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Identifying students' perceptions of industry placements

Ivan Gratchev[a], Simon Howell[a], Saeed Shaeri[b], Hugo Espinosa[a] and Andrew Busch[a].
Griffith School of Engineering and Built Environment [a], School of Computing, Mathematics and Engineering (SoCME) at Charles Sturt University [b]
Corresponding Author Email: i.gratchev@griffith.edu.au

ABSTRACT

CONTEXT

Griffith School of Engineering and Built Environment (EBE) and School of Computing, Mathematics and Engineering (SoCME) at Charles Sturt University run two distinct work-integrated learning (WIL) courses to prepare students for their industry careers. To maximize students' experience, students are expected to possess certain knowledge and sets of skills before their industry placements, which will help them to successfully apply their theoretical knowledge in practice. However, as it is not possible to teach every single skill during the undergraduate years at university, there may be mismatches between the student's knowledge level, competencies, and skills from one side, and the needs of the industry from the other side.

PURPOSE OR GOAL

This work seeks to investigate the students' perceptions of the industry and evaluate students' skills and readiness to undertake industry projects. The main research questions are as follows: What are the graduates' skills and competencies currently required by the industry? Are students aware of the industry skill set needs and expectations, and have they developed such skills during the first few years of their undergraduate programs?

APPROACH OR METHODOLOGY/METHODS

This study has surveyed and interviewed both students and the industry partners to better understand students' perceptions and experiences against the current industry perceptions and needs. Analysis of the data obtained from these surveys and student focus groups helped to identify areas for improvement at both universities. The results highlighted similarities/differences between students' expectations and industry needs and will be used to develop recommendations on how to improve the work-integrated learning programs.

ACTUAL OR ANTICIPATED OUTCOMES

The student surveys have been conducted at both universities, with about seventy responses being collected so far. The analysis of these data indicates that students are generally aware of the skills and competencies that the industry expects from them; however, a few mismatches in terms of the importance of certain skills and/or competencies have also been identified. This study is currently in progress, and more data from the student and industry partner surveys and focus groups will be obtained in the next several weeks.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The results of student surveys showed that students have a good understanding of what is expected from them by the industry. However, there are still skills and competencies that students may not find currently important; however, they are highly desired by the industry.

KEYWORDS

Work Integrated Learning, industry-ready graduates, student experience, employability.

Introduction

This paper presents and discusses the research methodology and preliminary results of the project jointly conducted by the Griffith School of Engineering and Built Environment (EBE) and School of Computing, Mathematics and Engineering (SoCME) at Charles Sturt University (CSU) to identify mismatches between students' perceptions of the industry readiness and industry expectations of university graduates. The following introduction will briefly discuss the work-integrated learning (WIL) programs at both universities, outline current issues related to WIL, and present the research questions of the project.

Work-integrated learning at Griffith and Charles Sturt Universities

Griffith School of EBE conducts an Industry Affiliates Program (IAP) to provide students across various engineering disciplines (i.e., civil, environmental, mechanical, electrical, electronic, software, and project/construction management) with the opportunity to work on real-life engineering projects in the industry for one trimester (12 weeks). This program uses a work-integrated learning (WIL) approach, which requires final-year undergraduate engineering students and master students to complete an industry-based thesis as part of gaining their work experience before graduation.

CSU Engineering offers a WIL approach to their engineering students (Graham, 2018), which takes place in the form of work placement learning (WPL). Civil engineering students complete several courses over three semesters on campus before starting their first one-year full-time paid work placement in the industry as cadet engineers. This is followed by three years of paid full-time work in different workplaces towards the award of an integrated Bachelor of Technology (Civil) and Master of Engineering (Civil) degree. Cadet engineers are strongly encouraged to change their workplace every year to gain different experiences from various industry organisations. While being in the industry placement, cadets are still required to complete courses as part of their degrees, by which their progress and performance in their workplaces are periodically assessed and evaluated against their personal and professional goals, as well as the competency standards set out by Engineers Australia (2019). Cadets are also required to complete and submit their cornerstone and capstone theses (at the end of the 2nd and 4th placements, respectively), directly based on real-life projects that they work on at their workplaces, while focusing on benefitting their host organisation (rather than solely satisfying their academic requirements). All the mentioned courses are offered online to enable students to choose their placement and work at any locations/companies they desire Australia-wide.

Current issues and research questions

The literature suggests that industry engagement from earlier stages of higher degree programs contributes effectively to better employability (Male & King, 2014a). Engagements as short as 12 weeks can be influential in providing students with more confidence, better-developed identities and experiences, and a better understanding of the industry needs to enter the workforce after graduation (Lowe et al., 2022; Male & King, 2014a). However, to maximize students' experience with WIL/WPL, students are expected to possess certain knowledge, skills, and competencies before their industry placements (Lowe et al., 2022; Winberg et al., 2020). The current practice shows that developing such competencies can be a challenging task because students may not clearly understand what it means to be an engineer and what critical skills they should develop during their university studies (Lowe et al., 2022). Additionally, it may not be possible to teach every single skill during the undergraduate years at university (Goller et al., 2020), and thus there may be mismatches between the student's knowledge level, competencies, and skills from one side, and the needs of the industry from the other side (Karim et al., 2020; Lowe et al., 2022; Winberg et al., 2020). As a result, it has been a challenging task across the country to produce industry-ready graduates who have sufficient knowledge and experience required by the industry (Chew et al., 2021; Llewellynn & Clark, 2014). To address this issue, Male and King (2014a,b) introduced and discussed best practices to facilitate industry engagement in Australian

engineering education. However, their work focused mainly on industry engagement rather than students' and industry perceptions, needs and expectations. Yet, there is still a need to better understand engineering students' awareness of the industry, their perceptions of the current workforce, and their readiness to undertake WIL/WPL placements (Rouvrais et al., 2020). Karim et al. (2020) noted that students' transition from novice learners to graduates with a focused mindset and developed identity would have the most effective outcome on society as a whole (Karim et al., 2020). Lutz and Paretti (2017) and Kövesi and Kálmán (2020) called for more research exploring student perceptions of what they have learned through completing a WIL placement and graduates' views on knowledge, skills, and attributes and how they meet their employment needs at the time of their graduation. Similar recommendations were made by Crosthwaite's (2019) scoping study of the engineering futures by 2035. Crosthwaite (2019) noted that it is important to better understand student employment contexts, their transition from education into work, career expectations and ambitions.

Considering the current knowledge, the research questions of this project were formulated as follows: What are the graduates' skills and competencies currently required by the industry? Are students aware of the industry skill set needs and expectations, and have they developed (or been offered the chance to develop) such skills during the first few years of their undergraduate programs? What are the important expectations of students from their WIL/WPL providers? What are the ways that the institutions could assist both students and industry to achieve the most out of the WIL/WPL initiatives?

This research project seeks to investigate the students' perceptions of the industry and evaluate students' skills and their readiness to undertake industry projects at both universities. This study focuses on the identification of differences (mismatches) between students' expectations from the WIL placements, their perceptions of the current workforce, and the industry's perceptions of students' skills and competencies. The results of this work should establish areas for improvement in offering WIL programs and provide engineering schools with recommendations on how to better support students in acquiring the knowledge and developing critical skills required by the relevant industry.

Methods

This study consisted of online surveys of students and industry partners, followed by a series of student focus group interviews.

Online survey

All undergraduate and master students from different engineering disciplines at the Griffith School of EBE were invited to participate in the anonymous online survey as part of the IAP program before they commenced their industry placements (March 2023). All undergraduate and master civil engineering students from CSU were invited to participate in the survey in May-June 2023. The survey questions were designed to 1) collect data on students' demographics; 2) students' ranking of the most important skills and competencies that they believe the current industry requires, and 3) students' evaluation of their skills and competencies concerning the industry. In addition, the open-response questions were analysed to identify the recurrence and co-occurrence of keywords or themes that reflected the participant's opinions on the importance of certain types of skills and competencies for students' industry careers.

The industry partners were surveyed at the end of the student industry placement to collect data on their satisfaction with student performance and to identify the areas where the current industry expectations were not met by the students. The industry partner survey included a series of questions about students' performance, their ethical and professional conduct, project management skills, and students' initiative and responsibility.

Focus groups

Focus group interviews with students were conducted at the end of their industry placements to clarify and discuss the findings of the student surveys and gain a better understanding of student perceptions of their WIL experiences. The students were offered an incentive (gift vouchers) to participate in these focus groups. The focus groups consisted of 3-4 students and were conducted online either via Teams or Zoom. The interviews were recorded and transcribed to analyse the students' responses to questions regarding students' experience with their industry placements, and their ranking of the skills and competencies required by the industry.

Preliminary results and discussion

Participants

There were 40 responses to the online survey obtained at the Griffith School of EBE and 30 responses from the students in CSU (March 2023). The questions related to students' demographics and engineering disciplines/programs are summarized in Table 1.

There are a few similarities between the two engineering schools such as most of the respondents (75% and 80%) were male at the age of 20-24. The major differences between the respondents were identified as follows: 1) there were about 38% international students at the Griffith School of EBE while CSU dealt with only domestic students in their program; 2) the Griffith School of EBE offered their WIL program to students from different engineering disciplines while CSU's program was offered to civil engineering disciplines only.

Table 1: Students' demographics

Variables	Values	Griffith University		Charles Sturt University	
		n	%	n	%
Gender	Male	31	75	24	80
	Female	9	25	6	20
	Prefer not to say	0	0	0	0
Age Group	17-19 years	0	0	4	13
	20-24 years	25	59	15	50
	25-29 years	8	21	4	13
	30-39 years	7	20	6	20
	40-49 years	0	0	1	4
Discipline	Civil and Environmental	22	44	30	100
	Construction/Project management	8	13	0	0
	Electrical/Electronic	4	23	0	0
	Mechanical	4	16	0	0
	Software	2	3	0	0
Student status	Domestic	21	62	30	100
	International	19	38	0	0
	Undergraduate	31	80	18	60

Level of degree program	Postgraduate	9	20	12	40
Previous internship/work experience	Yes	27	61	12	40
	No	13	39	18	60

Students' perception of the industry requirements

As the student focus groups and industry partner surveys were conducted later in the year, the obtained data is still being processed and analysed. For this reason, only the students' ranking of the professional skills and competencies will be presented and discussed in this paper.

As part of the online survey, students were required to rank a set of skills and competencies in order of importance for their industry careers. The list of skills and competencies was prepared before the student online survey using the data from a recent report (Engineers Australia, 2022) in which 68 industry partners across Australia identified the most important skills and attributes expected from university graduates. In this report, the industry partners ranked the most important skills required from university graduates, and the summary of this ranking is given in Table 2 in the column called 'Industry partners' ranking'. According to the industry partners' ranking (Engineers Australia, 2022), motivation, concern for safety, teamwork and communication skills were identified as the most important attributes of industry-ready graduates, with motivation being a standout priority.

The data from the student online surveys conducted at Griffith University and CSU was compared with the industry partners' ranking (Engineers Australia, 2022). Interestingly, most of the students at both universities ranked *communication skills* very highly (No.1 at both universities), followed by *concern for safety* (No.2 at the Griffith School of EBE), and *teamwork, leadership, and project management skills* (No. 2 at CSU). These results appear to be similar to the industry partners' ranking. Other similarities between the student's perceptions and industry expectations include *design skills* and *discipline-specific knowledge and capability*, which were ranked relatively low by the students and industry. The main differences (mismatches) are related to the relatively low ranking of *motivation* by Griffith students (only No.8), and the relatively high students' ranking of *problem-solving skills*, compared to the industry expectations.

It is expected that the data from student focus groups and industry partners' surveys obtained as part of this study will be analysed to clarify the aforementioned findings and identify the current industry expectations of university graduates at Griffith University and CSU.

Table 2: Ranking of skills and attributes

Skills/Attributes	**Industry partners' ranking** (from Engineers Australia, 2022)	**Students' ranking**	
		Griffith University	**Charles Sturt University**
Motivation	1	8	3
Concern for safety	2	2	6
Communication skills	3	1	1
Understanding the basic principles of engineering (mathematics, physics, computing)	4	7	9

Teamwork, leadership, and project management skills	5	4	2
Discipline specific knowledge and capability	6	6	7
Problem solving skills	7	3	4
Hands-on engineering skills	8	5	5
Design skills	9	9	8
Professional presentation and ethical conduct	10	10	10

Concluding remarks

The paper presents and discusses the preliminary results of the joint research project conducted by the Griffith School of EBE and the School of Computing, Mathematics and Engineering (SoCME) at Charles Sturt University. An online student survey was conducted among undergraduate and master students to identify students' perceptions of the industry requirements. It has been found that students have a good understanding of the importance of certain sets of skills such as commination skills and teamwork, leadership, and project management skills, which are attributes that the current industry requires from graduate engineers. Motivation and problem-solving skills were identified as mismatches between the student's perceptions of the industry needs and the industry requirements. It appears that Griffith students may underestimate the importance of motivation while students from both universities regard problem-solving skills as much greater as the current industry does.

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