

Strengthening Educational Partnerships: An Online Preparation Program for Engineering Partners*

FRANZISKA TREDE¹ and REZA MAHINROOSTA²

¹ Charles Sturt University, Division of Learning and Teaching, Panorama Ave, Bathurst, NSW, 2795, Australia.

E-mail: franziska.trede@uts.edu.au

² CSU Engineering, Charles Sturt University, Panorama Ave, Bathurst, NSW, 2795, Australia. E-mail: rmahinroosta@csu.edu.au

One of the key goals of professional engineering entry courses is to prepare graduates for the world of work, foster professionalism and strengthen employability. Universities can best accomplish this with effective, reciprocal educational partnerships with industry that include professional development support for host supervisors based on shared educational values and goals. To this end, a purposeful, self-paced, online preparation program for host supervisors was developed for an innovative, practice-based engineering degree situated in regional Australia. Survey methodology before and after the completion of the online preparation program was used to explore host supervisors' perceptions of its value and effectiveness as well as their views of what makes a good host supervisor. The results demonstrated that online preparation program was well received with supervision skills for cadet engineers the most informative of the five topics. Participant data provided evidence of host supervisors' insights into the complexity of their supervision role beyond training and recruiting technically competent future engineers. The paper discusses participants' keen interest in contributing to educating the next generation of engineers, their interests in purposeful, supervisor-centred professional development programs and concludes with implications for further research in this neglected yet so important aspect of engineering education.

Keywords: cadetship; host supervisor; professional identity; university-industry partnership; workplace learning; preparation program

1. Introduction

Workplace Learning (WPL) is an important part of university professional entry courses. WPL can be defined as purposeful, situated work with supervision. This builds academic credit, active student engagement with professional roles and responsibilities in real world professional settings. The purpose of WPL is to socialise students to their future professional roles, strengthen their employability, help them develop their professional networks and firm up professional values and identity [1, 2]. The latter is the main concern raised by Villanueva and Nadelson [3] for students in the engineering discipline. They highlighted the need for students to understand the norms and expectations of professional engineers. This can be best attained through learning experiences in real professional situations. WPL can be thought of as a transitioning pedagogy that integrates academic with practice based learning, where students learn to transition from being a student to becoming a professional [4]. With WPL students learn to integrate discipline-specific knowledge with professional and vocational skills. Discipline specific knowledge can be understood as inert. It is a-contextual, scientific knowledge that is taught in formal learning settings and can be acquired from textbooks. With WPL experiences, students develop their practice knowledge. This can be

understood as professional practice knowledge which is informed by so much more than discipline-specific knowledge, including social, cultural, relational, political, embodied, economic interests, as well as time and place interdependencies [2]. Universities alone cannot prepare students for the uncertain future world of work. This requires effective partnerships with, and support from, all WPL stakeholders. These include the future workforce (students), industry (practitioners, employers, and organisations), governments, communities and professional bodies. Effective WPL partnerships are grounded in mutual and reciprocal benefits for all involved. They should serve everybody's interests. Students want to learn to become future professionals and be employable. Industry wants a work-ready, capable workforce. Governments require universities to provide industry-relevant courses and finally, communities expect university graduates to contribute to economic and social wellbeing.

Unlike research partnerships, the WPL university-industry partnership is educational, with a focus on attaining intended student learning outcomes [5]. Although a lot depends on learner agency, students also rely on purposeful, skilled supervision in the host placement to make the most of WPL experiences [6]. Peach, Ruinard [7] also affirmed that supervisor feedback is crucial and that the "university needs to construct its relationship with industry conscientiously and with care"

and “prepare the workplace supervisors well for the WPL experience”. The WPL university-industry literature that focuses on host placement supervisors and their needs and perceptions for professional development, training and support is small compared with the literature on WPL students’ needs, and is predominantly located in the field of health and teacher education [8]. Male and King [9] who generated best practice guidelines for effective industry engagement in Australian engineering degrees identified as the number one guideline for faculties to “establish and maintain effective industry engagement as part of faculty culture”. This recommendation, however, fell short of discussing faculties’ duty of care to provide professional development to engineers in their role as host supervisors. There is a dearth of literature in the engineering education field of WPL that focuses on supporting host engineers in student supervision. Ananthakrishnan and Halyburton [10] reported on their case study of introducing a cadetship in regional Australia and asserted the benefits of WPL programs. However, their paper did not explore and cater to host engineers’ supervision skill needs. Rayner and Papakonstantinou [11] explored STEM employer perspectives of graduate skills and capabilities needed in current and future workplaces. They found that employers of new graduates ranked highly “graduates’ ability to apply knowledge to workplace environments” as well as “graduates’ problem solving and critical thinking skills” [11, p. 109]. They recommend that “regardless of the degree of alignment between universities and employers, graduate capabilities must reflect the current and future priorities of the workplace in order to enhance graduates work-readiness” [11, p. 108]. These graduate capabilities relate strongly to higher order thinking skills combined with social, cultural and organisational awareness. Helping students develop these metacognitive skills and professional dispositions must be a shared responsibility between universities and industries. Although these papers make valuable contributions on STEM WPL programs, little is known from the perspectives of host supervisors and what they perceive their own needs are, in order to become effective and confident host supervisors. The focus of this paper is on the WPL partnership between university and industry. More specifically, this paper focuses on appropriate university support in preparing host engineers for their supervisory role. Additionally, this paper theorises what is required to enhance the supervisor identity of host engineers. The aim of this study was to better understand the perceived value and effectiveness of an online preparation program for host supervisors. Before discussing the evaluation method, a brief context is

provided of the engineering course within which the online preparation program was embedded.

2. CSU Engineering course and the online preparation module

Charles Sturt University (CSU) introduced its first ever engineering degrees in the field of civil engineering in February 2016. At CSU Engineering, the traditional expectations of a university degree do not apply [12]; the program has neither lectures nor exams. Its curriculum consists of three semesters’ face-to-face, on-campus study (Project Based Learning (PBL) environment) followed by a series of four one-year paid cadet placements in the industry (Work Integrated Learning (WPL) environment), see Table 1 CSU Engineering Course Outline below. The curriculum is built on three pillars: project and portfolio based learning pillar, performance planning and review pillar (PPR), and a mastery of topics from the tree-of-knowledge pillar (Table 1). In the subjects in the first pillar, students are exposed to hands-on, practical, small group work projects designed based on authentic engineering challenges during the first 18 months, as well as real world projects from work placements and thesis (cornerstone and capstone) over the next four years to build their portfolio along with reflective self-assessment of their learning. Within the subjects in the second pillar, students engage in the management of their learning and professional performance, while they are supervised on placement and monitored by their academic mentors. It is the last pillar that students learn their technical knowledge through online content, which aligns their own learning needs in both university and industry. The online content adopts a self-selective modular approach, which empowers individual students learning journey. There are three phases in the curriculum: at the end of phase 1, students have reached the mastery level in specified online topics and successfully passed the engineering challenges and PPR subject, and are ready to go to their first workplace. At the end of phase 2 (end of the second workplace) and phase 3 (end of the fourth work placement), when students finish their cornerstone thesis and capstone thesis, they receive their qualification in Bachelor of Technology and Master of Engineering (civil system), respectively.

During workplaces, all students are supervised by practitioners in the host organisation, which have partnerships with the school. Because of the importance of supervision in the workplace, an online preparation program was developed for supervisor training which culminated in a face-to-face workshop during EngFest (CSU Festival of Engineering) right before students’ first placement commenced.

Table 1. CSU Engineering course outline [14]

			Project and Portfolio Based Learning Pillar	Performance Planning and Review Pillar	Civil Engineering Topic Tree Pillar
Phase 1	Session 1 Session 2 Session 3	Face-to-Face	Engineering Challenge 0: 2pt		
			Engineering Challenge 1: 14pt		Topic Tree - Student Engineer: 48pt
			Engineering Challenge 2: 14pt	Performance Planning & Review - Student Engineer: 4pt	
Engineering Challenge 3: 14pt					
Phase 2	1st Work Placement		Engineering Portfolio - Introductory: 14pt	Performance Planning & Review - Junior Cadet: 6pt	Topic Tree - Cadet Engineer: 72pt
			Engineering Portfolio - Developing: 14pt		
	2nd Work Placement		Engineering Cornerstone Thesis: 24pt	Performance Planning & Review - Intermediate Cadet: 6pt	
Phase 3	3rd Work Placement		Engineering Portfolio - Consolidating: 14pt	Performance Planning & Review - Senior Cadet: 6pt	
			Engineering Portfolio - Advanced: 14pt		
	4th Work Placement		Engineering Capstone Thesis: 32pt	Performance Planning & Review - Professional Engineer: 4pt	
			Engineering Portfolio - Professional: 2pt		

The purpose of the preparation module was to illustrate the principles of WPL and to provide supervisors with the resources, methods, and strategies that help them to support cadet engineers, and effectively supervise them. While supervising students is typically seen as an add-on to supervisors’ primary responsibilities [13], due to their insufficient time and high workload, it is an essential need in the CSU Engineering WPL model to build a structure to listen to its hosts and orient this interaction to prepare work-ready graduates. In addition to the skills required for supervising students, the core elements of the curriculum and expectation from supervisors have been discussed in the online programme. For instance, summative evaluations including feedback from host supervisors are considered in students’ final marking score in PPR subjects as well as cornerstone and capstone thesis. In the former, students set individual goals,

produce action plans and revise them to manage workload. Input from their supervisors is sought and considered during WPL and particularly in their assessment items. In the latter, students will define their thesis based on real world engineering problems in their workplace, and academics from university and their supervisors from industry will collaboratively supervise them to give technical support as well as align them to the standard process of doing a thesis.

The online preparation module includes 5 topics, the titles of which are shown in Fig. 1. The module was developed in the same online learning environment as for CSU Engineering students. The module was launched for the first time for the host supervisors in May 2017. All supervisors have access to the module as long as they have signed up to host CSU cadets.

Each topic has a variety of learning materials,

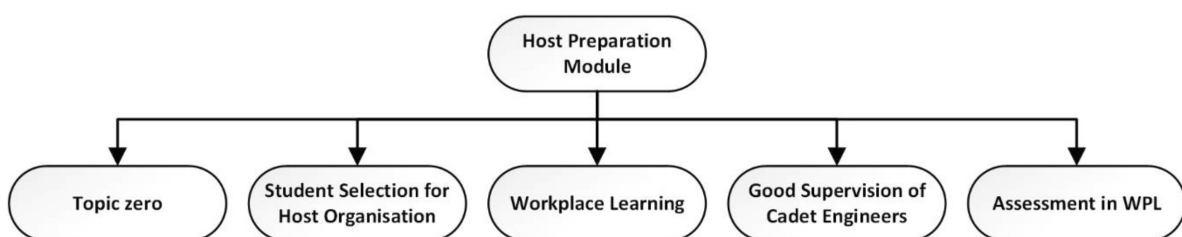


Fig. 1. Online preparation module for host supervisors.

ending with the final assessment item with multiple choice questions to assess supervisors' knowledge of the topic. The first topic (Topic zero) was designed to familiarize the host supervisors with this new curriculum. Due to the innovative approach of CSU Engineering, it was required to demonstrate its pillars, course structure, processes, and time frame to establish a common understanding of the course among all host supervisors. In addition, the position of WPL in the program and special subjects during cadetship were explained. These subjects, "Project and Portfolio", "Performance and Planning Review" and "Cornerstone and Capstone Thesis" spread across all four workplaces. The second topic "Student Selection for Host Organisation", discussed the students' journey from application for an internship to the final allocation to a host organisation. In this topic, the process of forming a relationship between university and industry was explained, then the advertising process about the host organisations was discussed and finally, the allocation process including student interviews was explained.

The third topic, "Workplace Learning," provided an overview of the key elements of engagement of host supervisors with students and academic staff before, during and after work placement experiences. It included the rationale and a definition for WPL as well as roles and responsibilities, the benefits of having students in the workplace, communication strategies with students and the university, key legal documents, as well as the reviewing and debriefing process of the workplace experience. The fourth topic, "Good Supervision of Cadet Engineers", included good supervisory practice principles. It explained the roles and responsibilities of the host supervisors and the main attributes of effective supervision. These attributes include making time to mentor, being present and available, reflecting, building relationships and valuing the supervisory role. SMART goal settings (Specific, Measurable, Attainable, Relevant and Timely), which are important for students' self-organisation in the workplace, was also discussed. The final topic, "Assessment in WPL" addressed the principles of academic assessment design of the university and types of WPL assessment. These principles range from student reflections on the journey and portfolio development to goal setting and periodic review of goals. These four assessment types are predominantly applied in CSU Engineering workplaces to assess cadets' progress in the workplace and professional identity development.

3. Methods

The host supervisors' self-perceived needs for pro-

fessional development in their supervisory role and the effectiveness of the online preparation program was evaluated through online surveys. The study comprised two objectives: First, to ascertain their self-insights into their supervision skill set and more specifically what they thought they needed to learn more about and second, to explore how useful the online preparation program was for each of them. The variables analysed for the first objective comprised level of existing experience, perceived challenges in student supervision, motivators for taking on the supervision role and their take on what makes a good supervisor. The variables analysed for the second objective comprised ranking the module topics and identifying gaps in content. The study sought the input from host supervisors before and after the online preparation program to better understand their expectations and to what extent the preparation program was effective to meet their needs. The study also wanted to identify what changes needed to be made to the preparation program for the next year. This study was approved by the university ethics committee.

3.1 Survey process

Once host organisations had signed the MOU and had a cadet engineer assigned to their workplace, they suggested one or more (in one case 4) host supervisors to study the online WPL preparation program. In total, 28 supervisors were introduced, 22 of whom participated in the online preparation program. Prior to commencing the online program, supervisors were invited to participate in a "Before Survey", then complete the online program and immediately afterward complete the "After Survey". The surveys were online, and the information sheet and consent form were accessible for the participant to download.

The survey questions are shown in two tables below. Table 2 lists the six questions before host supervisors completed the online preparation program and Table 3 lists the four questions after they had completed the online preparation program.

The survey included Likert Scale and open-ended questions. The purpose of the before survey was to better understand host engineers' motivation and current experiences with student supervision and what they expected from the preparation program. The after survey questions asked to evaluate the topics and provide suggestions for improvements.

4. Results

Of the 22 host supervisors, who completed the online preparation program, 18 completed the before survey (80% response rate) and 11 completed the after survey (50% response rate). Industry

Table 2. Before Survey

Q1 What motivated you to partner with CSU Engineering and take on students?
(tick as many boxes as you like)

- Contribute to the education of future engineers
- Pre-select future employees
- Learn from students
- Build professional relations with Charles Sturt University
- Other

Q2 How much experience do you have in supervising students in your workplace? (tick one box)

- Never had students before
- 1–3 years of experience
- More than 3 years of experience

Q3 What do you expect to be covered in these 5 online topics?
(please prioritise with putting numbers to each item below: 1 most important and 5 least important)

- Policies and guidelines
- Student learning goals and skills focus
- Supervision skills
- Rights and responsibilities
- Assessment of students' progress

Q4 What do you think are the key challenges in having students in your workplace?

- 1.
- 2.
- 3.

Q5 What do you think makes WPL rewarding for you? (list the 2 most important factors for you)

...

...

Q6 What do you think makes a good WPL educator?

...

...

Table 3. After Survey

Q1 Now that you have completed the 4 topics have they provided you with the contents you need to supervise students?

- To a very small extent
- To a small extent
- Somewhat
- To a large extent
- To a very large extent

Q2 Which topic was most informative for you?

- Topic: Student Selection for Host Organization
- Topic: Workplace Learning
- Topic: Good Supervision of Cadet Engineers
- Topic: Assessment in WPL

Q3 Which topic do you think needs to be expanded or reduced? Please specify and why.

Q4 What topics were missing that you think should be included as part of WPL educators' preparation? Or even for students and academic staff?

partners were drawn from a variety of workplaces mostly from regional New South Wales in Australia including local governments, consulting engineering companies and construction companies. The participants were aged 27 to 58 with the average of 43 and they were all male except one. Their experience in the workplace lay in the range of 4 to 34 with average 17 years. All participants had a Bachelor of Engineering except one participant, who had a Master of Engineering and another a diploma in civil engineering. Five participants were directors or acting directors in their organisations and the rest of them were engineers, senior engineers and project

managers. In the following section, the results of the survey for each question are presented.

4.1 Before survey questions

4.1.1 What motivated host supervisors to supervise students?

Figure 2 shows the supervisors' motivations to partner with CSU Engineering. 100% of respondents were motivated to supervise students because they want to contribute to the education of future engineers. This is a good sign because being committed to student supervision and interested in the

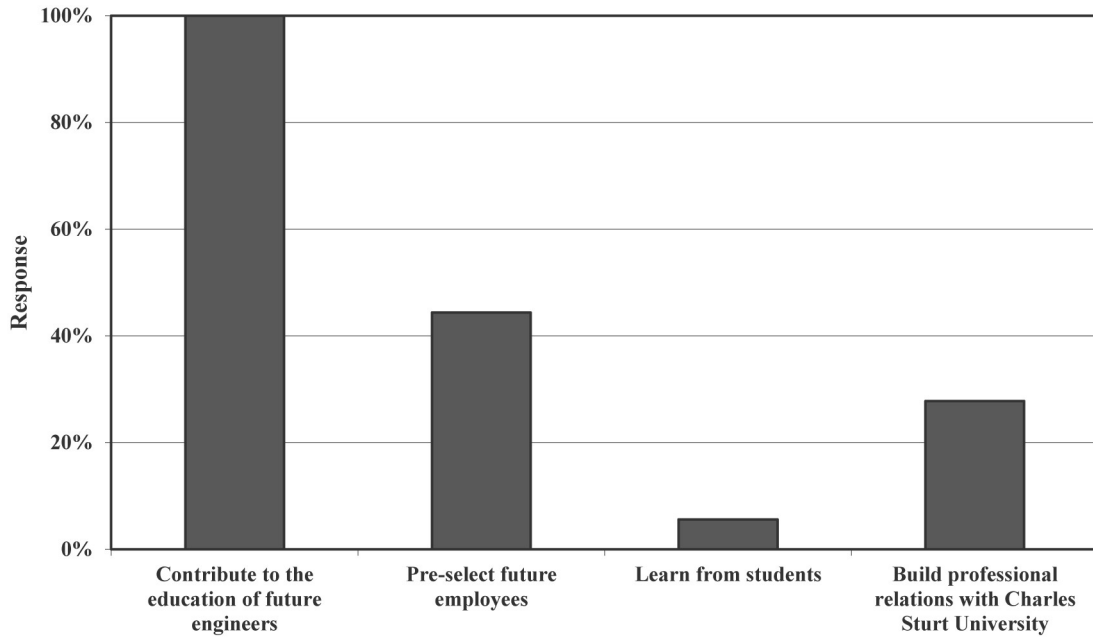


Fig. 2. Motivations of supervisors to partner with the university.

educational aspects of becoming a professional engineer can only be of benefit to students. The second greatest motivator with 45% of the participants was the opportunity to select future employees. This is a cost effective method in recruiting new employees [10].

The third strongest motivator was to build professional relations with the university. Having an interest in partnering with a university promises to a good partnership with two-way communication. The motivator that was least ticked with 5% only was learning from students. Participants' identity as supervisors had limited expectations that students can teach them anything.

Further open-ended responses to this survey question was to support this regionally based

course. This response highlighted an identity with place and being motivated to contribute to developing a skilled workforce in under-skilled regional Australia [15]. Another response was giving the host organization the opportunity of taking on challenges that can be passed on to cadets. Both of these responses can be interpreted as longer-term educational motivators with a social rather than economic agenda.

4.1.2 How much experience do you have in supervising students in your workplace?

The before survey result demonstrated that 72% of the supervisors had supervised students. Even 44% had more than 3 years of experience in supervising students (Fig. 3).

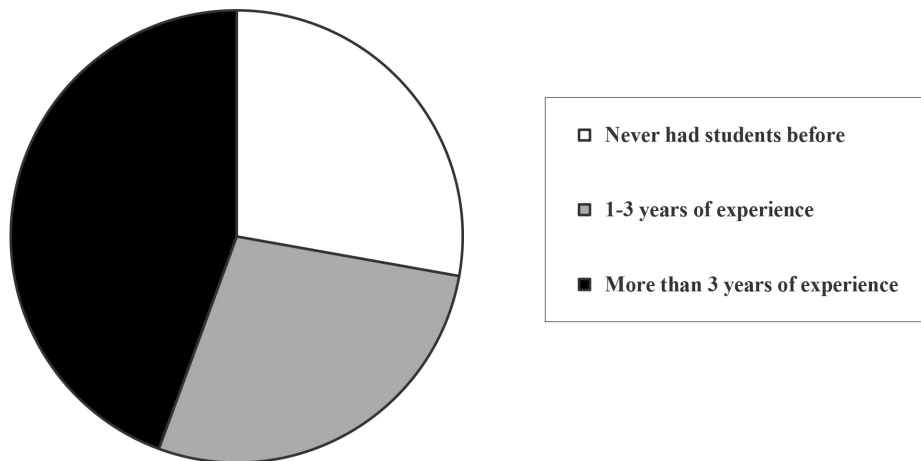


Fig. 3. Host organisations' previous experience in supervising students.

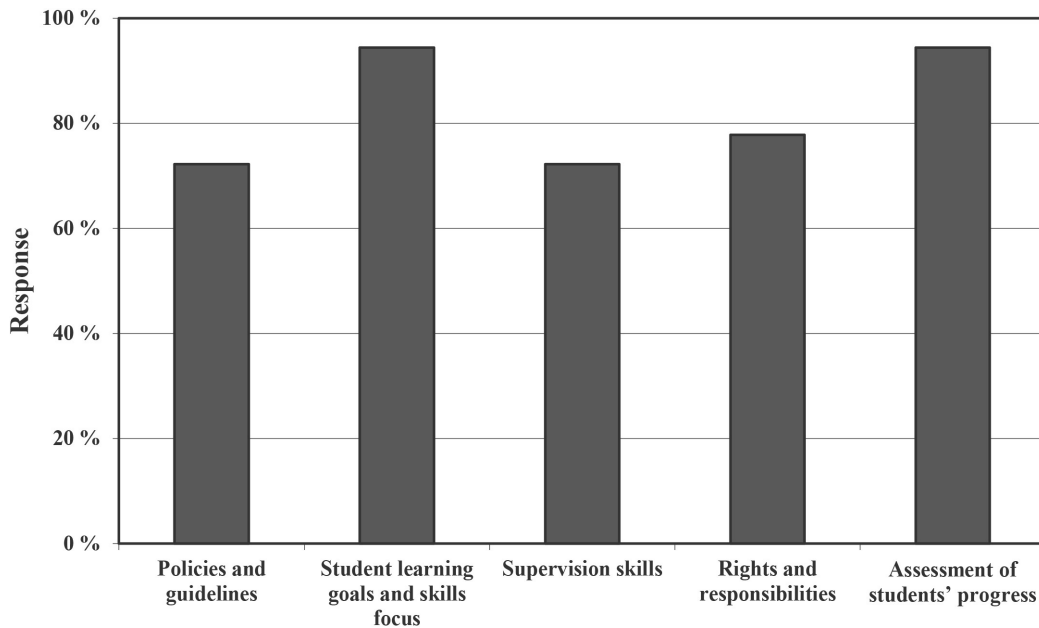


Fig. 4. Supervisors' expectation from online preparation program.

4.1.3 What do you expect to be covered in these five online topics?

Responses to this question are illustrated in Fig. 4. Understanding policies and guidelines for WPL and supervision skills rated lowest with 72% whereas student learning goals and assessment of students' progress rated highest with 94%. Understanding rights and responsibilities was an expected learning focus for 78% of participants. These responses indicate that the host supervisors expected a focus on students closely followed by understanding how they fit into the workplace in terms of roles and responsibilities. Supervision skills was least expected to be covered which is an indication that host engineers were more student focused than considering their own needs to develop their supervision skills.

4.1.4 What do you think are the key challenges in having students in your workplace?

The purpose of this question was to elicit their expectations and insights about the complexities of supervising students. 48 challenges were identified by the participants and they ranged from meeting university requirements to providing productive mentoring and keeping students engaged. The responses were clustered into five themes: industry-university partnership, workplace culture, student experience, supervision capability and time, see Table 4.

What stands out at first glance in the Table 4 is that student experience was mentioned in 19 responses (40% of all responses). It means that engaging students in the workplace with appropri-

ate work or projects was the highest perceived challenge for our participants. Closer inspection of the table shows that while industry-university partnership was important for novice supervisors and those with less than 3 years' experience, challenges in connection with workplace culture and environment were of main concern for the more experienced supervisors. They were more focused on providing students with an enabling environment that helps students develop a good work ethic and attitude.

Another noticeable result from this table is that a unique pattern can be derived for supervisors' years of experience. The more experienced supervisors listed more challenges than novice supervisors and the former emphasised challenges that related to the student experience, own supervision capability and time allocation to student supervision.

4.1.5 What do you think makes WPL rewarding for you?

Overall, 15 participants provided 27 responses to this question. Participants mentioned "giving back to society" as a key reward. Guiding students to learn to think like an engineer, "inspiring future engineers", passing on their expertise, contributing to student development, providing them with real experience and "on-the-job practical work" were responses to evidence their perceived value of student supervision. They saw their role rewarding because it provided an opportunity to inspire the younger generation and guide them in their transition from student to future professional. They looked at WPL as an opportunity to develop their team capability; they valued the role of mentoring

Table 4. Perceived key challenges of having students in the workplace comparing supervisors' experience (N = Novice supervisors, L = Less than 3 years' experience and M = More than 3 years' experience)

Theme	Quote	Supervisor Experience
Industry-university partnership	1. Skill focus in line with topic underway.	L
	2. Meeting the requirements of CSU.	L
	3. Meeting expectations of all stakeholders.	N
	4. Ensuring both parties get value from the relationship.	N
Workplace culture and environment	1. Teaching them to be professional.	M
	2. Not used as cheap labour.	M
	3. Developing a good work ethic and attitude while understanding that the student may require additional guidance (over and above existing workloads) and time to complete tasks or projects.	L
	4. Making students feel comfortable in the workplace environment allowing them to express their ideas and thoughts freely.	L
	5. New working environment.	M
	6. Management of expectation vs performance.	L
Student experience	1. Allocating appropriate work.	M
	2. Providing appropriate work/project.	M
	3. Providing meaningful work.	M
	4. Finding suitable work.	M
	5. Productive and suitable work.	M
	6. Ensuring suitable and challenging work.	L
	7. Providing meaningful tasks at a level complimentary to their knowledge.	M
	8. Exposure to real projects.	M
	9. Having suitable work that will teach and excite student.	N
	10. Providing interesting tasks.	N
	11. Providing exposure to a diverse range of activities.	M
	12. Assigning tasks that will interest them.	M
	13. Keeping them engaged.	M
	14. Keeping them engaged.	M
	15. Adequate experience.	L
	16. Variety of work.	N
	17. Providing adequate exposure to variety of tasks.	L
	18. Skill development.	L
	19. Setting reasonable goals and tasks.	L
Own supervision capability	1. Supervision.	N
	2. Providing supervision.	N
	3. Providing supervision to student.	M
	4. Providing adequate/sufficient learning.	L
	5. Being a good leader/mentor.	M
	6. Ensuring suitable supervision.	L
	7. Checking their work.	M
	8. Providing valuable feedback to young engineers.	M
	9. Ensuring they are challenged and supported.	M
	10. Creating the learning feedback loop—assessing that the student has become competent in assigned work tasks.	L
	11. Productive mentoring.	N
	12. Performance Management.	M
Time/cost	1. Allocating time of suitable mentors.	M
	2. Allocating time to guide the student.	L
	3. Allocating sufficient time to mentoring student.	N
	4. Making time to formally mentor students.	L
	5. Spending time to mentor.	M
	6. Available supervision.	M
	7. Cost of supervision.	M

and sought for developing mentor in their team and becoming an experienced (mentor) supervisor. They also recognised it as an opportunity to increase their knowledge by explaining the steps thoroughly to young engineers; a traditional way to become a deep learner.

Their responses also highlighted that they saw rewards of their supervision role not only as giving but also as receiving from students. For example, getting feedback from them, observing them grow

and develop abilities, seeing them contribute to innovation, and learning from them to “consider different ideas as solutions”. The responses did not stop with rewards for themselves but were extended to the wider host organisation. Participants recognised students as an asset and additional resource that added diversity to the workplace. Hosting university students was seen as an opportunity to develop mentors in the workplace, share skills and build their team capability. They saw rewards

coming from students' up-to-date knowledge and familiarity with new methods, software and modern techniques. In fact, they acknowledged WPL as a potential exposure to advance current engineering knowledge. There was also a variety of responses that supervisors considered the WPL approach as one of the most cost-effective ways of helping students to "fit in" and educating well-balanced employees and experienced graduates.

4.1.6 What do you think makes a good WPL educator?

14 responses were provided for this question and they can be categorised into host supervisor attributes and relational practices between host engineer and student. Patience, enthusiasm, command of disciplinary knowledge and skills, "ability to impart a good work attitude and ethic" and "willingness to put in time and effort to make it [student supervision] a success" were seen as attributes that make a good educator. The majority of relational practices of a good WPL educator included skills such as understanding students need, effective communication, good listening and motivational skills. "Imparting practical knowledge to real problems so that the student understands" and "recognising the skills and limitations of students to better provide them with guidance—rather than take a 'now listen up' attitude are both quotes in evidence of insightful understanding of good communication practices in WPL. Engaging with students and maintaining continuous communication in such a way that students do not feel left alone was seen as important in supervising students. Based on the responses, our participants described a good WPL educator as someone with the ability to understand students' needs and provide them with guidance through meaningful learning processes.

4.2 After survey questions

After participants had completed the preparation program they were invited to complete an after survey which comprised four questions and the results are presented below.

4.2.1 Now that you have completed the online topics, have they provided you with the contents you need to supervise students?

Of the 11 participants who responded to the after survey questions, eight (close to 75%) were satisfied "to a very large extent" and "to a large extent" with the content of the preparation program and three were "Somewhat satisfied".

4.2.2 Which topic was most informative for you?

Nine participants selected the fourth topic "Good Supervision of Cadet Engineers" as the most infor-

mative topic whereas one each selected topic "Workplace Learning" and topic "Assessment in WPL". The second topic "Student selection for host organisation" did not feature for any participant as most informative possibly because it was not perceived to add to their preparedness as host supervisors. The third topic provided an overview of WPL with no specific mention of the engineering context and might be most relevant for novice host supervisors only. It was surprising that only one participant found assessment most informative because assessment and grading student performance in the workplace is persistently a contested issue [13].

4.2.3 Which topic do you think needs to be expanded or reduced? Please specify and why?

Nine participants provided feedback on each of the topics. The second topic, student selection should be made available before students present for an interview and the selection process be made more transparent. The third topic WPL was perceived as "very in-depth and thorough but "a little bit over the top". The fourth topic, Good Supervision, the WPL films were perceived as being too long, not relevant enough to engineering and lacked specific guidance and rationale. The last topic, Assessment, received most critique because it was perceived least relevant, too long and too specific. To summarise participants wanted more focused, shorter and more engineer specific materials. They suggested that the preparation program is offered before student interviews.

4.2.4 What topics were missing that you think should be included as part of WPL educators' preparation?

Three of nine participants who completed this question did not offer any suggestion and one other said "the modules are very helpful". The remaining five participants wanted to have more information about students' capabilities at the point of starting the cadetship. They wanted to view students' portfolios and their grades in the first 18 months when considering employing them for a paid cadetship.

One participant asked for an overview of actions for host supervisors. It was suggested to prepare a simplified bullet point approach to explain what was expected from supervisors; e.g., anticipated time commitment and involvement in assessing students.

Another participant requested that university staff prepare students for 'office politics', regulations in the workplace and workplace culture; i.e., the range of attitudes and personalities they will have to deal with, official and unofficial workplace hierarchies as well as challenging behaviour in the

workplace. Some participants mentioned that host supervisors need to be aware and prepared to help students navigate challenging workplace cultures.

5. Discussion

The self-paced, online preparation module proved to be an effective and efficient medium because it enabled all host supervisors regardless of time and place constraints to participate. The value of the results lies in the insightful snapshot they provide of the participants' expectations of and satisfaction with the online WPL preparation program and their perceptions of what makes a good host supervisor. From the results four themes were generated, interest in educating future professionals, WPL as an educational partnership, one size does not fit all and paid placement, which are discussed in what follows.

5.1 Interest in educating future professionals

The results indicate that the participants were genuinely motivated to 'give back', support the next generation engineers and contribute to their education. Participants had pedagogical, professional, ethical and economic interests in participating in this cadetship. They saw not only students or university benefiting from their student supervision but also themselves, their workplace and regional Australia. They expected cadets to contribute innovative, up-to-date knowledge and skills to the workplace and they were acutely aware of the importance of respectful, inclusive, professional workplace environments. They understood the complexity of their role as host supervisor with responsibilities to cadets, as a university partner as well as an engineer with responsibilities to clients and their workplace. They saw themselves as a mentor, facilitator of learning but also as an expert. They mentioned the value of providing and receiving feedback and ensuring cadets are productively engaged with relevant and meaningful projects and achieve set learning goals. Their constructive feedback on the preparation program highlighted the importance of a more flexible and just-in-time design to make this suite of topics more relevant and fit-for-purpose.

5.2 WPL is an educational partnership

Host supervisors thought deeply about their challenges and took their supervisory role seriously. They anticipated diverse types of challenges they may face in mentoring cadets which ranged from micro (student-supervisor relationship), meso (student-workplace relationship) to macro levels (university-workplace relationship), see Table 4. Participants included themselves and their super-

vision capabilities as part of the challenge. They understood that they shared the responsibility for contributing to productive WPL experiences. Supervising was recognised as a relational activity which provided evidence of their critical awareness of the complexity of hosting cadets. The challenges were not limited to time constraints, student experience and their own capabilities as student educator but extended to sustaining mutually beneficial and reciprocal partnerships with the university and creating enabling learning environments in their workplace for cadets. They were able to see WPL as a relational, educational practice that requires each stakeholder to live up to their responsibility. The design of the online WPL preparation program could more explicitly articulate the imperative of sustaining this educational partnership.

5.3 One size does not fit all

The after survey generated constructive suggestions for improvement of the preparation program. The topics were perceived to be too long and not sufficiently specific for host supervisors' own context and needs. 72% of participants already had experience with student supervision and it is therefore not surprising that the after survey results suggested a more flexible and succinct program with the more condensed material. The concern about prioritising and allocating time to juggle student supervision and attending to their regular job duties is well recognised and finding time to study the preparation program is an additional stressor. Atkinson, Misko and Stanwick [16] discussed that host supervisors are not provided with adequate time to take part in professional development opportunities to build their supervisory capabilities. The CSU Engineering course curriculum itself with its modular elective options could be a good design guide for revising the host supervisor preparation program and making it more host supervisor-centred and personalised.

5.4 Paid placement

Participants mentioned their interest in gainfully selecting who they employed as cadets. Given that these cadetships are paid, one contentious issue was the cadet selection process where the university ultimately allocated cadets to host placements. Participants wanted greater transparency and input in the selection process. This raises issues about equal opportunity for all students and providing inclusive WPL programs [17]. University-industry partnerships are not without their challenges [18] and paid cadetships add another complex layer. This is in sound agreement with the survey study by Smith, Smith [19] on paid and unpaid placement, who found that paid placements

change the nature of the expectations the employers place upon students. This brings benefit and challenges for cadets and organisations. Being on the payroll makes cadets feel more connected, valued and committed to the placement. Organisations benefit because cadets are their employees and can be seen as cost-effective human resources, who bring new skill sets and up-to-date knowledge. However, being paid may compromise cadets' identity as learners where being productive and contribute to work outputs is perceived more important as questioning, reflecting and deeply understanding professional reasoning processes.

6. Conclusion

This research contributes to a better understanding of what is required to provide effective and efficient online WPL preparation programs for host engineers. From the findings of this research, a number of conclusions can be drawn. The survey results provided support for the idea of giving host supervisors a voice in what they need in their preparation as student educator. Many of their expectations of the online WPL preparation program were met however, some were left wanting. This research has set the foundations for a collaborative framework from which to build on. The next revision of the program based on this host supervisor feedback gathered from this research will further strengthen the educational university-industry partnership. Further research can expand and build on this study to deeper understand purpose and interest of host supervisors in participating in a preparation program. With the future world of work rapidly changing and new jobs constantly evolving while others are being automated and disappear, it becomes more acute to educate host supervisors in facilitating student learning for practice capabilities. This paper contributes much needed understanding about producing appropriate preparation programs for host supervisors and what learning activities enable better supervision capabilities. Shedding light on host supervisors' perceptions of this preparation program is an important contribution to strengthen the educational partnership between university and industry and provide relevant and effective support and professional development to host supervisors. All WPL stakeholders and in particular engineer cadets are greatly benefiting from better prepared and more capable engineers as host supervisors.

Acknowledgements—The authors gratefully acknowledge support from Professor Euan D. Lindsay and Professor James Morgan from CSU Engineering for their critical and helpful comments, which have led to significant improvement of the article.

References

1. K. E. Zegwaard, M. Campbell and T. J. Pretti, *Professional identities & ethics: The role of work-integrated learning in developing agentic professionals*, **32**, Emerald Publishing Limited, Bingley, UK, 2017.
2. F. Trede, Role of work-integrated learning in developing professionalism and professional identity, *Asia-Pacific Journal of Cooperative Education*, **13**(3), 2012, pp. 159–167.
3. I. Villanueva and L. Nadelson, Are We Preparing Our Students to Become Engineers of the Future or the Past?, *International Journal of Engineering Education*, **33**(2), 2017, pp. 639–652.
4. K. Zeichner, Rethinking the Connections between Campus Courses and Field Experiences in College- and University-Based Teacher Education, *Journal of Teacher Education*, **61**, 2010, pp. 89–99.
5. A. Henderson and F. Trede, Strengthening Attainment of Student Learning Outcomes during Work-Integrated Learning: A Collaborative Governance Framework across Academia, Industry and Students, *Asia-Pacific Journal of Cooperative Education*, **18**(1), 2017, pp. 73–80.
6. M. Goller, *Human Agency at Work: An Active Approach towards Expertise Development*, Springer, 2017.
7. D. Peach, E. Ruinard, and F. Webb, Feedback on Student Performance in the Workplace: The Role of Workplace Supervisors, *Asia-Pacific Journal of Cooperative Education*, **15**(3), 2014, pp. 241–252.
8. L. Cooper and J. Orrell, University and community engagement: Towards a partnership based on deliberate reciprocity, *Educating the deliberate professional: Preparing for emergent futures*, Dordrecht, 2016.
9. S. Male and R. King, *Best practice guidelines for effective industry engagement in Australian engineering degrees*, Australian Council of Engineering Deans, Brisbane, Qld., Australia, 2014.
10. K. S. Ananthakrishnan and G. Halyburton, Successful outcomes of industry-academic partnership in engineering programmes through a cadetship scheme, *World Transactions on Engineering and Technology Education*, **2**(3), 2003, pp. 379–382.
11. G. Rayner and T. Papakonstantinou, Employer perspectives of the current and future value of STEM graduate skills and attributes: An Australian study, *Journal of Teaching and Learning for Graduate Employability*, **6**(1), 2015, pp. 100–115.
12. J. R. Morgan and E. D. Lindsay, The CSU Engineering Model, *the Australasian Association for Engineering Education Annual Conference*, Torquay, VIC, Australia, 2015.
13. M. Yorke, Work-Engaged Learning: Towards a Paradigm Shift in Assessment, *Quality in Higher Education*, **17**(1), 2011, pp. 117–130.
14. CSU Engineering, Engineering but not as you know, https://issuu.com/charlessturtuni/docs/csu_engineering_student_pack_web, Accessed 26 July 2018.
15. Australian Government, Skill Shortage List, Australia, <https://docs.employment.gov.au/documents/skill-shortage-list-australia>, Accessed 15 December 2017.
16. G. Atkinson, J. Misko and J. Stanwick, *Work Integrated Learning in STEM Disciplines: The Employer Perspective (Consultative Report)*, National Centre for Vocational Education Research (NCVER), South Australia, Australia, 2015.
17. J. Orrell, *Good Practice Report: Work-Integrated Learning (Final Report)*, Australian Learning and Teaching Council (ALTC), New South Wales, Australia, 2011.
18. C. Arlett and R. Dales, *Engage project report*, Higher Education Academy Engineering Subject Centre, Loughborough, 2008.
19. S. Smith, C. Smith and M. Caddell, Can pay, should pay? Exploring employer and student perceptions of paid and unpaid placements, *Active Learning in Higher Education*, **16**(2), 2015, pp. 149–164.

Franziska Trede is Associate Professor in Higher Education and Professional Practice at the University of Technology, Sydney where she leads research in the professional practice program in the Faculty of Engineering and IT. She is particularly interested in professional identity development and agency. She received her PhD from the University of Sydney and her Master in Health Personnel Education from the University of UNSW, Australia. Dr. Trede is a national board member of the Australian Collaborative Education Network (ACEN) and editorial member of *Active Learning in Higher Education*, *Teaching in Higher Education*, *Studies in Continuous Education*, *Professions and Professionalism*, and the *International Journal of Work Integrated Learning*. Dr. Trede received four national large grants from the Office of Learning and Teaching that explored education for practice themes. She has published 7 co-edited books, and over 80 book chapters and journal papers. Her latest book 'Educating the deliberate professional: Preparing for future practices' offers new possibilities about how to teach and learn responsibly and creatively for future practices.

Reza Mahinroosta is a Lecturer in the School of Engineering, Charles Sturt University, Australia. He received his BSc in Civil Engineering and MSc and PhD in Geotechnical Engineering, all from Sharif University of Technology, Iran. Before assuming the current position, he gained experience in an international water industry for 10 years designing and supervising large scale infrastructure projects. During that time, he led a department numbering over 30 professional engineers, including several cadet engineers. In addition, he also has extensive experience lecturing in university, teaching technical content to students as well as supervising student engineering projects.