Development of a rubric for identifying and characterizing work-integrated learning activities in science undergraduate courses

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There is a societal expectation that undergraduate degrees will contain activities that focus on making graduates workplace ready. Although it is likely that many of these activities occur in science degrees, there is a lack of formal and tested methodologies and frameworks for identifying them. One existing framework (Edwards, Perkins, Pearce, & Hong, 2015) was used to analyze WIL activities identified in course (unit, n=81) documentation and interviews with unit coordinators (n=71) at one Australian University. This revealed many (hidden) WIL activities that had not been previously articulated to either students or curriculum designers. The authors refined the existing framework to develop a rubric that allows the depth and breadth of WIL activities to be captured in a standard manner and WIL activities in a degree to be readily mapped.

Keywords: Work-integrated learning, WIL, curriculum design, STEM, employability

Work-integrated learning (WIL) encompasses a variety of learning approaches to develop the skills and attributes of students such that they can be work ready and have career resilience in a disrupted future of work. The onus on higher education institutions to ensure that students are equipped appropriately for employment is a growing international trend (Knight & Yorke, 2003; Yorke, 2006). In Australia, a national strategy on WIL in university education has been adopted to enable students to have ready access to WIL as pedagogy to support employability (Patrick et al., 2008; Universities Australia, 2015). This has been in response to a gradual decline in employment rates for new graduates, partly due to the government's demand driven funding model and to address capacity gaps in transferable skills of graduates as identified by industry. In Australia, the percentage of graduates in full-time employment four months after completion has fallen from 84.5% in 2007 to 71.8% in 2017, with science and mathematics graduates dropping from an already low base of ~ 75%, to 59% in 2015 (Graduate Careers Australia, 2015). It should be noted, however, that employment rates for science graduates do improve further out from completion (Kaider, Hains-Wesson, & Young, 2017).

Australian society is questioning its investment in higher education if it does not cater for the needs of current and future employers. For recent graduates, including those from science disciplines, employers are reporting that they lack the required level of development in skills such as oral and written communication, teamwork, problem solving, critical thinking and leadership (Deloitte Access Economics, 2014; The Australian Industry Group, 2018; Kramer, Tallant, Goldberger, & Lund, 2014). To counteract the disconnect that graduates and society see between the role of higher education and the workplace, WIL must be an integral component of all degrees (Office of the Chief Scientist, 2013). As noted by Edwards, et al., (2015), finding appropriate WIL activities for science, technology, engineering and mathematics (STEM) students is potentially problematic given the diversity of career destinations and the increased volume of graduates. Developing WIL programs that can effectively address the diversity of career destinations is a challenge for implementation along with a belief that workplace skills can only be taught in the workplace and not in the classroom (Orrell, 2011). Indeed, Papadopoulos, Taylor, Fallshaw, and Zanko (2011) noted that there was a perception amongst

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academics that a vocational institution rather than a university was more appropriate for teaching employability skills. In addition, in science an attitude amongst academics is that 'real' WIL necessarily includes laboratory work that is undertaken with a discipline focus. To some extent, this reflects previous definitions of WIL that focus on a work placement (Cooper, Orrell, & Bowden, 2010). In science degrees an enormous value is placed on laboratory-based practicals to equip students with the appropriate skills to become a scientist and there is a general belief that any other necessary skills will be learnt in the workplace. Consequently, the limited availability of appropriate laboratory-based placements in science is often used as an insurmountable barrier to expand WIL to all students in science degrees. In this scenario, it would be impossible to provide such an experience for every undergraduate student in Australia (Oliver, 2015).

Science discipline industry placement as a WIL activity is attractive because it is readily identifiable and can be acceptable to both internal and external stakeholders. However, the diversity of skills required for improving student employability, which includes not only workplace-related skills but also, for instance, career management skills, and the ability to successfully navigate job applications and interviews (Freudenberg, Brimble, & Cameron, 2009; Hains-Wesson & Campbell, 2014), means that a vast array of activities should be considered (Knight & Yorke, 2003; Oliver, 2015). Like all learning outcomes these need to be developed and assured in the curriculum, alongside discipline specific knowledge and skills (Whelan, 2017). This has led institutions to assess what WIL outcomes are developed within as well as outside of the classroom, with the view to enhance employability even for those who do not complete an external placement. It can be difficult to identify activities that contribute to employability outcomes as they often occur randomly and/or are not seen as fundamental degree outcomes by staff. Debates centers on the definition of WIL and acceptance that a particular activity can be regarded as a valid WIL activity, and then once identified, determining what assessments and their associated standards and criteria can be applied. At a higher level, it is necessary to establish what thresholds of WIL outcomes are required in a course to make a graduate more employable.

The Problem

To address the societal and undergraduate expectation of adding value to graduates by making them workplace ready, there was perceived a need to audit the volume and breadth of WIL in science undergraduate courses at Western Sydney University (WSU). The breadth of the science degrees was typical to most tertiary institutions spanning traditional disciplines such as mathematics and chemistry to applied areas like food and forensic sciences. Only one degree had the requirement of least 400 hours of work experience, with no learning or quality assessment of the placement. Not for-credit WIL placements were available and there appeared few explicitly identified WIL activities in any of the degrees.

Reflecting on the broad definition of WIL as "an activity or program that integrates academic learning with its application in the workplace" (Edwards et al., 2015) curriculum designers were confident a range of WIL activities existed, but were either not assessed and/or not explicitly identified to the university or to students. These WIL activities were defined as 'hidden WIL' by the research team. Informal conversations indicated extensive hidden WIL so it was decided to identify and map all WIL activities across the programs. However, an appropriate framework was required and despite the national strategy on WIL, no national guidance on WIL standards and criteria was available. In this void, universities use their own models for defining WIL engagement with little explanation of underlying standards and required learning outcomes (Edwards et al., 2015). For example, some descriptors of WIL activities and frameworks are available (Papadopoulos, et al., 2011; Rowe, Winchester-Seeto, & Mackaway, 2012) but they are typologies of WIL activities linked to desired outcomes or 'focus capabilities'. One Australian university uses a '9-square' matrix based on an authentic assessment framework that places activities in context of both authenticity and proximity to a real workplace (Kaider et al., 2017). While this work identified WIL activities that were assessed and visible in unit documentation, it does not link the activities to desired learning outcomes. This work also raises the question of whether only activities that rank high in both authenticity and proximity, such as external placements, should be considered WIL (Kaider et al., 2017). This contrasts with ideas about the broad range of activities that should be considered appropriate to improve employability now and in the rapidly changing future of work (Knight & Yorke, 2003; Oliver, 2015). Edwards et al., (2015) have recognized the prevalent, but limited attitude that a placement is the best WIL and have developed a framework to help identify the many different types of activities that can be considered WIL. This framework (herein referred to as the Edwards framework) correlates the primary objectives of WIL (i.e. learning outcomes) as listed in Table 1, with activities that can help achieve the objectives.

TABLE 1: WIL learning outcomes/objectives developed by Edwards et al. (2015).

1	To build workplace specific skills and knowledge
2a	To develop occupation specific skills and knowledge and skills to adapt and apply them
2b	To train professionals to enter a specific industry
3	To build understanding of the nature of industry/occupations
4	To facilitate self-understanding
5a	To develop employability and contextualized language, literacy and numeracy skills.
5b	To develop career management skills

Even though there are no clear national guidelines surrounding WIL, there are clear learning outcomes, competencies and expectations that are consistently identified by employers (Atkinson, Misko, & Stanwick, 2015; Graduate Careers Australia, 2015). The Edwards framework appears to be one of the first to try to link WIL learning outcomes with activities in the form of a traditional rubric. In this study the Edwards framework was used to identify WIL activities in all the science units currently offered at Western Sydney University. Unlike some authors that have identified WIL activities by mapping assessments (Kaider et al., 2017), which is ideal in a well-established WIL program, in our degrees WIL is not yet embedded in a directed manner, and as such this approach could miss many activities. In this project, units were scrutinized for WIL activities by reviewing unit documentation (learning guides, that articulate learning outcomes, teaching activities and assessments to students) and via interviews with academic unit leads (Unit coordinators). In this way we aimed to identify all WIL activities, including 'hidden WIL' so these activities could be mapped across our science courses. The outcomes of this research are reported here.

METHODOLOGY

Context of the Study

Western Sydney University supports diverse access to higher education (33,000 students) with deep connections with the local community. Seventy percent of the student population reside in Western Sydney with 60% being first in family to attend university. The School of Science and Health with over 177 academics delivers 15 science degrees and involves the integration of 120 units of study sourced from six schools and a research institute. The structure of degrees is quite variable (24 units in total), with some following a defined study sequence of 16-20 units, while others require 16 science units (8 defined major, 8 from a pool of science units) together with eight free electives from any area of university study. For some degrees, accreditation requirements dictate no elective spaces. Across disciplines, sub-majors, majors and specializations there is considerable sharing of units that enables multiple majors to be accumulated.

Study Design

Two science academics independently audited units for WIL activities by firstly examining learning guides. Evaluation was based on the framework developed by Edwards et al., (2015). Visible and assessable learning activities explicitly identified as falling within the framework were considered 'explicit WIL'. Activities that fell within the framework but were not assessed and/or the links to workplace were not articulated to students were designated 'hidden WIL'. Unit coordinators (n=71) were then interviewed face to face to identify additional WIL activities (WSU Human Ethics Approval H11624). To structure the interviews, a survey containing both open ended and directed questions was used. This included questions to initially assess the academic's level of knowledge regarding WIL before providing them with an accepted but broad definition of WIL as "an activity or program that integrates academic learning with its application in the workplace" (Patrick et al., 2008). This was presented to promote discussion and used as a platform to allow identification of WIL activities that were occurring but were either not present in the learning guides or identified by the academic as WIL. As previously indicated, if these were assessed they were considered 'explicit WIL' otherwise they were recorded as 'hidden WIL'. If a unit indicated multiple activities categorized to a single field in the framework, i.e. they fulfilled the same WIL learning outcome, then they were noted but only recorded once for mapping purposes. Using this methodology all science units (n=81) were assessed for their WIL content. The WIL content of complete science degrees was determined by reconstructing the degree from individual units and then mapping WIL activities across the complete degrees. This methodology allowed determination of WIL content across a diverse set of science degrees.

Development of a New Rubric to Assess WIL Activities

An action-in-research methodology was used to develop a new rubric for identifying WIL in science courses (Ferrance, 2000). The rubric was based on the Edwards framework - at the end of each interview, the team reflected on the strengths and weaknesses of the framework in capturing the WIL activities in the unit being audited. This included how well the identified WIL activities and how well the learning outcomes aligned to the activities. If an activity could not be assigned to a classification in the Edwards framework, then a new descriptor was developed and included. Once all units had been assessed and the additional activities had been identified, the Edwards et al., (2015) learning outcomes were reassessed to determine if they adequately reflected the desired outcomes for WIL activities. The Edwards framework was then redesigned to incorporate additional learning outcomes and related WIL activities, and the interview team then validated the new rubric by reassessing five science units.

RESULTS

Identification of WIL Activities

A particularly pleasing outcome, which aligned with the perception of curriculum designers, was that there were considerable WIL activities occurring in our science degrees. This involved significant contributions from units not formally identified in either learning guides or by the unit coordinators as providing WIL outcomes. Typical examples of the mapping at the unit level using the Edwards framework is shown in Figure 1. Although no one unit was expected to contain activities that contribute to all objectives, it is clear from these units, one from each year of a science degree, that there were activities that contributed to multiple WIL learning outcomes. A clear feature revealed by the unit mapping was that few WIL activities occurred outside the classroom in any of the 81 units investigated. Although extramural activities are defined as higher level activities by the Edwards framework, the few activities that could be considered outside the classroom generally involved a research placement under the supervision of academics. An unsurprising feature revealed by the mapping was that the units early in a degree (Level 1) tended to have WIL activities that could be considered introductory (show, sell) whereas the later units tended to have activities with direct involvement (engage and practice). This trend was expected as science degrees build on a knowledge foundation, and some academics consider the ability to critically analyze multifactorial, industry relevant problems as only possible in the later stages of undergraduate education. The most populated learning outcomes identified in science units was "To develop occupation specific skills and knowledge and skills to adapt and apply them" and "To develop employability and contextualized language, literacy and numeracy skills". On face value this seems to reflect the attainment of some desirable WIL outcomes, yet it was found that in almost all cases the occupation specific skills were very closely aligned to research (e.g., writing a scientific paper). Similarly, the contextualized language was nearly always focused on a research career in the area of the academic coordinating the unit.

Units (n=20) from level one to level three were analyzed for explicit and hidden WIL activities. In most cases, hidden WIL activities were only revealed during the face-to-face interviews. The results showed that WIL activities become more explicit to students in later years in the degree, compared with year one. Given the WIL activities in the later years tend to encompass direct involvement WIL activities (Figure 1) then it is perhaps not surprising that there is a greater level of contextual development compared to first year. Indeed, the introductory level WIL (show) in first year is often examples of real world practices/problems presented in lectures without students being aware that it is directly relevant to an industry or workplace. From these data, we hypothesize that academics see the explicit linking of WIL activities to future employability as only becoming important once a student approaches graduation. As an outcome of the interview process, once a hidden WIL activity had been identified, it was relatively easy to suggest small changes in the context delivery to allow the WIL to become explicit to students. For example, a first year chemistry laboratory exercise to analyze chlorine in commercial bleach samples was classified as hidden WIL due the bleach being presented as "chemical samples" and outcomes being reported in the form of a traditional research report. Discussion with staff allowed it to be moved to explicit WIL by aligning the activity to those procedures undertaken in industry and by redeveloping the reporting process to be relevant to the workplace.

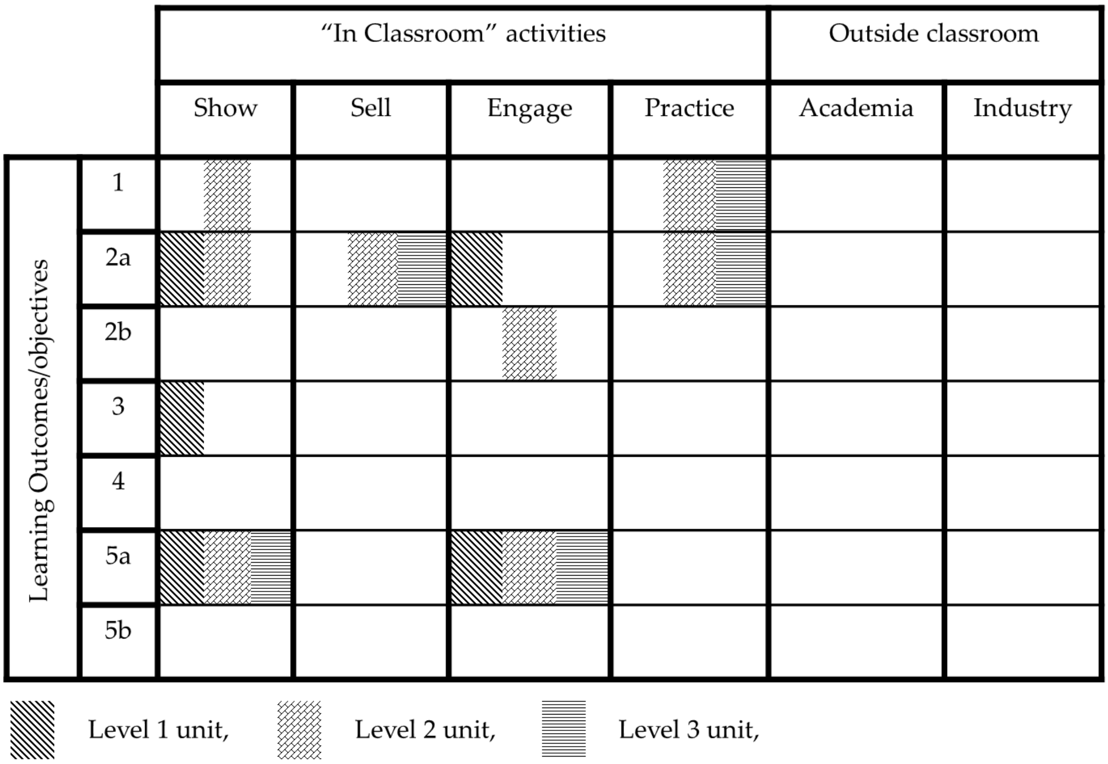

FIGURE 1: Mapping of WIL activities in science units.
Example of WIL activities identified in three units at level 1 (Biodiversity), level 2 (Metabolism) and level 3 (Advanced Immunology).

Mapping WIL Activities across the Curriculum

A key aim of this project was to be able to map the WIL activities occurring throughout an entire degree (composed of 24 units). The mapping of WIL activities in two WSU degrees BSc (Mathematical Science) and BSc (Forensic Science) represents the extremes in terms of WIL activities identified in the study (Figure 2). The most populated learning outcomes are 2a and 5a (Table 1), consistent with the most populated learning outcomes observed in individual units (Figure 1). The BSc (Mathematical Science) degree had low levels of WIL activity with many units containing no WIL at all. In a broad context Mathematical knowledge underpins every aspect of society making explicit links to industries and workplaces possible, but clearly this was not seen to be a priority to academic staff. This was clear in interviews with staff that indicated a teaching focus on mathematical processes and concepts, and any everyday examples were only used to provide data when needed. It was evident from the interviews that opportunities to allow students to see the very real importance of mathematics to their future careers had not been considered a mandate of the teaching program. In contrast the Forensic Science degree had WIL covering the breath of learning outcomes identified by Edwards et al., (2015) (Figure 2, Table 1). While this should be generally applauded, our interviews indicated that the WIL outcomes were narrowly focused on the outcome of a graduate becoming a forensic scientist with, for example, writing communication focusing on presenting evidence in court. The degree included the same WIL activities repeated in multiple units with no scaffolding of the skills obtained. For example, analysis of DNA is introduced and developed only in the context of a forensic situation with a particular emphasis on maintaining the chain of custody for presentation of evidence in court. It is left up to the student to link how DNA analysis could be used in a different industry/workplace. This neglects the reality that a large number of the graduates in this course will gain employment in other disciplines. These results show that by only using a typology or rubric for evaluating WIL activities, the mapping of WIL activities can give a distorted view. The problem arises because the Edwards framework identifies activities without regard as to whether or not the activity is specific to a particular industry or broadly applicable to a range of graduate destinations. The interviews with the unit coordinators became a necessary part to tease this out.

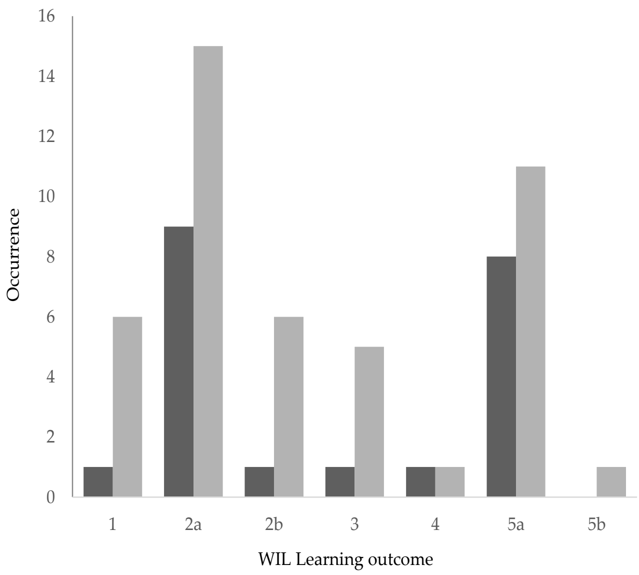

FIGURE 2: Mapping of WIL activities to entire courses. The proportion of WIL activities occurring in the BSc (Mathematics) (dark grey bars) compared to BSc (Forensic Science) (light grey bars) highlights the comparative lack of WIL activities in the Maths degree. See Table 1 for description of WIL Learning Outcomes.

The Power of Conversation

Although close examination of the unit outlines often indicated that WIL activities might be occurring, it was only by direct interview with the unit coordinators that the true situation could be determined. There was a reluctance to allow independent completion of the questionnaire, as this was reliant on compliance and a common understanding of the intent of the question. Conversations around the questionnaire helped expose WIL activities that otherwise would not have been identified by the unit coordinator. For example, many unit coordinators stated they had no WIL activities in their unit, however in response to the question "Did you have any guests from industry come and talk to the students?" they frequently answered 'yes'. In most cases, through conversation the unit coordinators realized that WIL activities were occurring and should be genuinely made explicit in student learning. With small adjustments often around how information was presented or changing the language around certain tasks, other WIL activities could also be put forward for students to see the links to their employability.

Through the interviews the unit coordinators became critical friends and the process, in part, became the start of an education program for academics about what activities constitute 'good WIL' (Costa & Kallick, 1993; Cooper et al., 2010; Orrell, 2011). This included the acceptance of developing broad employability as a valid degree outcome. With the need to comply with University requirements to incorporate WIL activities; the interviewers became the champions of change who used conversation to gain acceptance from the academics especially when they provided simple measures to enhance the WIL content of units. For instance, in personal interviews when staff were asked 'Do you know what WIL is?' 47% said no and of those who said yes, many considered it to be a placement or internship in a workplace. These answers meant that the rest of the questionnaire identifying WIL would have become invalid. Instead, through conversation, most instances WIL activities could be identified in nearly all units.

TABLE 2: Questions used in interviews to identify hidden and explicit WIL.

1	Do you know what WIL is? If 'yes' please describe.*
2	Can you identify potential WIL activities in your unit?
3	How would you describe the WIL activity (choice related to activities in rubric).
4	Do you teach this activity? If 'yes' please describe.
5	Do you assess this activity? If 'yes' please describe.
6	If you were to employ a graduate, besides professional knowledge, what are the four most important graduate attributes you would be looking for? (Choose from list of attributes ‡)
7	In order to prepare students better for the workplace in the area of their specialization, what should be added to their university experience.

* If 'no', "WIL is a term for an activity or program that integrates academic learning with its application in the workplace" was the broad definition provided by the interviewer.

‡ Previous experience in a similar role; Scientific oral communication; Scientific written communication; Marketing Experience; Ability to work in a team environment; Excellent time management; Punctuality; Self-directed; Reliability; Leadership; Skills associated with meetings; Management skills; Educational skills; Ability to follow directions; Digital media skills; Ability to self-reflect; A well-structured application and CV; Experience working in the community; Creativity; Persistence; Problem solving.

Interview questions (Table 2) were aimed at identifying hidden and explicit WIL activities and asked if the activity was taught and assessed without consideration of the quality of the assessment (e.g. design, weighting). Other questions included what non-discipline related graduate attributes academics desired in an employee (Table 2, question 6) and what learning should be added to existing degrees to prepare students for the workforce (question 7). This questioning was in the context for future curriculum renewal and to identify the alignment of academic thinking with those of broader community and industry groups. It was clear that many academics did not understand or value the role of non-discipline specific WIL and the need to scaffold them through the degree. This was evident for a first year unit "Scientific Literacy" which aims to introduce generic skills such as the scientific process, reflective practice and critical thinking, the exact type of 'soft skills' embodied in WIL definitions. Most academics only perceived this unit to teach English language skills and how to write scientific papers. Academics complained that because students had not developed these skills, in a discipline specific context, by third year it was due to the failure of learning outcomes of this level I unit. The lack of understanding of the outcomes of units in the degrees academics teach into, and the place of those units in a WIL context, was identified and challenged in the interviews.

These conversations have radically changed the perception of WIL by our staff, challenging their ideas at the start of the project that WIL only centered on activities aligned with traditional science careers. This, together with increased public discussion of the role of higher education in the Australian society

(Patrick et al., 2008), has led to broad acceptance by staff to provide significant curriculum space and assessment to assure graduate capacities in this area. The explicit curriculum reform we are leading also aims to further increase student understanding of the importance of developing transferable skills as course outcomes. This may result in increased degree satisfaction beyond student perceptions of providing career entry into traditional destinations.

DISCUSSION

Modification of a WIL Activity Framework into a Functional Rubric for the Identification of WIL

Using the Edwards et al., (2015) framework to identify WIL activities proved to have its challenges. For example, the framework has learning objectives where no activities are identified to meet these aims, for instance the objective '*To build workplace specific skills and knowledge*' (see Table 2, Edwards et al., 2015, p. 46), has no activities listed under 'Sell' and 'Engage'. In addition, there are WIL activities commonly undertaken in the classroom which did not map to the framework. These include exposure and use of professional level documentation, activities showing how science skills can be transferred to non-traditional settings and learning generic organizational functions such as how meetings are run or understanding the hierarchy of organizations. Furthermore, as noted above, the Edwards framework did not separate academic skills from more generic WIL skills. This also made mapping difficult. To account for these deficiencies a modified rubric was developed allowing broader WIL learning outcomes (Table 3) and activities (Appendix A 3) to achieve these outcomes.

TABLE 3: WIL learning outcomes/objectives of the Western rubric.

1	To develop curriculum linked STEM workplace/occupation specific skills, knowledge and be able to adapt and apply them
2	To build an understanding of the nature of industry and the roles of different occupations as they relate to industry
3	To facilitate self-understanding
4	To train professionals to enter a specific STEM industry in accordance with standards of a defined industry
5	Develop employability and contextualized language, literacy and numeracy skills
6	To develop career management skills

The learning outcomes/objectives were designed to encompass three broad areas – Generic science WIL (Table 3, outcomes 1-3), industry specific WIL (outcome 4) and WIL associated explicitly with employability and careers (outcomes 5 and 6). All these outcomes could be easily adaptable to different disciplines outside of science if required. The types of activities that contribute to these learning outcomes are shown in Appendix A; the level of WIL depth (e.g., 'show and tell', 'sell') was retained from Edwards et al., (2015) although, like Edwards et al. we do not consider any one level of WIL depth to be superior to another. It was not considered necessary to divide the 'outside classroom' activities into 'Academia' and 'Industry/Community' given that academia is ultimately just another industry that is a potential graduate destination. Therefore, the modified rubric considers external WIL to be any outside of the classroom activity that occurs within a workplace. Inclusion of some of the activities that were absent in the Edwards framework, such as professional documentation and recognition of professional behavior, was placed in learning outcome 5 (Table 3) as these are the type of 'soft skills' that can distinctly contribute to employability and which employers often considered to be lacking in new graduates.

The rubric was also designed to ensure that graduates had demonstrated capacities to enter broad careers such as entry graduate programs in business, banks and government that require the completion of a degree without a necessarily prescribed discipline. For example, NSW State Government Graduate Program requires completion of any degree, however candidates must clearly demonstrate high-level capacity in self-management, communication, problem solving and project management skills. Recruitment also focuses on basic demonstrable capacity in teamwork and personal integrity (Public Service Commission, NSW Government). In addition, the rubric must also map skill attainment for more traditional science entry based employment such as quality control officers, hospital scientists and technicians.

Part of the common definition of WIL is that it is *purposefully designed and linked to the curriculum* so the first learning outcome incorporates activities that explicitly identify to students that what they are learning is directly relevant in the workplace. Indeed, in contrast to the Edwards framework, the modified rubric includes clear references to the workplace when analyzing WIL activities. An example of where gaps existed in the original Edwards framework was in learning outcome 4 'To facilitate self-understanding' (Table 1), where no activities outside the classroom were considered able to fulfil this objective. The activities that contribute to this objective revolve around reflective practice and this new rubric (Appendix A) acknowledges that reflective practice can have a very different impact when the assessor is from an external organization. Indeed, a WSU final year science unit, Laboratory Quality Management, uses this very effectively (Phillips & Markham, 2016). In this unit an external auditor from the National Association of Testing Authorities (NATA) meets with groups of students and provides feedback on a written report and students' technical performance in specific laboratory activities. Time is then allowed for the students to reflect on the session and correct their actions. The use of an external, industry profession in a genuinely co-delivered unit promotes high level WIL that the modified rubric can identify.

The modified rubric can be used to not only facilitate the identification and mapping of WIL activities across units and curricula, but it can be used to move individual WIL experiences to a higher level or to move hidden WIL to explicit WIL. This will benefit scaffolding of WIL throughout a degree to ensure students graduate with an appropriate level of WIL. Indeed, the explicit inclusion of WIL into institution level graduate outcomes is only possible if it is known what WIL is happening. Furthermore, WIL is not currently explicitly included in the science Threshold Learning Outcomes (TLO), yet mapping of WIL in programs will allow the sector to begin to decide what level of WIL is satisfactory for a new science graduate and allow embedding into the science TLOs.

CONCLUSION

Based on our findings, it is highly likely that many activities are already taking place in most science undergraduate degrees across the sector, and these activities go a long way towards meeting the societal and undergraduate expectation of developing work ready graduates. The problem is that many of these activities have not been explicitly identified (hidden) by the course documentation nor clearly articulated to students. These activities need to be identified to resolve this problem and use of a rubric combined with direct discussions with unit coordinators will facilitate this process. Using the rubric that we have proposed would give a firm basis for this process and subsequently allow course mapping of WIL activities. Once such maps are constructed, they will provide the basis for the next steps such as developing descriptors of the activities that clearly identify them as WIL. These descriptors will also provide the basis for performance in an activity to be matched to competency and so link standards and criteria to an activity. Mapping according to the rubric will also provide a basis for interaction with central facilities in the University such as Careers so that the full resources of the University can be strategically applied to ensure work ready graduates.

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APPENDIX A: The Western WIL rubric developed from the Edwards framework (Edwards et al., 2015). The rubric correlates WIL learning objectives with different ways to achieve those objectives and the activities that contribute to learning objectives.

Objectives of WIL		**Ways in which WIL objectives are achieved**				
		In classroom				**Outside of classroom**
		Show & Tell	**Sell**	**Engage**	**Practice**	**Acad/Indust/Community**
Generic Science WIL	1. To develop curriculum linked workplace/occupation specific skills, knowledge and be able to adapt and apply them.	Workplace specific examples and guest lecturers who *articulate* the link between *curriculum* and *industry.* Explicit examples in lectures and course notes of skills relating to workplace. Observational field trips to workplaces.	Explicit focus on *why* concepts, skills and information are important to the workplace and *how* they may be applied in the workplace.	Field trips structured around directed activities that focus on *how* skills and knowledge *apply* to the workplace/ occupation. *Inquiry based learning* with explicit activities linking skills and knowledge to the workplace/ occupation.	Self directed case studies and scenarios with problems to solve using skills and knowledge obtained in the course. Simulations. Workplace provided real world issues for the basis of student projects which are managed, completed and assessed *internally*.	Students as active members of university based teams to solve workplace problems including reflection and debriefing. Industry/work placement based projects where the topic specific skills and professional knowledge are applied and linked to the curriculum.
	2. To build an understanding of the nature of industry and the different occupations as they relate to industry.	Industry guests, professional associations, academics talk about industry, their occupation and responsibilities within that industry. Discussion of professional expectations, ethics and protocols within the industry.	Promotion of specific graduate destinations.	Field trips with *explicit reflection* on employer expectations about professional practice. Reflection on what it means to work as a graduate/professional in a particular industry including academia.	*Self-directed* case studies/scenarios using skill sets and knowledge across platforms involving different occupations in the workplace. Simulations of complex problems requiring multiple and nested skills for solutions.	Selected students for short term placement at the university, sector, community or government level.
	3. To facilitate self understanding	Observation of reflective practice in action by professionals.	Explain *why* reflective practice is critical for developing personal and professional understanding and is the basis of reflective learning by professionals	Explicit exercises to teach and promote deep reflection.	Opportunities for self-reflective practices and debrief on process.	Opportunities for self-reflective practices and debrief on process by external professionals.

Objectives of WIL		Ways in which WIL objectives are achieved				
		In classroom				Outside of classroom
		Show & Tell	Sell	Engage	Practice	Acad/Indust/Community
Industry specific WIL	4. To train professionals to enter a specific STEM industry in accordance with standards of a defined industry.	Course design and lectures reflect Industry input. Lectures share own (extensive) industry experience.	Build a sense of belonging to a profession and the identity of the profession, e.g. discipline branding, course uniforms, badging, graphic design. Recognition of industry professional bodies	Explicit focus on the *whys* and *hows* of professional practice. Work orientated applied focus through out course with scaffolded opportunities to apply theory in real world situations and consider issues and potential consequences of decisions.	Simulations. University owned/based clinics.	Skilled mentors. Supervision in workplace (this could include university as the workplace). Ongoing feedback from employers. Self-reflection and skilled debriefing. Extensive placement throughout course with scaffolded opportunities to try new things, understand consequences of decisions. Year long projects with high degree of student autonomy and responsibility.
Employability and careers	5. Develop employability and contextualised language, literacy and numeracy skills.	Recognition of professional behaviours, communication, documentation, WHS, ethics and regulations, management skills, professional workplace hierarchy, group work dynamics	Explain *why* and *how* professional language, literacy and behaviour leads to employability.	Case studies with explicit focus on non-technical skills. Explicit training in techniques and strategies.	Simulated activities. Interdependent group work with explicit roles. Role playing.	Industry based placements with minimal preparation, support or feedback. Industry based placements with explicit focus on technical and employability skills with supports such as mentoring and client feedback.
	6. To develop career management skills	Career advice and skills training e.g. resume writing. Examples of job ads in relevant fields.	Alumni speakers focusing on *how* their course has proven useful or who illustrate an unusual career pathway.	Industry network events.	Mock interviews involving industry members.	Formal applications required for industry projects/placements. Competitive processes for winning industry placements. Student initiated work placements and projects.