Engineering students' perceptions of industry placements: Insights and experiences

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This study examines students' perceptions of industry and evaluates their skills and readiness for industry placements. Engineering students participating in work-integrated learning (WIL) at Griffith University and Charles Sturt University completed pre-placement online surveys and post-placement focus group interviews to assess their awareness of industry expectations and the extent to which they had developed the required skills and attributes. The findings indicated that students generally had a solid understanding of industry expectations and believed they had developed necessary skills during their studies. However, some attributes that students considered less important were highly valued by industry. These insights highlighted areas for improvement within both universities. Furthermore, industry placements helped students re-evaluate the importance of certain attributes, underscoring the critical role of WIL programs in supporting students' professional development.

Keywords: Work-integrated learning, industry placement, student experience, employability.

Work-integrated learning (WIL) placements are a recognized strategy to expose students to authentic learning experiences within industry. WIL is defined as "student experiences of work within the curriculum, undertaken in partnership, through engagement with authentic and genuine activities with and for industry, business or community partners" (Campbell et al., 2019, p. 11). Jackson et al. (2017) noted that in Australia, WIL typically refers to a range of activities that connect industry with education, enabling students to apply theoretical knowledge in practical contexts. This can occur through industry placements such as internships where students gain hands-on experience in a workplace or through industry-based projects (non-placement) that provide authentic learning experiences within a university setting. Such WIL experiences are recognized as a valuable tool for developing knowledgeable and skilled graduates who are well-prepared to succeed in the workplace (Universities Australia et al., 2015). The current literature shows that WIL benefits students by providing them with direct entry into the labour market, improving their employability (Jackson & Rowe, 2023), and improving their teamwork and communication skills (Male & King, 2014b). Students can better understand the nature and standard of industry-required skills (Gamble et al., 2010), and find out about industry expectations (Wilton, 2012). Industry partners also benefit from this approach, not only by providing an altruistic contribution to their sector, but they also gain from the completion of short-term technical tasks at low cost (Ferns et al., 2014). However, the literature also indicates that industry placements may require additional resources from universities (Rana et al., 2025), and there are a range of challenges including providing academic supervision for students (Smith & Worsfold, 2015), coordinating with industry partners (Choy & Delahaye, 2011), developing suitable projects (Jackson et

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al., 2017), student safety (Hay & Fleming, 2021), and addressing financial challenges faced by students (Moore et al., 2015).

Industry engagement experiences, such as WIL, 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., 2025; Male & King, 2014a). To maximize the benefits from industry placements, students are expected to possess certain knowledge, skills, and competencies (Campbell et al., 2019; Kay et al., 2019; Lowe et al., 2025; Winberg et al., 2020). However, developing such competencies during a university program, especially in the first few years of student studies, 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 (Lowe et al., 2025). In addition, it may not be possible to teach every single skill at university (Goller et al., 2020), as classroom learning may not always adequately prepare students for their industry placements, especially in their ability to use technology and speak comfortably to clients and co-workers (Jackson, 2015). As a result, there may be a mismatch between the student's knowledge, skills, and competencies on one side, and the industry's needs on the other (Itani & Srour, 2016; Karim et al., 2020; Khalid et al., 2014; Lowe et al., 2025; Winberg et al., 2020). These differences make it challenging to produce industry-ready graduates (Chew et al., 2023; Llewellynn & Clarke, 2014).

To better prepare students for the workforce, students should have a better understanding of the current needs and expectations of the industry (Rouvrais et al., 2020). This will facilitate a smooth transition from novice learners to graduates with a focused mindset and a developed identity, leading to the most effective outcomes for society (Karim et al., 2020). Kövesi and Kálmán (2020), and Lutz and Paretti (2017) called for more research on student perceptions of WIL placements and their views on the knowledge and skills expected by industry. Crosthwaite (2019) noted that it is important to better understand student employment contexts, their transition from education into work, and their career expectations and ambitions.

This study focuses on graduate attributes (i.e., skills, knowledge, and abilities of university graduates), which are applicable across various contexts and are acquired through the completion of an undergraduate degree (Barrie, 2006). Graduate attributes are generally seen as generic (Male, 2010) and transferable (Kensington-Miller et al., 2018), and they are important tools that help graduates engage constructively with the world beyond the classroom (Kember et al., 2017) and improve graduate employment prospects (Clarke, 2018; Schech et al., 2017). Several studies (Bridgstock, 2009; Jackson, 2014; Jones, 2013) provided a list of graduate attributes, including communication, critical thinking, problem-solving, and teamwork capability, which are considered essential for industry careers. However, graduate attributes may vary depending on the industry workplace and discipline specificity, making it a challenging task to identify which skills to develop to bridge the gap between education and employment (Cole & Hallett, 2019; Fleming et al., 2009; Kensington-Miller et al., 2018). Certain attributes can be considered integral to one discipline while they may be viewed as peripheral to another (Nisbet et al., 2022; Schulz, 2008).

Research Questions

Considering the current knowledge, the research questions of this study were as follows:

1. Are students familiar with the graduate attributes expected by the engineering industry?
2. Do students understand the importance of certain attributes for their graduate career success?
3. Have students developed such attributes and competencies during their university studies?

This article aims to examine whether engineering students at two Australian universities are aware of the graduate attributes currently required by industry and whether they have developed the essential skills and competencies needed for successful careers in the sector. Additionally, through a series of online surveys and focus group interviews conducted before and after industry placements, this study explores how these experiences influence students' perceptions of the skills and attributes valued by industry. The novelty of this research lies in comparing students' views on the importance of specific skills and attributes before and after completing industry placements. This work is a collaboration between the School of Engineering and Built Environment (EBE) at Griffith University (GU), and the School of Computing, Mathematics and Engineering (SoCME) at Charles Sturt University (CSU). The following section will introduce the work-integrated learning programs at both universities.

WORK-INTEGRATED LEARNING AT BOTH UNIVERSITIES

Griffith University uses the Industry Affiliates Program (IAP) to provide students across the 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 industry for one trimester (12 weeks) (Gratchev et al., 2025). IAP uses a work-integrated learning (WIL) approach, which requires final-year undergraduate engineering students to complete an industry-based thesis as part of gaining their work experience before graduation. Postgraduate students enrolled in the project management and advanced civil engineering programs are also required to complete the IAP course.

The IAP course offers students a unique opportunity to work on an industry-related project while completing an industry placement. This is made possible through the joint efforts of the Griffith School of EBE and the Work Integrated Learning (WIL) Partnership Office, which coordinate and arrange placements for students. To ensure project suitability, all industry-proposed projects are reviewed and approved by WIL coordinators. Additionally, each student is assigned an academic supervisor who provides guidance on the project and feedback on assessments.

CSU Engineering offers a WIL approach to their engineering students (Graham, 2018), which takes place in the form of work placement learning (WPL) when students work in the industry while taking university courses. 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 on 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 worked 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.

METHODS

The study involved an anonymous online questionnaire completed by students prior to their industry placements, followed by a series of focus groups with students who had completed their placements. The pre-placement survey aimed to assess students' perceptions of the graduate attributes they considered important for industry and to evaluate which of these attributes they believed they had developed during their university studies. The focus group interviews explored whether students' industry experiences had influenced their views on the importance of specific skills and competencies.

Online Survey

An invitation to complete the online questionnaire was emailed to all undergraduate and master students who were enrolled in the IAP course (6002ENG and 7605ENG) at Griffith University in Week 0 before the students started their placements in (Terms 1 and 2 of 2023). The same online survey was administered at CSU in Week 0 before students commenced their industry placements. No incentives were offered for participation and thus the students who participated in the survey were intrinsically motivated to express their opinions. All participants consented to participate in the study, and the research was conducted in accordance with ethical guidelines to ensure their rights and confidentiality were respected.

The survey was open for two weeks and was designed using Microsoft Forms to collect data on the following dimensions: 1) student demographics; 2) students' ranking of the most important skills and competencies that they believe the industry requires, and 3) students' evaluation of their skills and competencies concerning the industry. This questionnaire included a set of statements, where respondents could select from Strongly Agree to Strongly Disagree on a standard 5-point Likert scale. Three open-ended questions prompted participants to reflect on their industry experiences and how well their university studies had prepared them for their placements. In addition, students were requested to rank ten skills and attributes in order of importance for industry careers. The list of skills and attributes was presented to students in alphabetical order.

A total of 96 survey responses were received, which included 66 from GU, and 30 from CSU. Four GU responses from non-engineering students were removed as they were ineligible for the survey, leaving a total of 92 valid responses.

Student Focus Groups

Focus groups were conducted with students at the end of their industry placements to clarify and discuss the findings of the student online surveys and gain a better understanding of student perceptions of their industry experiences. The students were offered a gift voucher incentive to participate in these focus groups. The focus group interviews were conducted online either via Microsoft Teams® or Zoom®. The length of focus group interviews varied from 45 minutes to 60 minutes. The students were selected based on their willingness to participate, and to ensure representation of different genders. The interviews were recorded and transcribed to analyze the students' responses to questions regarding students' experience with their industry placements, and their ranking of the skills and competencies required by the industry.

The questions were as follows:

1. What were the positive and negative aspects of your industry placement experience?
2. Rank ten skills and attributes and explain why you ranked it this way (where 1 is highest and 10 is lowest). Note that the same list of skills and attributes as the one used in the online survey was presented to the students in each focus group in alphabetical order.
3. Do you feel that your previous university studies helped you develop the skills/attributes that were important for your industry placement? Why?

Data Analysis

Survey responses were recoded to range from one ('Strongly Disagree') to five ('Strongly Agree'), and means and standard deviations were calculated for each of the survey questions as per Harpe (2015). SPSS 30 was used for statistical analysis of the survey responses. When the Mann-Whitney U test (Mann & Whitney, 1947) was used for analysis, effect sizes were calculated using the Wendt (1972) approach as suggested in Kerby (2014).

The open-response items in the online survey as well as the data from the focus group interviews were analyzed to identify the recurrence and co-occurrence of keywords or themes that reflected the students' perceptions of industry.

The ranking of skills/attributes produced by the surveyed students and the focus groups was compared with rankings from industry partners from a report by Engineers Australia (2022). In the report, sixty-eight industry partners were surveyed to determine the most important attributes that industry expected from university graduates.

PARTICIPANTS

Online Survey

The demographics of the online survey participants are shown in Table 1. Similarities between participants from the two engineering schools included gender (75% (GU) and 80% (CSU) were male students) and age, where at least half of the respondents were between 20-24 years old. The cohorts also had differences, with no responses from international students at CSU, compared to 35.5% of the responses at GU coming from international students. In addition, the industry program at Griffith University was offered to students from a range of different engineering disciplines, while CSU's industry program only included students from the civil engineering discipline.

TABLE 1: Demographics of students who participated in the online survey.

Variables	Values	GU (N = 62)		CSU (N = 30)	
		n	%	*n*	%
Gender	Male	46	74.2	24	80.0
	Female	16	25.8	6	20.0
Student Type	Domestic	40	64.5	30	100.0
	International	22	35.5	0	0
Age Group	17-19	0	0	4	13.3
	20-24	35	56.5	15	50.0
	25-29	15	24.2	4	13.3
	30+	12	19.4	7	23.3
Program Level	Undergraduate	50	80.6	18	60.0
	Postgraduate	12	19.4	12	40.0
Major	Civil / Environmental / Project Management	35	56.5	30	100.0
	Electrical / Electronic / Software	16	25.8	0	0
	Mechanical	11	17.7	0	0

Focus Group Interviews

All participants completed their industry placements before the focus group (FG) interview. Four focus group interviews were conducted, with the student details given in Table 2.

TABLE 2: Demographics of focus group interview respondents.

Variables	Values	Focus group 1 (FG1)	Focus group 2 (FG2)	Focus group 3 (FG3)	Focus group 4 (FG4)
University		Charles Sturt University	Charles Sturt University	Charles Sturt University	Griffith University
Total number of students		3	4	3	3
Gender	Male	3	2	2	0
	Female	0	2	1	3
Age Group	20-24 years	3	2	2	3
	25-29 years	0	2	1	0
Discipline	Civil / Environmental engineering	3	4	3	4
Student status	Domestic	3	4	3	1
	International	0	0	0	2
Level of the degree program	Undergraduate	3	4	3	2
	Postgraduate	0	0	0	1

ONLINE SURVEY RESULTS

The online survey results are presented in Table 3, in order of the highest to lowest mean survey response for Griffith University students. Although the ranking order is slightly different for both universities, the top three items with the highest means were the same, which suggests that students believed their studies helped them to develop their ability to work in teams, solve problems, and improved their future employability. The bottom two items at both universities were also the same, and related to students understanding links between their studies and the impact of their work in the context of First Nations and Indigenous Australians, as well as developing their understanding of health and safety practices.

TABLE 3: Results of the online student survey.

	GU (N = 62)		CSU (N = 30)	
Questions: I think my previous studies helped me …	*M*	*SD*	*M*	*SD*
develop my ability to work as a team member	4.15	1.05	3.97	1.03
develop my ability to solve problems	4.13	0.90	3.90	1.09
improve my future employability in Australia or internationally	4.10	0.92	4.10	1.16
develop my technical knowledge	4.08	1.03	3.67	1.16
develop my written communication skills	4.05	1.06	3.77	1.04
understand the contribution engineers make to society	4.05	1.00	3.83	1.23
develop my confidence in tackling unfamiliar work-based problems	3.84	1.06	3.77	1.04
develop my presentation skills	3.81	1.07	3.77	0.94
develop my hands-on engineering skills	3.74	1.20	3.83	1.15
develop my understanding of ethical conduct	3.71	1.06	3.77	1.07
develop my understanding of health and safety practices used in industry	3.69	1.03	3.60	1.13
understand the impact of my work in the context of First Nations and Indigenous Australians	3.27	1.27	3.40	1.19

Survey responses from each university were analyzed separately to identify any significant differences, as outlined in the following sections.

Gender Differences

When comparing responses by gender, a Mann Whitney U test indicated that scores for the *developing my understanding of ethical conduct* item were significantly lower for women (Mdn = 3.5, M = 3.25) than in men (Mdn = 4.0, M = 3.87) at Griffith University, U = 244.5, p = .036. The effect size, r = 0.34, indicates there is a medium effect. No other significant differences were found for any other item when comparing men and women at either university.

Degree Program Level

When comparing undergraduates and postgraduates, a Mann Whitney U test indicated that scores for *develop my presentation skills* were significantly higher for postgraduate students (*Mdn* = 4, *M* = 4.41) skills than in undergraduate students (*Mdn* = 4, *M* = 3.66) at Griffith University, $U = 181.5$, $p = .025$. The effect size, $r = 0.59$, indicates there is a large effect. No other significant differences between undergraduates and postgraduates were found at either university.

Student Status

As there were no responses from international students at CSU, testing focused on comparing responses from international ($n = 22$) and domestic ($n = 40$) students at Griffith University. Of the 22 international students, ten were undergraduates and twelve were postgraduates. As shown in Table 4, scores for international students were significantly higher than domestic students on six items, with effect sizes indicating a medium effect.

TABLE 4: Overview of significant differences between international and domestic students.

Item	International *Mdn* (*M*)	Domestic *Mdn* (*M*)	Result	Effect Size
develop my hands-on engineering skills	4.5 (4.14)	4 (3.53)	$U = 301$, $p = .034$	$r = 0.32$
develop my presentation skills	4 (4.18)	4 (3.60)	$U = 298$, $p = .026$	$r = 0.32$
develop my confidence in tackling unfamiliar work-based problems	4 (4.18)	4 (3.65)	$U = 301.5$, $p = .032$	$r = 0.31$
develop my understanding of health and safety practices used in industry	4 (4.09)	4 (3.48)	$U = 282$, $p = .013$	$r = 0.36$
understand the impact of my work in the context of First Nations and Indigenous Australians	4 (3.77)	3 (3.00)	$U = 279.5$, $p = .015$	$r = 0.36$
improve my future employability in Australia or internationally	5 (4.36)	4 (3.95)	$U = 284$, $p = .012$	$r = 0.35$

Discipline Differences

As the CSU participants were all from the civil engineering discipline, only the scores from the different disciplines for Griffith University respondents were compared. Testing did not identify any significant differences between students from the different majors.

Student Comments

The positive scores regarding technical skills, written communication skills, and problem-solving are reflected in student opinions suggesting that they have developed such skills during their academic studies.

Comments from Griffith University students included the following: "I developed analytical and writing skills by doing my assignments and projects," "When it comes to soft skills, writing skills, group work skills, and team management skills, we learnt them at Griffith University, and they were useful during the IAP program" and "I think the actual technical content that I learned at uni applies to the industry that I'm in. It's packaged differently, but the main principles are all the same."

The CSU students noted that their courses helped them prepare more effectively for their industry placements, particularly by enhancing their understanding of professional ethics and improving their presentation and communication skills. Some relevant comments included the following: "We would do assignments on ethics, and we started to understand what those basic ethics were, and what that looks like in the workplace" and "There were specific subjects on preparation for entering a workplace, which included all the professional presentation, communication, and all the ways that you act."

Ranking of Skills and Attributes

As part of the online survey, students ranked a set of skills and competencies in order of importance for their industry careers. This list of skills and competencies was extracted from a recent Engineers Australia (2022) report in which 68 industry partners across Australia identified the most important graduate attributes expected from university students. The results of students' ranking and comparisons with the industry partners' ranking are given in Table 5.

According to Engineers Australia (2022), motivation, concern for safety, teamwork and communication skills were identified by industry partners as the most important attributes of industry-ready graduates, with motivation being a standout priority (Table 5). The students who participated in the online survey before their industry placements similarly ranked certain attributes: 1) many students at both universities ranked communication skills very highly (as their top priority), followed by concern for safety (ranked second at GU), and teamwork, leadership, and project management skills (ranked second at CSU); 2) the design skills, professional presentation, and ethical conduct were ranked relatively low by the students from both universities, similar to the industry partners' ranking. However, there were also a few differences (mismatches), which were related to the relatively low ranking of motivation by the Griffith students (ranked sixth) and the relatively high students' ranking of problem-solving skills (for both universities) compared to the industry expectations.

FOCUS GROUP RESULTS

The focus groups provided insights into the student rankings of the attributes and competencies and were conducted after the students had completed their placements. The students ranked the same attributes as the ones used in the online survey and commented on the rationale for their choices. At the end of each focus group, the final ranking was produced and agreed upon by all members of the focus group (Table 5). The focus group discussions revealed that, in general, many students believed that at the start of their career, interpersonal and soft skills were more important than industry-specific skills because industry would know that students did not have much experience and technical knowledge yet. More details regarding each attribute are given below.

TABLE 5: Students' ranking of graduate attributes and competencies.

Skills/Attributes	Industry partners' ranking (from Engineers Australia, 2022)	Students' ranking before placement (online survey)		Students' ranking after placement (focus groups)			
		Griffith University	Charles Sturt University	Focus group 1	Focus group 2	Focus group 3	Focus group 4
Motivation	1	6	3	1	9	4	1
Concern for safety	2	2	6	10	10	8	7
Communication skills	3	1	1	4	1	1	2
Understanding the basic principles of engineering (mathematics, physics, computing)	4	9	9	9	3	5	6
Teamwork, leadership, and project management skills	5	4	2	2	2	3	5
Discipline-specific knowledge and capability	6	7	7	5	7	6	8
Problem-solving skills	7	3	4	6	5	2	3
Hands-on engineering skills	8	5	5	3	4	7	9
Design skills	9	8	8	8	8	10	10
Professional presentation and ethical conduct	10	10	10	7	6	9	4

Motivation

Compared to the results of the pre-placement online survey, the industry placements highlighted the importance of motivation, with three out of four focus groups ranking it highly. Students recognized the critical role motivation plays in real-world settings and acknowledged its significance for their future careers, as suggested by the following comments from focus group participants: "I would say motivation is #1 because they (the industry) know you are still a student, so they don't expect you to have an amazing technical idea or knowledge, but they really appreciate your attitude" (Participant 1). "Motivation is more important to someone who's going to have more successful outcomes" (Participant 2). "If you are motivated to do something, and if you do enjoy doing it, you are going to do a lot better job than you would normally" (Participant 3).

Interestingly, the second focus group did not view motivation as particularly important, ranking it relatively low at number nine. They appeared to regard motivation not as a skill, but as a temporary state. Their reasoning was as follows: "Your motivation comes and goes, it's not a reliable thing as you're doing it "(Participant 4) and

> I think, in my experience. Motivation is time and constrained resources. It only comes and goes at certain points and doesn't really last. The nature of my brain and how it works is that I don't always have a lot of motivation. (Participant 5)

Concern for Safety

All four focus groups ranked it low. Students appeared to view it as less important, as they had not encountered situations during their placements where safety was a primary concern. Their comments suggested that the emphasis on safety varied by industry and an individual's understanding of safety. Students also noted that its importance could increase in contexts involving the management of a team or on-site construction work. For example, one participant noted that

> Concern for safety depends on which part of the industry you're in. It's going to be up to the individual in the role to make the decision because people who sit behind the desk, and just do asset management all day, probably won't have as much of a concern, because they're not managing crews or anything like that. It's more the people doing the project management would have more of that concern. (Participant 6)

Communication Skills

All four focus groups ranked this skill highly, which was consistent with the online survey results collected before the industry placements. The industry placements reinforced students' understanding of the importance of communication skills, as they frequently worked in teams and participated in regular meetings. "I feel like communication skills should be #1 because we need to arrange so many meetings with our academic and industrial supervisors" (Participant 7).

> At the start of the career, the interpersonal skills and the soft skills are more important because the industry knows that we don't have that experience yet and that's what they're planning to teach us. It seems that industry-specific skills are the least important at this stage. (Participant 8).

> I think communication skills are more important, just because you might not necessarily always be in a teamwork or project management position, but being able to communicate and work well with those who are, is going to be more important in most cases. (Participant 3).

Understanding the Basic Principles of Engineering (Mathematics, Physics, Computing)

The students' rankings were similar to those of industry professionals. They recognized the importance of fundamental engineering principles, ranking them higher than discipline-specific knowledge and capabilities. Students viewed these fundamentals as an essential foundation upon which they could build as they advance in their careers. One participant also noted the requirement to be able to explain that understanding to those without technical backgrounds: "It's good to know the fundamentals. You have to present the results of your findings, and your designs, which are all based on engineering and math principles to people who probably don't understand any of it at all" (Participant 8).

Teamwork, Leadership, and Project Management Skills

The results of the post-placement interviews were very similar to those of the pre-placement online surveys, where students showed a clear understanding of the importance of these interpersonal skills, particularly for career advancement. The industry placements further reinforced this belief and provided valuable insights into industry expectations: "Engineers expect us to have good leadership and project management skills" (Participant 6), and "There's a level of skill that's inherently expected. Like having those teamwork skills and leadership skills" (Participant 9).

Discipline-Specific Knowledge and Capability

Similar to the online survey, students in the post-placement interviews ranked these skills relatively low. However, the interviews also offered explanations for why discipline-specific knowledge and capability were not ranked higher. It appeared that industry placements helped students realize that such knowledge and skills could be developed on-site, as industry partners were willing to teach the technical aspects of their roles. "If you're new to the industry, you probably wouldn't really know much about the discipline, and your personal capability would be lower than other senior engineers on the team" (Participant 8).

Problem-Solving Skills

Universities emphasize the importance of problem-solving skills, particularly for engineering students who are expected to tackle real-world challenges in their careers. It is not surprising that students regard this as a key attribute for their future success. However, the post-placement interviews revealed differing views on its significance. While all four focus groups acknowledged the value of problem-solving, two groups ranked it relatively lower, which was similar to the industry partners' assessment. The group discussions suggested that students considered other attributes to be more critical, as illustrated by the following quotation: "I think problem-solving skills are a lot more important later on. If we are just talking about going on a placement, then understanding the basics of engineering should be more important" (Participant 3).

Hands-On Skills

There were different opinions about the importance of hands-on skills, with two focus groups ranking them relatively high (third and fourth), while the other two focus groups ranked them low (seventh and ninth). It is noted that the relatively low ranking agrees with the industry partners' ranking (eighth). The rationale for the low ranking was that such skills can be taught or acquired on-site, and thus they may not be critical at the beginning of students' careers in industry. "It's relevant to which workplace you're working in, and the expectation is that you'd learn them (i.e., hands-on skills) on-site" (Participant 10), and "My project didn't require any hands-on engineering skills" (Participant 1).

Design Skills

Similar to the industry partners' ranking, students in the focus groups also placed design skills relatively low. The prevailing view was that these skills are highly specific and can be developed later on the job when they become relevant. Students also believed that industry partners would provide training to develop such skills when needed.

The following quotations offer further insight into the students' reasoning: "I feel like design skills would be lower because if we're new to the industry, we don't know what the design skills are and a lot of the time that's the things you learn on the job" (Participant 8), "The least important things are the things that you can teach… things like design skills" (Participant 10) and "The design skill because the industry is open to teaching you in the office" (Participant 1).

Professional Presentation and Ethical Conduct

The relatively higher ranking by the focus groups differed from both the pre-placement survey results and the industry assessment of this attribute. It appears that during their industry placements, students were exposed to professional ethics and presentation practices, which led them to re-evaluate the importance of these competencies in the workplace. The following quotation reflects the general consensus reached by the focus group: "We have to respect the ethical conduct of the industry partner we're working with. And when we have a professional presentation, they understand that we take it seriously" (Participant 7).

DISCUSSION

The online survey results indicate that students at both universities believed their engineering programs provided opportunities to develop technical skills, communication skills, problem-solving abilities, and teamwork. Rankings of skills and attributes from the survey and focus group interviews confirmed that students recognized the importance of soft skills, such as communication and teamwork, for successful career development in industry. These findings align with recent literature emphasizing the critical role of soft skills, alongside technical expertise, in enhancing career prospects (Caeiro-Rodríguez et al., 2021; Itani & Srour, 2016; Patacsil & Tablatin, 2017). However, this study also identified areas within the curriculum that require greater attention, as well as potential mismatches between student and industry perspectives, which are discussed below.

The online survey revealed that current programs at both universities do not provide sufficient knowledge about the impact of engineering work on Indigenous communities, highlighting an area for improvement. Previous studies (Fletcher et al., 2017) suggest that students perceive cultural diversity and ethical responsibilities as under-taught in universities, indicating the need for greater emphasis. Additionally, the survey and focus group interviews showed students were not confident in their understanding of health and safety practices. This may be because many focus group participants were engaged in desk-based tasks or activities where health and safety was not a primary concern. Although neither university offered dedicated modules on ethics or health and safety, these topics were addressed within various courses across the engineering program. It is possible that students may not realize that they have covered these areas unless lecturers explicitly highlight them.

The survey revealed significant differences between men and women at Griffith University regarding the item on developing an understanding of ethical conduct, although the reasons for this disparity remain unclear. Further research is warranted to explore this area. The study also identified several differences between international and domestic students at Griffith University, which may suggest that international students have different expectations about course content. Interestingly, international students expressed confidence that studying in Australia would enhance their employability; however, previous research indicates that international graduates often face challenges in securing employment (Blackmore & Rahimi, 2019; Coffey et al., 2021).

This study identified differences between student perceptions and industry expectations, particularly regarding motivation and problem-solving skills. Motivation is often defined as students' willingness to engage and succeed in the learning process (Bomia et al., 1997), yet it is not typically classified as a soft or technical skill. The online student survey ranked motivation relatively low, especially among Griffith students. In contrast, industry ranked motivation highly, recognizing its role in helping graduates quickly develop on-the-job skills, gain experience, and advance their careers. Interestingly, Shah et al. (2019) observed that students may begin industry placements with low motivation, but their motivation often increases by the end of the project. Similarly, Pantzos et al. (2023) noted that once students gain work experience and understand company expectations, their motivation to engage in learning significantly improves. These findings align with the focus group interviews in this study, where students who had prior practical experience ranked motivation as the most important attribute.

Interestingly, both industry and students ranked hands-on engineering and design skills relatively low, but their views differed on problem-solving skills. Students, both with and without industry experience, ranked problem-solving notably higher, likely because universities emphasize its importance in academic curricula. In contrast, industry partners ranked this skill lower, suggesting it is less critical compared to other attributes. According to Stevens and Norman (2016), employers are generally willing to provide in-house technical training to enhance graduates' skills, including hands-on engineering and design capabilities. However, many employers consider soft skills to be difficult to teach in the workplace, making them a key hurdle for employability. This may explain why industry placed less emphasis on problem-solving skills compared to student focus groups.

The shift in students' perceptions of the importance of certain attributes can be understood through Kolb's experiential learning theory (ELT), which describes learning as a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Kolb (2014) emphasized that a key goal of self-directed learning is applying knowledge and professional values to practices that are both competent and ethical within an organization (Bates et al., 2007). Through workplace-based experiential learning, students translate theoretical knowledge into practice and develop a more experience-driven perspective (McRae, 2015).

This study found that industry experience prompted students to re-evaluate the significance of professional competencies, with motivation being a notable example. The increased value placed on motivation appears to align with the reflective observation and abstract conceptualization stages of Kolb's model, as students processed and interpreted their workplace experiences. Kolb (2014) also noted that workplace learning opportunities enable students to become active decision-makers in their own learning. Through this process, students internalize professional values and adjust their self-perception, leading to the formation of a professional identity and underscoring the critical role of work-integrated learning (WIL) programs in supporting professional identity development (Jackson, 2017; Trede et al., 2012).

RECOMMENDATIONS

The results of this study indicate that students have a good understanding of the skills and attributes required by the current industry. However, there are a few areas that need improvement.

Students may not always be fully aware of the skills they have developed during their time at university unless these are explicitly communicated. It is important for academic staff to highlight the value of specific skills and attributes such as soft skills, health and safety practices, and motivation, particularly when these are supplementary to the core course content. Ideally, academics should discuss these skills during class and provide opportunities for students to reflect on the material covered.

It is recommended that safety in the work environment should be included in the engineering curriculum, which could be part of module or course related to professional practice. For example, the Grifith School of Engineering and Built Environment requires all students to complete a risk assessment when undertaking their final-year industry or research projects, which aims to introduce students to potential health and safety issues that may occur in industry.

Engineering programs should place greater emphasis on Indigenous perspectives by incorporating case studies that illustrate and critically discuss the potential impacts of engineering projects on First Nations and Indigenous communities.

LIMITATIONS

The following limitations may affect the generalizability of these findings. The online survey and focus group interviews were conducted among engineering students at Griffith University and Charles Sturt University. While these two schools may broadly represent typical engineering programs in Australia, the data presented reflects only the opinions of the respondents. A larger survey sample could provide a more comprehensive understanding of students' perceptions of industry and industry placements.

Additionally, the data discussed in this study primarily relates to industry placements arranged for final-year students at Griffith University and second-year students at Charles Sturt University. The online survey questions were designed to capture students' views on their readiness for industry placements, focusing on skills and attributes developed at these institutions.

As the survey asked students to indicate how their previous studies prepared them for various areas, postgraduate students may have interpreted 'previous studies' as either their entire academic history or only their studies in Australia. Future surveys could ensure the survey question is clearer to avoid any confusion.

CONCLUSION

This paper presents and discusses the findings of a research project conducted by the School of Engineering and Built Environment at Griffith University and the School of Computing, Mathematics and Engineering at Charles Sturt University. A pre-placement online survey was conducted among undergraduate and postgraduate students to identify their perceptions of industry requirements, while post-placement focus groups were held to clarify these findings and assess whether industry placements influenced students' views of the profession. The major conclusions are as follows.

The respondents demonstrated a solid understanding of the knowledge, skills, and competencies required by industry. Students recognized the importance of communication, teamwork, leadership, and project management—attributes that industry expects from graduate engineers. Many respondents believed that at the start of their professional journey, interpersonal and soft skills were more critical than industry-specific technical skills, which could be developed on the job.

Students believed they had acquired technical knowledge and industry-related skills through assignments, projects, and teamwork, which they felt would enhance their future employability. However, students also reported low confidence in understanding ethical conduct, health and safety practices, and the impact of engineering work on First Nations and Indigenous Australians.

Motivation and problem-solving skills emerged as areas of mismatch between student perceptions and industry expectations. Students from Griffith University appeared to underestimate the importance of motivation, while students from both universities ranked problem-solving skills much higher than industry did. However, industry placements seem to have helped students recognize the importance of certain skills and attributes for their future careers. This finding underscores the critical role of WIL programs in supporting the development of professional identity.

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In this Journal, WIL is defined as:

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Reference

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