Industrial Training for 4000 Engineering Students: How Hard Can It Be?

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Introduction

All engineering students at the University of New South Wales must complete a minimum of 60 days of approved Industrial Training (IT) before they can graduate and qualify for accreditation by Engineers Australia. As a form of Work Integrated Learning (WIL), IT provides students with the first-hand experience to work as an engineering professional (Jollands et al., 2017). The students have the opportunity to transfer the skills and knowledge they have learnt at university, as well as reflect on the learning undertaken. A good IT program will also provide students with employability skills, professional development opportunities, networking within their chosen field of study and an opportunity to experience what their future career may hold.

The University of New South Wales Faculty of Engineering has more than 16,000 socially, culturally and linguistically diverse students who are enrolled in 165-degree specialisations. Approximately 4,000 of these students will be seeking industrial placement each year. At this scale, cooperation and coordination between key stakeholders, including student partners, engineering schools and faculty WIL administrators, student success unit, professional bodies and industries are required to ensure the students develop the necessary skills and knowledge to secure quality placements.

Herein, we present the process which the University of New South Wales Faculty of Engineering used to ensure students are prepared, approved and assessed to complete the IT program. We describe the challenges of providing quality IT program for a large engineering faculty and describe how the IT program is managed, highlighting the key components to success and compliance with Australian Higher Education Standards Framework 2015, the Australian Fair Work Act 2009 and the Fair Work Regulations 2009, as well as Engineers Australia's professional accrediting requirements (see Figure 1) (Anon, 2015; Anon, 2009a; Anon, 2009b; Anon, 2017). We used reflective practice and employer's evaluation to gauge students' learning during their IT placement. We will also highlight how engineering schools work closely with their student society, faculty, student success unit and professional bodies to raise their students' understanding of the engineering discipline, including relevant skill sets and career paths, instil peer support and mentoring, and to engage successfully with industry representatives.

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Proceedings of the AAEE2019 Conference Brisbane, Australia,

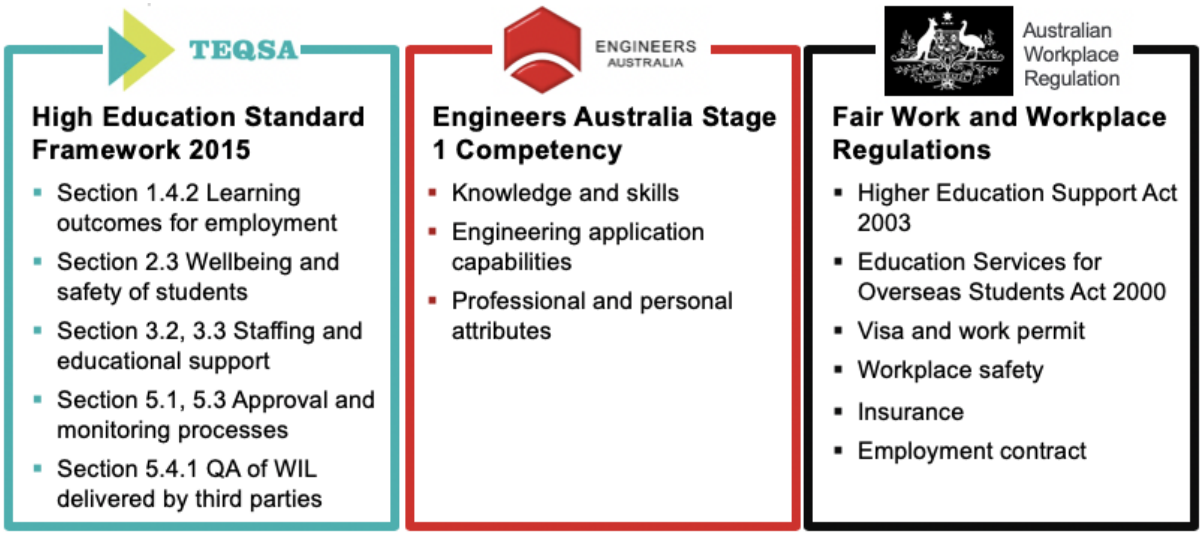

Figure 1: Australian Higher Education Standards Framework, Engineers Australia professional accrediting requirements, and Fair Work and Workplace regulations that are relevant to Australian universities' IT program.

Preparing Student for Industrial Training Through Clear Communication of Objectives and Expectations

Our rationale is the University of New South Wales Engineering students must secure quality placements if they were to achieve good learning outcomes from IT. This not an easy task for the student as first, the students have to secure the placement themselves, and second, the students often lack the time and support needed to develop the job search, employability and networking skills that are required to secure quality placements. This challenge is amplified if the student is from a disadvantaged background. A holistic and coordinated program starting on day 1 of the four-year degree program, and spanning the entire student lifecycle, is required to fully prepare a student for IT (Patrick et al., 2009).

The program begins with an event that welcomes Stage 1 students to the University of New South Wales. In this event, information on the Industrial Training's procedures and expectations, and on how to access university and external support services for IT placement are provided. We tell the student it can take several months to years to acquire the skills needed to find and secure a good placement. We encourage them to start early and participate in activities that will support or develop their skills in their first year of study.

In Stage 2 of the engineering degree program, we convey workshops that raised the students' understanding of the engineering discipline. This include the differences between the sectors which employ engineers, as well as current and future career paths, in-field and out of field (Young et al., 2017). We also work closely with our student success unit to convey specialise workshops on how to (1) engage successfully with industry representatives, (2) target their resume and cover letters to different industry sectors, and (3) address the selection criteria (Figure 2). We also explain to the students the intricacies of the job search process, what their rights and obligations are, and how to find the placement that best match their identity, personal interest, values and requirements. These workshops and supports are important as students are often unaware of the discipline specific skills and knowledge that are required to secure good placement, especially if the student is disabled, from regional Australia, an international student (a third of the cohort), first in family to attend university, from lower socioeconomic or culturally and linguistically diverse backgrounds (Bennett et al., 2016).

Figure 2: The skills and discipline knowledge required by students to secure good placements.

The University of New South Wales School of Chemical Engineering also began working closely with student societies to organised events that increase the students' awareness of the IT process and requirements, as well as improve their network and employability skills. These include multiple information or panel sessions, industry events (e.g. trivia night, cocktail night), industry visits and industry presentations with the Chemical Engineering Student Society and the Women in Engineering Society. We ensure peer supports and mentoring are built into these programs; senior students, recent graduates and industry representatives are invited to guide or provide advice to current students on how to find and achieve the best outcomes from their IT placements. Some of the peer-support and mentoring occur on a one-on-one basis.

Student partnerships are critical to the success of these initiatives (Healey et al., 2014). The key to success is to mentor the student societies on their engagement with our professional body and industry, which can lead to financial and in-kind support from the latter to support the societies' professional development-related activities. We also worked toward increasing the uptake of student memberships with professional bodies (e.g. Engineers Australia); this is important for the students' professional development and network. The students strive to ensure the events are successful because the students have the most gain to gain from these initiatives, developing valuable 'soft skills' as part of the process. Many of our alumni would return years later to help the current students as a way to pay it forward. Some student partners continued to undertake leadership roles in school or faculty boards, where they continued to advocate for their fellow students.

Organisational System and Process to Meet Compliance Requirements

Previously, the University of New South Wales Engineering did not have a good system for administering its IT program. Decisions were often made in an *ad hoc* manner at the School level and as such, the institution was at risk for not complying with regulatory and professional bodies' requirements in matters related to IT (McBride and Foley, 2017). Our students were also exposed to unethical or unlawful placements, as well as workplace harassment (Stewart et al., 2018; Hewitt et al., 2019). It soon became clear that digital tools and centralisation at the Faculty, if not institutional, level are necessary to manage the IT program at scale and to mitigate these risks, leading to the development of an integrated Learning Management System and Customer-Relationship Management (LMS-CRM) platform. The LMS delivers a series of training modules which inform students about their rights and obligations while on placement. The CRM is used to register, approve, track and process each student's placements.

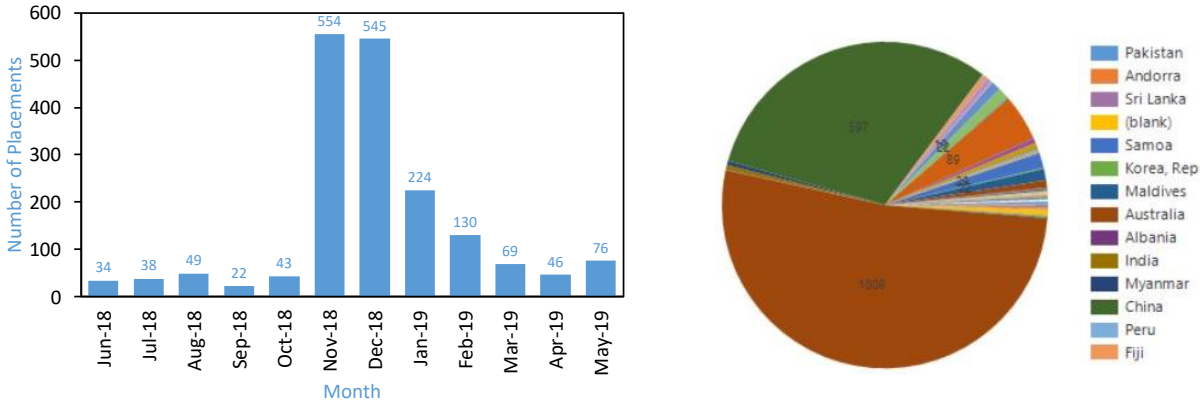

Figure 3: Examples of real time data that can be extracted from the integrated Learning Management System and Customer-Relationship Management platform.

Faculty or institutional access to real-time and coherent data about student placements enables optimal allocation of resources and reduces the administrative burden for the schools (see Figure 3). At the University of New South Wales Faculty of Engineering, a team of four professional staffs manage the system and process for administering IT for the whole faculty, compared to nine academic staffs previously (one per school). This change enables academic staffs to perform their core function, which is mentoring and assessing students on matters related to IT.

Working in partnership with a student and representatives from the University of New South Wales legal, financial and public relation departments, we created an online information pack which provide information to stakeholders about the IT requirements and process. The information pack is used by all engineering schools in the faculty to inform all stakeholders about the IT requirements and processes, including important information about Australian workplace regulations, health and safety regulations, visa and work permits requirements, and insurance. The later streamlines the communication between external Industrial Training providers and the institution, ensuring that all stakeholders have realistic expectations of what to anticipate before, during and post-placement (Patrick et al., 2009). Feedbacks received from students indicate the information pack reduce the confusion around the Industrial Training process and simplified the communication between external industrial training providers and the student/institution. We also worked to ensure a single point of administrative contact for matters related to industrial training; this prevents misinformation and ensures matters related to industrial training (e.g. queries, opportunities) are actioned quickly and efficiently.

Evaluating Student Learning

The students' activities and learning from their IT placements is captured and assessed or evaluated in two stages: (1) At the end of each placement by the placement provider; and (2) On completion of the Industrial Training Program, whereby an Industrial Training Report written by the student, covering every placement undertaken by the student, is assessed by an academic.

For the first stage, an online Qualtrics form was developed to enable the external placement provider (usually the immediate supervisor of the student) to act as a co-assessor and evaluate the students' performance. Since almost 50% are international placement, the form is multi-lingual and in-situ translation between seven different languages can be made (see Figure 4). The form also enables the institution to communicate effortlessly with and monitor the wellbeing of 4000 students for the entire duration of their placement.

The form records the goals that were set for the students at the start of the placement. The goals were articulated using the SMART (an acronym that stands for Specific, Measurable, Achievable, Realistic, and Timely) approach so that all expectations and the student's responsibilities to the placement provider or client are made clear.

The external placement provider also evaluates the students' cognitive and behavioural competencies from the perspective of future employers at the end of the placement. Both the goal-setting step and the competencies evaluation step were carried out in the presence of the student. Direct feedback and dialogues with the placement supervisor provide a degree of authenticity to the student (Young et al., 2017). The external placement provider evaluation is formative because the external placement provider may be inexperienced in undertaking formalised assessment.

The student then completes the process by writing a reflective piece using Gibbs' approach (Gibbs, 1988). Together with the employer evaluation, reflective writing helps students contextualise their industry experience with their university education and other life experience (Coll et al, 2002).

Figure 4: Multi-lingual online Qualtrics form which enable external placement provider to act as a co-assessor and evaluate the students' performance.

Because a student's IT experience is inherently variable, unpredictable, high-risk and sometimes brief learning events that are not replicable, the assessment of the final IT report should depend more on overall judgment than on fine-grained measurement. The IT report consists of three sections.

The first is a 300-500 words description of the placement provider and the tasks undertaken by the student. The main purpose of this section is to provide the assessor with some context about the nature of the placement.

In the second section, the Employer Evaluation Form that was mentioned previously is used to guide the student in writing this section. The student has to select 5 out of the 16 Indicators of Attainment from Engineers Australia's Stage 1 Competencies Standard and discuss how specific activity from their placement demonstrate their chosen competency. At least 1 indicator of attainment must be chosen from each of the 3 Stage 1 Competency graduate attributes. The final section is another reflective writing activity.

In the third and final section, the student is asked to reflect again. In the Employer Evaluation Form, reflective writing is used to determine if the student can connect their experience whilst on placement with their university education. Here, the main purpose is to determine if the student has developed a professional identity after nearly completing the Industrial Training Program, i.e. did the student's experience transform into learning that enhances future professional practice and identity.

A set of rubrics and marking guide to assess the students' learning were derived from the AACU's Integrative and Applied Learning VALUE Rubric and Engineers Australia's Stage 1 Competency Standard (Rhodes, 2010; Anon, 2017). The use of a marking rubric standardises and simplifies the assessment and feedback to the students. Moreover, the information collected can be used to certify the students' professional skills attainment in a university-wide micro-credentialing project.

Conclusion and Recommendations

A holistic program spanning the complete student lifecycle is required to prepare students for WIL. The success of the program relies on the cooperation of key stakeholders, including student partners, engineering school and faculty WIL administrators, student success unit, professional bodies and industries. Information pack and the use of an integrated Customer Relationship Management and Learning Management System will reduce the administration burden of IT and ensure compliance with regulatory requirements. Reflective practice and multi-lingual online form can be used to asses students' abilities to connect their experience with their university education.

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