Corporation Berhad	2020

The collaboration between PUO and Malaysia leading construction industry has gained a positive impact on BCT graduates' employability. Total time spent at the workplace through WBL (40 weeks) enabled the students to be trained and exposed with real work environment. Students become more competent in both technical and non-technical skills such as personal and inter-personal skills in critical thinking, problem solving, communication, teamwork, leadership, and creative thinking. PUO BCT-WBL participating companies has given full commitment and they are basically satisfied with the graduates. Accordingly, the first cohort of graduates was fully employed immediately after their graduation.

To date, the BCT programme had produced 5 cohorts of graduates and all have an outstanding employment rate record. Graduates employability data collected annually by the Department of Polytechnic and Community College Education (DPCCE) during the graduation using TVET Tracer Study System - *Sistem Kajian Pengesanan Graduan-TVET* (SKPG TVET) recorded that almost all graduates has been employed either by the partners' company or other company in the same field locally and overseas, some became entrepreneurs, others pursue further studies and a few took a break for personal reasons. The BCT employability rates are summarized in Table 2. The statistics show that the BCT graduates were immediately offered a job upon completing their WBL, with the longest waiting time of two months.

Table 2. Graduate Employability for PUO BCT-WBL Graduates

Year / Cohort	Number of graduates	Work with Participating Companies	Work with Other Companies	Self Employed/ Entrepreneur	Further Study	GE %
February 2017 1 st Cohort	28	11	10	5	1	96
February 2018 2 nd Cohort	28	8	18	1	1	100
August 2018 3 rd Cohort	25	11	11	2	1	100
August 2019 4 th Cohort	30	6	21	2	0	97
August 2020 5 th Cohort	26	Result still in progress				

4. Discussion

In recent years, there is a shift in the construction industry towards IoT and automation, with safety being one of the major challenges. This is the cause that underpin the BCT-WBL programme to be revised and continuously improved (CQI) by focusing on new technologies and modern practices namely Information Technology (IT) Construction via Building Information Modelling (BIM), risk assessments and quality management in construction sector. BCT programme has taken into consideration the shareholders' needs and skills such as employability skills or acquisition of real-world marketable skills. Employers look for potential employees who possessed skills in critical thinking, problem solving, communication, collaboration, and creative thinking. The BCT-WBL in PUO integrated the learning approach of the Civil Engineering Technology programme by working closely with the industry to ensure graduates produced are aligned with industry's need.

The construction industry has gained a positive impact on BCT graduates' employability. Student has been exposed with real work environment during their WBL and this has made them became more competent in both technical and non-technical skills. Indeed, the first cohort of the graduates were gainfully employed immediately upon graduation. Figure 3 shows that BCT programme had produced 4 cohorts with outstanding employment rate record. The statistic has been collected annually by the Department of Polytechnic and Community College Education (DPCCE) during the graduation, using a TVET Tracer Study System. It is recorded that almost all graduates of BCT-WBL program had been employed either by the partners' company or other company in the same field locally and overseas, some became entrepreneurs, others pursued further education and a few took a break for personal reasons.

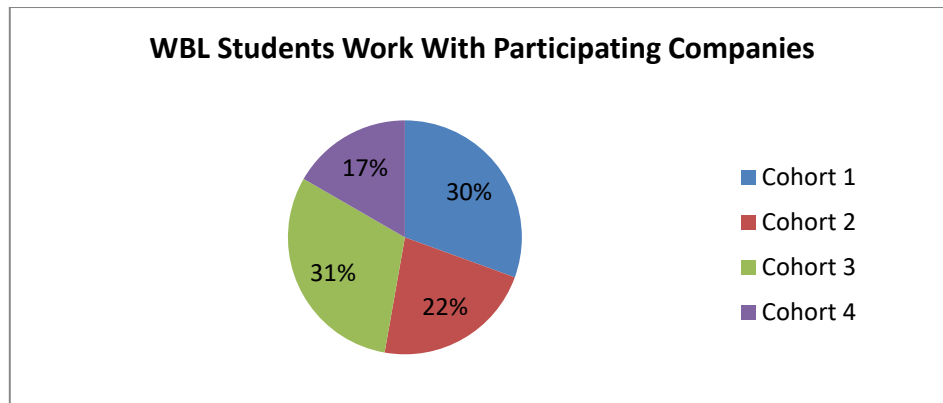


Figure 4 - PUO BCT-WBL Students Work with Participating Companies

The first cohort of 28 BCT students graduated in February 2017. A total of 11 graduates were offered jobs by the concessionaire company upon completion of the WBL. While 5 became entrepreneurs, 10 others got jobs in the field within 2 months of graduation and 2 others chose to work outside the field whilst 1 took a break for personal reasons.

The second cohort of 28 BCT students graduated in February 2018. A total of 11 graduates were offered jobs by the concessionaire upon completion of the WBL but 3 declined their offer of employment and worked with other companies where 1 of them worked abroad. Meanwhile 15 others have been employed in the field within 2 months of graduation, 1 went for further studies and 1 was self-employed.

The third cohort of 25 BCT students graduated in August 2018. A total of 13 graduates had been offered jobs by the concessionaire immediately after WBL's completion but 2 had rejected the offer because they chose to work with another company. While 9 others got jobs in the field within 2 months of graduation, 1 chose to work outside of the field, 1 became an entrepreneur, and 1 pursued further studies.

The fourth cohort of 30 BCT students graduated in August 2019. A total of 10 graduates were offered jobs by the concessionaire upon completion of the WBL but 4 declined their offer of employment and worked with other companies where 1 of them worked abroad. Meanwhile 21 others have been employed in the field within 2 months of graduation and 2 was self-employed, whilst 1 took a break for personal reasons.

There are many reasons why these graduates turned down the offer by participating companies, for example the location of the project site, distance from family/hometown, salary offered by other competitors as well as pursuing further education. From the study, interestingly for each cohort there are graduates who chose to become entrepreneur/self-employed. In addition to the tracer study conducted, a testimonial by employers was also gathered. PUO BCT-WBL participating companies had given full commitment and they are really satisfied with the graduates.

A testimonial received from these 4 key players in construction companies highlighted that BCT students demonstrated an excellent attitude and had always given their best efforts to all tasks assigned. It is in fact has become a benchmark by other universities in Malaysia.

Table 3 - Industry Testimonials of PUO BCT-WBL Graduates

No.	Testimonial	Organization and Position
1.	<p>"I would like to congratulate BCT programme as it has become a benchmark programme for B.Tech programmes by universities in Malaysia. We at MBAM work hand in hand with PUO to implement WBL adhering to the modules we agreed upon and the students will be put under the industries' mentors at the companies and learn from the experts at the work place for 10 months. Under the wing of various mentors from the companies during their WBL stint, the students adopt the soft skills promisingly and received their training with open hearts for their own future development. I am proud to say MBAM has no regrets working with Politeknik Ungku Omar on this BCT-WBL program and we welcome any other activities in future. All the big public listed construction companies that participated in our BCT-WBL program really valued their employees coming from BCT graduates."</p>	<p>Y.Bhg. Tan Sri Sufri Mohd Zin, Deputy President of Master Builders Association Malaysia (MBAM) cum Group Managing Director of Trans Resources Corporation (TRC) Sdn. Bhd.</p>
2.	<p>"When the candidates enter WBL, they will start to learn basic procedures and process in the companies. So when we hire them after they finished their studies, they will straight away become real engineers venturing into the real world. So there is no learning curve required for BCT graduates, they can immediately start work and able to catch up with site works as soon as possible. They can perform better and can very fast adapt to the construction industry."</p>	<p>Ir. Selvaraja Marappan, Project Manager of Sunway Construction Group Berhad.</p>
3.	<p>"The student is able to work with least supervision and very innovative. We have adopted the Final Year Project designed by the student, "e-Borelog", an application that prepares bore log as a payment claim. The project is very helpful to us as it really saves us time and money as we move forward into a paperless society"</p>	<p>Ir. Shalom Morris, Senior Engineer of Bauer (Malaysia) Sdn. Bhd.</p>
4.	<p>"The student is very hardworking and showed an excellent attitude towards his OJT and willing to learn new things. He has developed the Standard Operating Procedure (SOP) for Mivan Formwork at 17RM2 Project as his Final Year Project based on the implementation of proprietary system formwork for structural works. His SOP has been implemented for the construction of three blocks of building structures consists of 800 units of residential apartments at 17RM2 Project in Putrajaya"</p>	<p>Ir. Zainal Samsi, Project Manager of Pembinaan Mitrajaya Sdn. Bhd.</p>

5. Conclusion

The PUO BCT-WBL program has gained industry recognition and the BCT graduates are proven to be more industry-ready and confident in facing the complexity and challenges of the construction industry. The program has put together technical and non-technical skills and able to offer an effective applied method of inculcating appropriate awareness, skills and abilities in graduates. Indirectly, the program also promoted productive collaboration and partnerships between HEIs and employers and has built greater understanding between these stakeholders. However, there are still gaps in BCT graduates' skill sets and the employers urge for future students to be more resilient in working in the 3D (Dangerous, Dirty and Difficult) environment of the construction industry. They need to have higher tolerance and to recover quickly from difficult work situations at the construction project site. In addressing these gaps, immediate action by PUO is by introducing an outbound camp activity for the upcoming cohorts. The activity is hoped to build students' flexibility and perseverance in the challenging situations as well as to apprehend their full potential through the tasks and challenges given during the camp's expedition. Nevertheless, above all, the literature and the findings have overwhelmingly highlighted that employers and graduates value work-based learning as an effective approach to increase graduates' employability. These experiential opportunities require careful planning and time for reflection must be built in, if they are to be an effective way of providing HEI students with relevant employment skills, knowledge and awareness of employer culture.

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