Authentic assessment in work integrated learning promotes student work readiness in industrial settings

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Introduction

Australian universities are increasingly adopting work-integrated learning (WIL) to produce industry ready graduates. This trend has been driven by employer demand for graduates who are better able to meet the changing requirements of the economy and industry. Students and graduates are able to adapt and enhance their skills, understanding and personal attributes, that make them more likely to find and create meaningful work that benefits themselves, the community and the economy. Therefore, WIL outcomes are beneficial to universities, students and industry.

Within an engineering education context, WIL necessarily involves collaboration between employers and universities to provide students with the ability to apply their disciplinary knowledge and problem-solving skills to work-based and professional scenarios. The scope of WIL activities are broad in nature, and can include project-based learning, internships, simulations and work placements. A key focus of WIL involves engagement and collaboration between universities and industry, as the contribution of industry partners is essential in achieving support for WIL.

Work placement activities provide a congruent environment for the application of authentic assessment, as the student is readily exposed to real-world problem-solving tasks. They are able to develop proficiency in making complex judgements about their own work, and others, in uncertain and unpredictable circumstances. It is held that assessment tasks that assist students in preparing for the complexity of their professional career better support their authentic leaning needs.

Literature Review

In the paper (Jackson, et al., 2017), the authors iterated that the relationship between university and industries could be in the form of 'placement to industry' and 'non-placement to industry'. In the placement to industry option, students are embedded in industry through work placement initiatives, and achieve real-world work experience. The latter option focuses on student learning through industry-based projects and simulations to develop work-related skills. The authors also outlined some of the barriers that may limit the extent to which employers engage in WIL.

Ferns (2016) asserted that WIL embeds real-world learning into the curriculum and assisted engineering graduates in preparing to face the challenges of real-world problems. WIL also assists universities to adopt the required changes in engineering curriculum due to the changing nature of technology and processes impacting industry. Like Jackson, et al., (2017) and Swart (2014), Ferns (2016) identified some challenges and barriers the employers were facing. These included insufficient resources and support, cost, limited information about WIL, mentoring students and the complexity of collaboration with universities.

Like Ferns (2016), Kaider, et al, (2017) claimed that WIL was a key approach in increasing students' employability by integrating theory with practice of work within a purposely designed curriculum. They defined a framework for authentic WIL-related assessments utilising the concepts of authenticity and proximity. They concluded that authentic assessments with graduate capabilities were valued by employers and students, and such work-related assessments served as an important vehicle for students to enhance their employability skills.

In a conference article, Ferns (2016a) emphasised that robust engagement between industries and universities was important in defining student skills development in the curriculum. The author also mentioned that the industry partners were keen to contribute to authentic learning through industry-focused resources. The authors responded to a question of strategies and resources required by industry to support WIL, and how to improve these (du Plessis, 2019).

Agwa-Ejon and Pradhan (2017) pointed out that WIL enabled alignment of academic and industry work practices for the mutual benefit of students and employers. The authors examined the potential of students' employability and impact of WIL on selected organisations. They also reported that in some cases there was less collaboration in terms of university assistance and lecturers' visit during the WIL period in selected industries. The important recommendations given by Agwa-Ejon and Pradhan (2017) were:

- A proper placement process should be implemented to ensure students were aligned to set tasks in their workplace
- There should be improvements in assistance both from university and industry
- Provision for better induction courses and hands-on experience before work placement
- There should be an increase of lecturers' visits
- There should be an improved coordination between students and mentors/supervisors before and during the WIL placements.

Finally, Fleming and Pretti (2019) and Lu et al. (2018) conducted research to determine whether the presence of a WIL student in the workplace community caused changes to workplace dynamic, both from a team and individual perspective. They recommended pre-placement preparation of students focus on workplace relationships and scenarios where students may be exposed to unprofessional behaviours. Strategies and processes also need to be provided to ensure student wellbeing during their WIL experience.

Through the literature review, it is asserted that WIL is an effective learning method in developing work-ready engineering graduates. Different authors focused on the WIL processes, activities, assessments, pre-placement preparation, employer engagement and barriers to effective outcomes. This study focuses on authentic assessment of students learning within a work placement environment, including evaluation of performance against Engineers Australia Stage 1 Competency Standard requirements.

Methodology

An essential component of student learning in School of Engineering of Technology at CQUniversity involves WIL, with activities including project-based learning, industry supervised projects, industry visits and work placements embedded within the curriculum. The two major degree-based programs enable students to achieve professional engineering qualifications. The Bachelor of Engineering (Co-operative Education) incorporates two six-month work placements coupled with a Diploma of Professional Practice (Engineering) over a 4.5 year course period.

The work placement experiences form a key component of the Co-operative Education program. The program aims to develop an integrated approach to building engineering practice capabilities by enabling students to apply content knowledge in the workplace. Within the WIL placement program, students' progress through three phases:

- Preparation: Students undertake research into industries and associated engineering roles they would like to experience and develop employability skills such as resume development and position applications.
- Application: Student undertake work placements, applying the skills and knowledge developed in the academic course in an industry-based WIL context.

- Assessment: Students plan their placement objectives, conduct reflective writing to evaluate their experience, receive feedback on work performance, and document their technical, professional, and social development.

As outlined in (Ferns, 2016) industry's role in WIL is critical - effective engagement with industry partners is essential for enabling work placements. Involvement of the industry partner in the recruitment, supervision, mentoring and assessment processes is key to achieving authentic student learning. A four-stage methodology has been developed to describe the roles of the three partners (student, industry and university) in the WIL process. Figure 1 presents these stages, which are:

- Stage 1: Relationship Formation
- Stage 2: Recruitment and Selection
- Stage 3: Industry Placement
- Stage 4: Capability Assessment

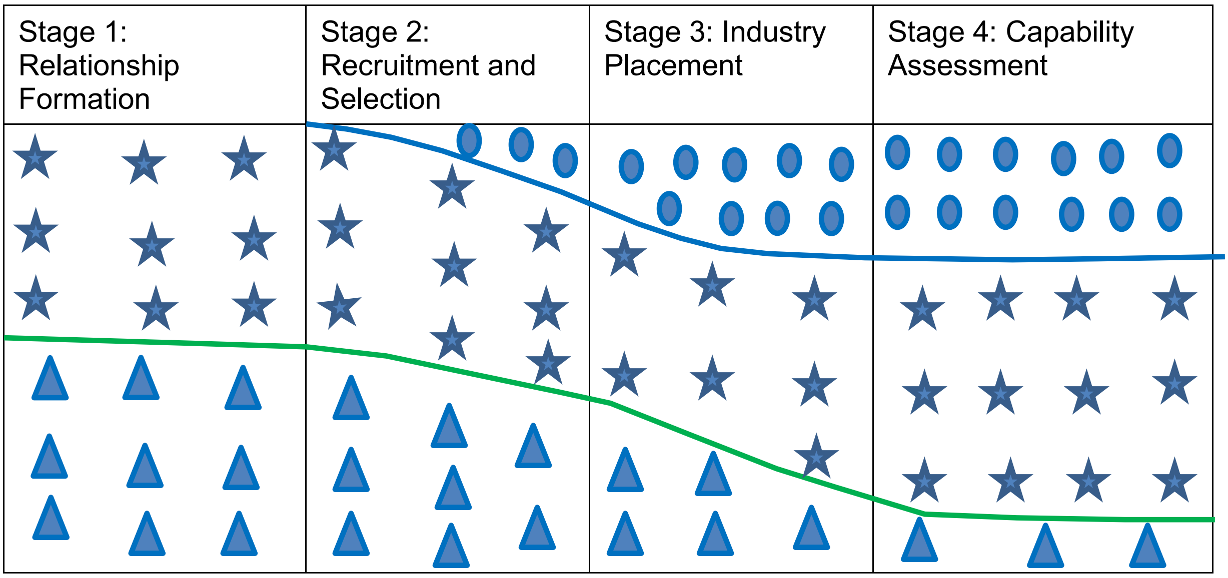

Figure 1: Four-stage WIL methodology: Contributions of university (), Students () and Industry () in each stage

Stage 1: Relationship Formation

The initial stage involves development of a relationship between industry and the university, seeking to achieve mutual benefits for both parties. It is important to note that a WIL relationship may be one of many engagement activities an employer may be pursuing with the university. Other activities may include research projects, curriculum committees, professional development, industry-based projects, student scholarships and event sponsorship.

In some cases, both parties may elect to formalise the broad intentions under a Memorandum of Understanding (MoU) to describe the benefits, goals and complementary activities. Conversely, employers may also seek to leverage WIL for specific requirements, including as a response to fluctuating organisation workload, investigative projects, or as capability development strategy.

In the initial phase, it is important that the university provides the industry partner with relevant information regarding the program, the recruitment process, work placement requirements and the student assessments. It is key that the nominated student supervisor is involved in this phase by defining the placement position requirements and understanding their role as part of the work placement.

Stage 2: Recruitment and Selection

Once a WIL relationship exists, the industry and university undertake a recruitment process for WIL placements. This process commences as students are completing the development of their employability skills as outlined above. Employers develop a student position description and selection criteria, which is loaded to an online recruitment system.

Students are provided access to the system as job seekers, select relevant position(s) and undertake the recruitment process. Students are required to apply their industry and role research to determine the positions of interest and follow the employer's process for application. The process mirrors a real-world recruitment process within a controlled environment, scaffolding students with a near-equivalent experience to applying for a position with their prospective employer.

Stage 3: Industry Placement

In this phase, the industry partner provides employer support and facilities to students selected in Stage 2. During this phase, the student enrols into an academic unit that provides learning content and assessment items required to be completed by the student on placement. Assessments are designed to promote authenticity and encourage the involvement of employers in planning, monitoring and reviewing the student's work placement experience and outcomes. These assessments include:

- Work Placement Objectives: Developed early in the work placement, these objectives enable the student to plan for their skills development, and to articulate the opportunities available for them to learn. The objectives are also a communication channel between the student and their supervisor to develop an understanding of each other's expectations for the work placement period. Ideally these objectives include a mix of the employer's *task-driven* requirements regarding the student's work, and the student's *learning-driven* goals to develop certain knowledge and skills.
- Weekly Journals: Students are required to document their activities via weekly journals, which are reviewed by their supervisor. This includes a practice of reflection on work activities, encouraging the student to review their work and seek improvement. The journal establishes a regular form of communication between the student and the supervisor and serves to document their work placement activities. The student provides a 5-scale rating of their learning experience for the week as a key point of discussion.
- Work Placement Report: Developed midway through placement, the report allows the student to evaluate how they are proceeding in achieving their planned objectives. Students will often encounter issues on their work placement that impacts their ability to achieve their objectives, and the assessment provides the ability for them to revise their objectives.
- Work Samples: Students are required to provide explanations and examples of work undertaken during your placement period. This may consist of engineering reports, drawings, photographs or other relevant documentation that demonstrates development of skills and knowledge, professional practice, and achievement of placement objectives.

In addition, the student, supervisor and university representative conduct a work placement meeting during the work placement period. This meeting is an opportunity for the three partners to review and discuss the work placement experience from each viewpoint. The discussion is typically based on understanding the student's role in the organisation, skills and knowledge acquisition, challenges and outcomes to date.

Stage 4: Capability Assessment

On conclusion of the placement the student's supervisor undertakes an assessment of the student's performance during the work placement. For their initial work placement, this survey is based on attributes including interest and enthusiasm, initiative, organisation and planning, ability to learn, productivity, quality of work, judgement, teamwork and communication.

For the second and final work placement, the capability assessment is based on a mapping of Engineers Australia Stage 1 Competency Standard. This Standard describes three competencies covered by sixteen Elements of Competency, as outlined in Table 1. The Competencies represent the profession's expression of the knowledge and skill base, engineering application abilities, and professional skills, values and attitudes that must be demonstrated at the point of entry to practice (Engineers Australia, 2019).

Table 1: Engineers Australia Stage 1 Competency Standard (Summary)

Competency	Elements of Competency
Knowledge and Skills base	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. 1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline. 1.4. Discernment of knowledge development and research directions within the engineering discipline. 1.5. Knowledge of engineering design practice and contextual factors impacting the engineering discipline. 1.6. Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline.
Engineering Application Ability	2.1. Application of established engineering methods to complex engineering problem solving. 2.2. Fluent application of engineering techniques, tools and resources. 2.3. Application of systematic engineering synthesis and design processes. 2.4. Application of systematic approaches to the conduct and management of engineering projects.
Professional and Personal Attributes	3.1. Ethical conduct and professional accountability. 3.2. Effective oral and written communication in professional and lay domains. 3.3. Creative, innovative and pro-active demeanour. 3.4. Professional use and management of information. 3.5. Orderly management of self, and professional conduct. 3.6. Effective team membership and team leadership.

The employer evaluation incorporates the Stage 1 Competency Standard Elements of Competency, each being rated by the supervisor based on a five-level Likert Scale:

- Well Above Average = 5
- Above Average = 4
- Average of Graduate Engineer = 3

- Below Average = 2
- Well Below Average = 1

In addition to the quantitative scoring, employers are asked if the opportunity were available, whether they would re-employ the student.

The evaluation serves two purposes. Firstly, students are required to consider their evaluation as rated by their employer from a performant, graduate-ready perspective, and from a reflective viewpoint; e.g. did the employer's evaluation cause a positive or negative reaction, and if so, why. Secondly, the evaluation serves as a value-based measure for the employer, assessing the student's performance in comparison to a graduate engineer employed within the organisation. Employers, based on this assessment, can value the WIL placement program from a workforce capability perspective.

Results and Discussion

As outlined by (Kaider 2017), authentic WIL based assessment can be described according to authenticity and proximity. Authenticity refers to learning activities and assessments requiring students to work on problems, processes and projects that they may encounter in their professions and product artefacts relating to professional practice. Proximity refers to learning experiences that occur in real workplaces and professional contexts, and enable students to interact directly with industry practitioners.

Typically, work placements are characterised by high authenticity, high proximity assessment. In Table 2 we utilise the typology as introduced by Kaider to categorise the Co-Operative Education assessments described above.

Table 2: Categorisation of Assessment Authenticity

Assessment Task	Authenticity-Proximity Classification	Authenticity of Task	Proximity to Workplace /Practitioner
Work Placement Plan Student develops a plan with objectives for their skills development and articulate learning opportunities.	Medium Authenticity – Medium Proximity	Students develop a plan that includes some workplace objectives.	Students seek feedback and input form their supervisor.
Weekly Journals Students are required to document their activities via a weekly journal.	High Authenticity – High Proximity	Students document activities and reflect on their work experience.	Supervisor discusses, reviews and signs off on journals.
Work Placement Report The report allows the student to evaluate how they are proceeding in achieving their planned objectives	High Authenticity – Low Proximity	Students are reporting on their activities and experiences in the workplace.	No interaction with workforce.
Work Samples Students are required to provide explanations and examples of work undertaken during your placement period.	High Authenticity – High Proximity	Students document activities undertaken in the workplace.	Students are working within a real organisation and interacting with practitioners.

Employer Evaluation Capability assessment is based on a mapping of Engineers Australia Stage 1 Competency Standard	High Authenticity – High Proximity	Evaluation is based on the student's performance in the workplace.	Evaluation is undertaken by key practitioner (supervisor).

As noted, although most work placement assessments are rated with high authenticity, the involvement of the employer is a determinant of the authentic assessments. Consequently, employer engagement, education and involvement in work placement assessment tasks is key to improving authentic learning.

In order to evaluate work placement value to employers, we analysed the past seven years of employer evaluation assessments. These assessments were undertaken by organisations within Construction, Electricity, gas and water supply, Manufacturing, Mining, Local Government, Professional, Scientific and Technical Services. The data shown in Figure 2 is classified using the three Stage 1 Competencies detailed in Table 1, whilst Figure 3 shows the number of students surveyed in each year.

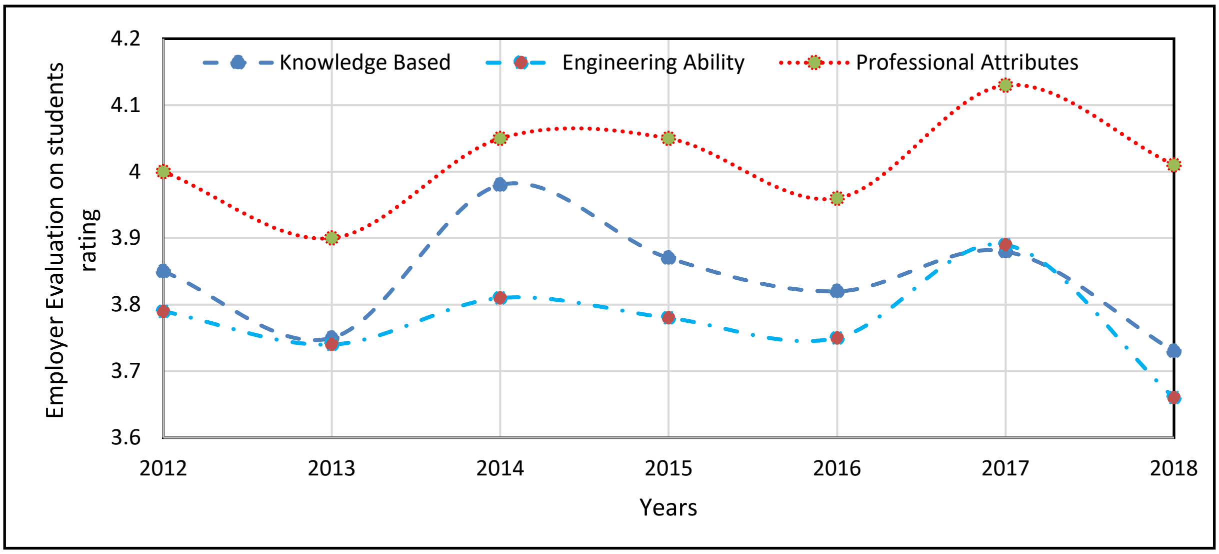

Figure 2: Employer evaluation on student rating against EA Stage 1 Competency Standard of three key areas: Knowledge Base, Engineering Ability and Professional Attributes

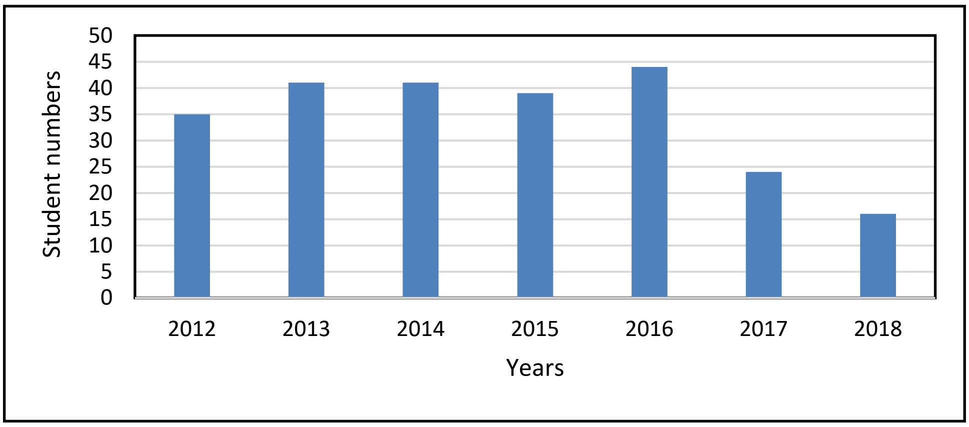

Figure 3: Number of students assessed by employers at the end of the placements

As indicated, each competency is rated at a level higher than the graduate rating. We note that the professional attributes competency is consistently rated higher than engineering knowledge and ability. Further analysis of the data indicates some supervisors do not rate students in every element of competency, as the position scope has not afforded the opportunity to exercise all competencies. Recent data indicates this situation applies to competencies PE 2.4: Proficiency in engineering design, and PE 3.3 Capacity for creativity and innovation. Finally, in response to the re-employment question, employers answered in the affirmative for 100% of evaluations.

Conclusions

This study has presented a four-stage methodology to describe the roles of the three partners (student, industry and university) in the WIL work placement process. The process demonstrates that an engaged relationship with industry partners is essential for enabling work placements. In addition, the university must educate and support the industry partner in the recruitment, supervision, mentoring and assessment processes to achieve positive WIL outcomes.

A review of the Co-operative Education program assessment indicates that although most work placement assessments are rated with high authenticity, the involvement of the employer is a determinant of truly authentic assessments. Employer engagement, education and involvement in work placement assessment tasks is key to improving authentic learning.

Finally, as an assessment of work placement value to employers, we analysed the past seven years of employer work placement evaluations, whereby supervisors rate students against the Engineers Australia Stage 1 Competency Standard. Based on the data available, the following conclusions can be made:

1. Students are consistently evaluated as work-ready, as they are rated above the average performance expected for a graduate.
2. They perform better than the average in all areas, however the highest rated competency is Professional and Personal Attributes, evaluated at a level of Above Average.
3. In the other competencies, the ratings are influenced by the opportunity to exercise their skills in all elements of competency, particularly engineering design, creativity and innovation.

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