

Full Paper

From work placement to employability: a whole-of-course framework

The goal of this paper is to present a framework to embed work integrated learning and employability skills across an undergraduate engineering degree informed by relevant literature. Employability refers to the ability to secure employment in a profession that will benefit the individual as employee as well as the employer, the economy, and the community at large (Yorke, 2006). Employability requires the development of skills beyond disciplinary or technical knowledge. Employers list traits generally aligned with generic skills as the most important for professional advancement (Goleman, 1998; Hart Research Associates, 2010). Such skills include the ability to apply knowledge in context, self-awareness, self-efficacy beliefs, and the ability to reflect prior and post action, and to adapt accordingly (Yorke & Knight, 2006; Scott, Coates, & Anderson, 2008).

Australian universities are giving more and more importance to graduate employability and to their graduates' ability to gain and retain employment. The most common way universities have responded to the emphasis on employability skills was through Work Integrated Learning (WIL). WIL is defined as "an umbrella term for a range of approaches and strategies that integrate theory with the practice of work within a purposefully designed curriculum" (Patrick et al., 2009). Research shows that students who have undertaken some form of WIL activity during their university degree are more likely to find employment in their chosen field, and are also more likely to reflect positively on their academic experience (Orrell, 2004).

For this purpose, Universities generally embrace work experience (placement, practicum, internship) as an effective form of WIL that students can undertake during or at the end of their degree. The requirement for sixty-days of work experience tends to be the way universities have responded to the need to equip engineering students with employability skills. The workplace appears to provide students with authentic situations and learning that cannot be replicated in a university setting. The university provides a cognitive form of learning (Duignan, 2002; Franz, 2008), which is "predictable, intentional, replicable, prolonged and student-focussed" (Orrell, 2004). The workplace, in contrast, provides the opportunity for a behavioural form of learning (Duignan, 2002), which is "unpredictable, immediate, unique and transparent" (Orrell, 2004). Both forms of learning are important and complementary.

The main issue, however, is that work placement in itself is not enough to guarantee the intended learning of employability skills (Britzman, 2003). For work placement to be successful in providing opportunity for the development of graduate employability, there are two possible means of assuring the learning experience: either the nature of the placement must be carefully controlled or there must be some other way in which students can achieve the desired learning outcomes, regardless of the opportunity provided by the workplace.

Carefully controlling the work placement experience requires that a strong partnership between employers, students, academic and professional staff needs to be established with clear intended outcomes and benefits for all parties involved (Harvey et al., 1997). Further, Harvey et al. (1997) stated that the employer's perception of work placement varied upon a continuum from "value added", whereby a student is expected to serve and contribute short-

term returns to the host organisation without specific focus on student learning, to “stakeholder”, where the host organisation focuses on longer-term benefits, and emphasis is on student learning of employability skills. As a result, depending on where the host organisation is placed on this continuum, employability skills may or may not be learnt through work experience even though students are in the right workplace environment (Harvey et al., 1997). If universities choose to rely on work placement as the only form of WIL, they need to guarantee consistency of learning for all students. This requires host organisations to be involved in the planning of work experience from the start (Moody, 1997). It also requires appropriate pedagogy that informs learning (Hunt, 2006), training and support for supervisors in the workplace (Orrell, 2004), and adequate risk management processes (Orrell, Cooper & Jones, 1999). As a result, a large amount of resources must be put in place in both university and workplace settings, which is often not achievable (David & Franz, 2009).

A comprehensive study of WIL, in the form of work placement, in a large number of Australian universities demonstrated a “number of resourcing issues, including: workload and time constraints for staff of universities and employers, the financial cost of placements to employers, and the inflexibility of university timetables in enabling students to spend appropriate time in the workplace” (Patrick et al., 2009). It follows that, unless universities are prepared to invest a large amount of time and resources with host organisations to facilitate work placement that consistently generates employability skills, it is not reasonable to rely on work placement as a sole form of WIL. In the context of engineering, work placement has recently become more challenging due to the recent difficulties in the resources sector. International students are particularly struggling to find industry work in Australia. It is, therefore, imperative to design and implement other forms of WIL to complement, if not substitute, work placements. One sentence for grey area?

Billett (2011) further argues that “having only workplace experiences is insufficient for effective student learning”, even when it is possible to control those experiences. He emphasises the importance of preparing students for placement, supporting them during placement and connecting their experiences in work placement with their on-campus curricular learning.

Smith and Smith (2010) describe WIL as both on-campus and off-campus learning experiences. In the context of the creative arts industry where finding work placement for students is deemed difficult, Daniel and Daniel (2013) suggested a continuum of WIL activities, including on-campus interactions with industry, on-campus emulation of work placement, or industry informed project work. This, they argue, would also allow for a better transition into the workplace.

The Science and Engineering Employability Framework (Whelan, 2014). Is summarised in figure 1 and expands employability to include:

- Preparation for work placement through a whole-of-course approach to embedded work integrated learning experiences from first year to final year, which involve industry and/or community partners, authentic tasks and purposefully designed assessment;
- On-campus learning experiences that develop capacity for critical reflection and introduce students to a range of tools that prepare them to both reflect on their work

experience and also to confidently demonstrate their employability skills, from first year to final year;

- The (continuing) requirement for a work placement;
- A capstone unit requiring students to draw together their work integrated learning experiences (both embedded and in placement) in a culminating critical reflection and demonstration of their achievement of graduate learning outcomes, and consequentially their employability.

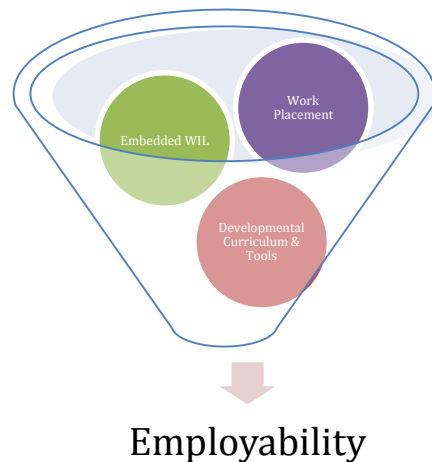


Figure 1: Science and Engineering Employability Framework

The WIL Framework

The Science and Engineering Employability Framework is built around a general philosophy of ease of access, transparency and good communication. WIL is simply defined as a planned set of activities occurring in the curriculum, where students learn through engagement with industry and community partners on authentic activities that are planned for and assessed. The critical components of this definition include:

1. type of engagement (that is with a defined industry or community partner);
2. authenticity of the WIL activity;
3. planning and assessment of the WIL activity.

Program teams working with this definition use some of the following types of placement activity; work placements, field experience, industry and community-based projects, professional experience or community service placements. Both internships and cooperative education are also included under the definition. Site visits or field observations, market or audience analysis, shadowing or study tours also qualify. The range of assessment tools used in relation to WIL is extensive. The opportunity to work with industry partners to broaden their role in the assessment regime is a key component of the developing framework. Industry and community partners are involved more formally at all stages of the course from guest lectures, site visits, case studies through to working with small groups of students on defined problems. The authenticity of the experience is the key

attribute to support the motivation that characterises successful engineering students (Male and King, 2013).

The structure of the Bachelor of Engineering (Honours) is an enabler to the embedding of WIL across the curriculum. The course is composed of three broad components: program core, primary major and complimentary studies (second majors and minors). As referenced by Oliver (2010, p.11),

“Academic staff believe this (WIL) is best taught integrated across curriculum by discipline teacher and specialist in the attribute followed by discipline teacher alone and/or through WIL” (Radioff et al, 2009).

Each of the eight disciplines within the Bachelor of Engineering (Honours) at XXX University is structured into discrete streams of academic focus. Using the Civil Engineering major as an example (as outlined in the ‘tree’ below) these streams comprise; design, construction, water and transport. In this case, WIL support activities are embedded within the project based construction stream in which the professional practice capabilities of students are developed and assessed. This articulated approach makes WIL an explicit activity across the course. It enables the course team to communicate requirements and activities to students and ensure the learning experience has relevance and context within the whole of program experience. It also enables students to appreciate the development of different WIL related skills and activities over time.

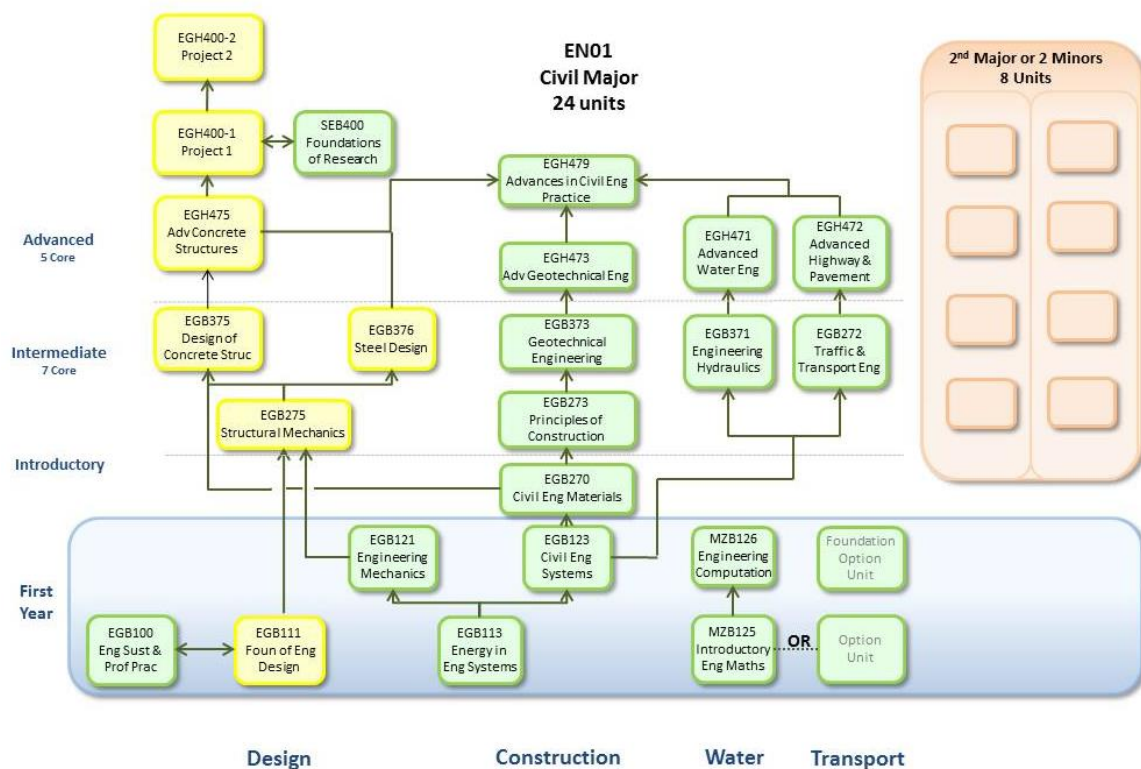


Figure 2: EN01 Civil Major (unit streams)

The Use of E-portfolio

The university has an e-portfolio tool available to all students not only throughout the tenure of their studies but also once they have graduated. The e-portfolio is the primary repository for selected artefacts produced by the students throughout their embedded WIL activities. The use of the e-portfolio is required as an assessment tool for particular tasks. It is envisaged that as students become familiar with the tool they will use it both as a general repository during the course of their studies and to assemble and collate a comprehensive portfolio of artefacts and reflections to assist in their eventual transition to work. Part of this process of assembling their work is to assist the student to make overt links between their learning and experiences, therefore raising self-awareness and efficacy in relation to their emerging engineering practice and transferable skills and attributes appropriate to their working life:

'...employability derives from complex learning, wider than 'core' and 'key' skills the transferability of which is often assumed (Yorke, 2006)... complex and interconnected...learning how to learn...empowering critical reflective citizens...needs continual refreshment throughout working life (Yorke, 2004)'; (Oliver, 2010)

The e-portfolio is introduced to Engineering students in their first year and used each semester to ensure the development of the portfolio throughout the duration of the course.

A critical component of the WIL experience is the work placement that student's undertake in their senior years. Underpinning the administration and management of WIL is the adoption of a university wide solution to managing placements. XXX University has adopted the use of the 'In-Place' tool to support placement activity. The Science and Engineering model of placement remains a self-placement model. The use of the In-Place tool ensures that placement details are captured and managed and importantly the student meets obligations under Health and Safety Compliance. It also ensures that reporting requirements are met. Students are able to load their own information into the tool and their placement activity can be approved and managed through it. The use of the tool ensures that administrative and management overheads are optimised and that students meet all of their placement requirements both within their course and as part of their accreditation needs. In-Place is fully integrated across the university and talks to the central student management system to assist in streamlining the student management aspects of placements.

Developing critical reflection

Significant curriculum development has occurred in developing disciplinary knowledge and applied skills as well as generic skills through mapping of assessment tasks to specific elements of program learning outcomes in core program and discipline (major) units throughout the degree.

Table 1: Civil Major Units – Course Learning outcome and Assessment Map

Course	Assessment	Course Learning Outcome											
		1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	
Advanced Water Engineering	Model (theoretical)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Project (applied)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Portfolio	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Exam (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Online Problem solving task	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
Advanced Highway & Pavement Engineering	Portfolio	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Design report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Exam (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Professional Plan	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Presentation	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
Foundations of Research	Portfolio	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Design report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Exam (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Professional Plan	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Presentation	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
Intermediate Level	Structural Hydraulics Report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Traffic & Transport Design	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Geotechnical Online Problem Solving Task	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Laboratory Practical	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
Principles of Construction	Reflective Journal	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Project Report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Structural Mechanics Problem Solving Task	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Design of Steel Structures Quiz	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
Intro	Civil Engineering Materials Report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Design of Concrete Structures Report	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Problem Solving Task	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2
	Examination (written)	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2

To assure that students are developing the metacognitive skills to continually critically reflect on what and how they are learning, including with and from their peers as well as academic and professional, industry people and work experiences is a significant challenge. The terms cited by Oliver (ibid, pp.10-11) to describe this, includes:

- “...clearly, repeatedly and consistently reminded of the outcomes and levels of achievement expected of them.” (Yorke & Knight (2006)
- ...capacity to reflect on, in, and for action; and self regulation.
- ...an ability to ‘read’ what is going on in each new situation and to match an appropriate course of action with a set of “diagnostic maps” (Scott, Coates & Anderson, 2008)”

To embed work integrated learning across the curriculum in the context of employability skills, we are adapting and developing critical reflection and feedback tools (aligned with engineering course learning outcome and unit assessment task maps) to be embedded via the design/professional practice stream of units in each discipline major. These include:

- Student self-assessment via ongoing skills assessment surveys that output ‘Skills & Attributes’ (excel spider maps) changing shape over time to reflect change and development
- Review questions tailored to specific activities and stages of the course for students to identify and consider actions in response to a range of skills and attributes
- E-Portfolio for repository, review and final graduate ‘profile’ diagram, professional CV and a range of artefacts (projects, posters, reports, presentations etc) to evidence employability skills

The focus will be on student self, peer and academic project supervisors appraisal in second and third year and linked to industry supervisor appraisal undertaken in final year. The industry appraisals are based on discipline/industry standards linked to course learning outcomes.

Critical reflection on skills and attributes: some tools

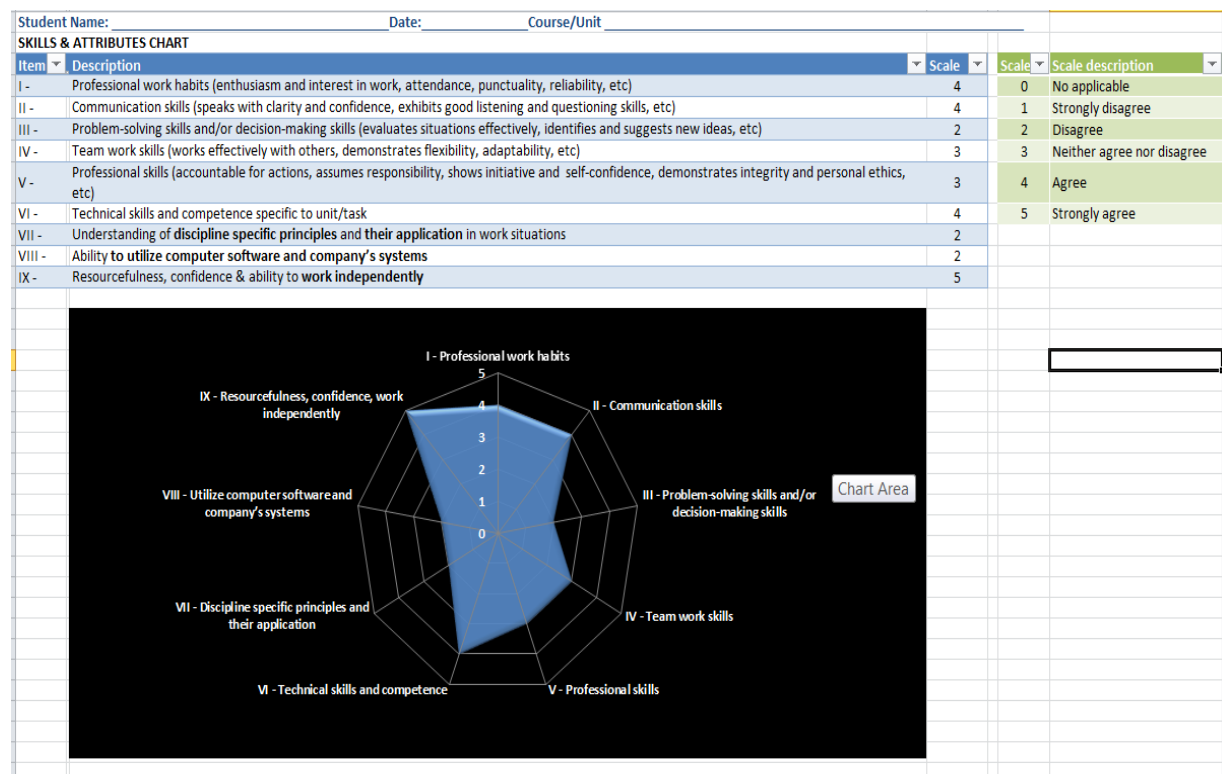


Figure 3: Skills & Attributes maps

These progressive ‘maps’ of graduate capabilities are prepared, revisited and reflected upon annually (alongside related project artefacts, reports, presentations, etc) as part of a unit assessment task within the design or professional practice (project) stream of units in each major. Assessment, including relevant artefacts and reflections occurs within the student portfolio. The Skills & Attributes maps are accompanied by review questions and activities (“teacherly interventions” according to Billett, 2012) tailored to support critical reflection appropriate to the unit activity and stage of the course. It is the combination of all of these activities, resources and cross-curricular artefacts that enable the student to actively connect their engineering technical capabilities with their broader, emerging professional identities.

Student e-portfolios used in conjunction with skills maps and pedagogic support activities gather or ‘net’

‘material evidence of learning directly from the distributed and inaccessible world of each individual student and process it such that it is then amenable to the kind of formal interactions between students and teachers required for assessment... (Allen and Tay, 2010, p. 6)

While the collection of artefacts for evidence of employability is important, Allen and Tay (ibid) emphasise that this is secondary to the reflection.

Conclusion

This paper presents a framework that encompasses work integrated learning but does not focus solely on work experience placement for the development of employability skills. A student and program lifecycle approach has been adopted to assist the journey of the student from novice to emerging professional, and key to this is the development of self-knowledge through critical reflection, that is, an understanding of personal strengths, challenges, needs and strategies for growth in a rapidly changing work environment. The importance of this is confirmed in both national and global contexts where “entry level roles for young people are disappearing” and 70% of all jobs are being radically changed by automation (Foundation for Young Australians, 2015). Engineers are involved at the centre of these changes as well as being impacted by them. And require ever more integrated and flexible resources and systems to connect and assure their learning.

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