Applications of Work Integrated Learning Among Gen Z and Y Students

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Preface

It has become evident that within the gradual reshaping of Higher Education, and within (or in partnership with) the workplace, there is a growing demand for an integration of the learning that takes place at Higher Educational Institutions (HEIs) and the workplace. This is especially crucial when considering how the labour market is rapidly changing and how these changes will impact the new labour force of Generation Y and Z. This has been particularly significant considering the impact of the Coronavirus (COVID-19).

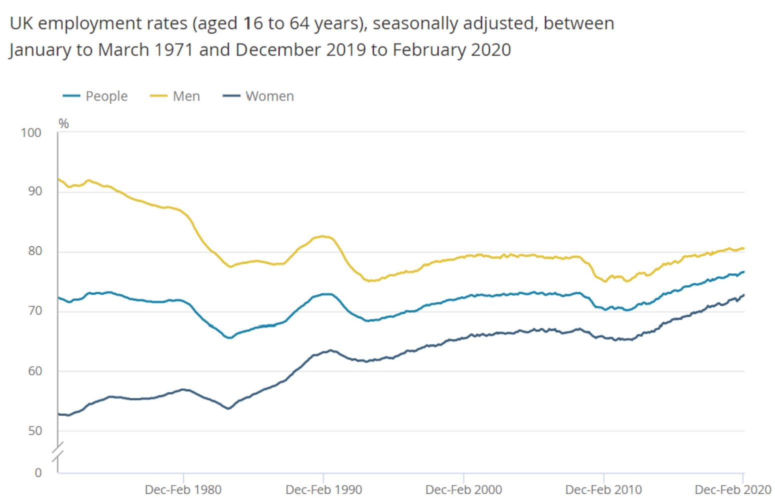
CHALLENGING LABOUR MARKET CONDITIONS

Gallagher (2020) states "this is not a surprise and is a moment the country [the United Kingdom] has been preparing for", when on the 31st of January 2019, the first two cases of COVID-19 were confirmed within the UK. By 18th March 2019, the BBC announced that the government was to shut all schools by the end of that week, except for children of key workers and those classed as vulnerable. Richardson (2020), a BBC education correspondent asked, "How long will they remain closed? How will pupils cope with learning from home? Who will look after them?" A few days later, on 20th March 2019, the BBC announced the government's intention to "pay 80% of salary for staff who are kept on by their employer, covering wages of up to £2,500 a month", as a strategy to prevent job losses due to business closures, or the reduction of services due to national lockdown measures. The analysis of Islam (2020) from the BBC was that "in theory, it should save hundreds of thousands of jobs." Fast forward to the 6th of September 2019, and Elliott (2020) for the Guardian newspaper reported on the grim impact of Covid 19 on the UK: "Instead of a 14% drop in national output, the latest forecast from the Bank of England is for a 9.5% contraction, making it merely the worst recession since the one after the end of the first world war" adds Elliott (2020). Carrick (2020) further articulated this grim forecast by confirming for readers of London's business newspaper City A.M, that based on forecasts by KPMG, the UK economy is not likely to recover until 2023.

In the United Kingdom (UK), considering the impact of COVID-19 restrictions, a significant 13.1% rise in redundancies has been recorded among young people aged 16-24, the highest rise ever recorded (BBC, 2021). With the average age of a UK graduate being 22 years (Bolton, 2021), graduate recruitment has suffered its largest decline since the 2008 global financial crisis (Inman, 2020). Research by the UK-based graduate jobs website Milkround (2020) suggests just 18% of graduates were securing jobs in 2020. In comparison, 2019 saw 60% of graduates had secured jobs before the pandemic (Milkround, 2020). A survey conducted towards the end of 2020 revealed that out of 5,000 UK final year students and graduates, 67% feel negative about their future careers (Greaves, 2020). A highly educated population is a precondition for economic success in the globalized economy, argues Talbot (2019), who also recognises that those exiting the formal education system are perceived by industry to be ill-equipped for the modern workplace. According to Universities UK (2016, p.3), universities "educate graduates to meet UK and global demand for higher-level skills, generate world-class research that transforms lives, and drives innovation that supports local and national economic growth" (Tudor, et al., 2014).

KPMG forecasts the unemployment rate rising to 9% in the fourth quarter, averaging 5.9% this year and 8.2% in 2021. The Office for National Statistics (ONS) (2020) stated that for the period December 2019 to February 2021, "The UK employment rate was estimated at a record high of 76.6%, 0.4 percentage points higher than a year earlier and 0.2 percentage points up on the previous quarter" as seen below in Figure 1.

Figure 1. Labour force survey
Source: Office for National Statistics (2020)



Data by Statista (2020) provide another visual illustration of the impact on labour markets as seen in Figure 2 below:

However, KPMG suggested to the BBC (2020) that "We estimate that as many as 13 million jobs are in sectors highly affected by the lockdown, representing 36% of all jobs in the UK, which could see unemployment rising to just under 9% [it was 4% prior to lockdown] during the lockdown period".

Jones, Palumbo & Brown (2020) from the BBC provided a visual comparison of the UK unemployment rates and other countries, indicating the impact of world labour markets on work-integrated learning among graduates as seen in Figure 3 below:

Global economist Lee (2020) provides an even starker picture of the accelerated rate of job losses globally as illustrated in Figure 4:

Figure 2. UK unemployment
Source: Statista (2020)

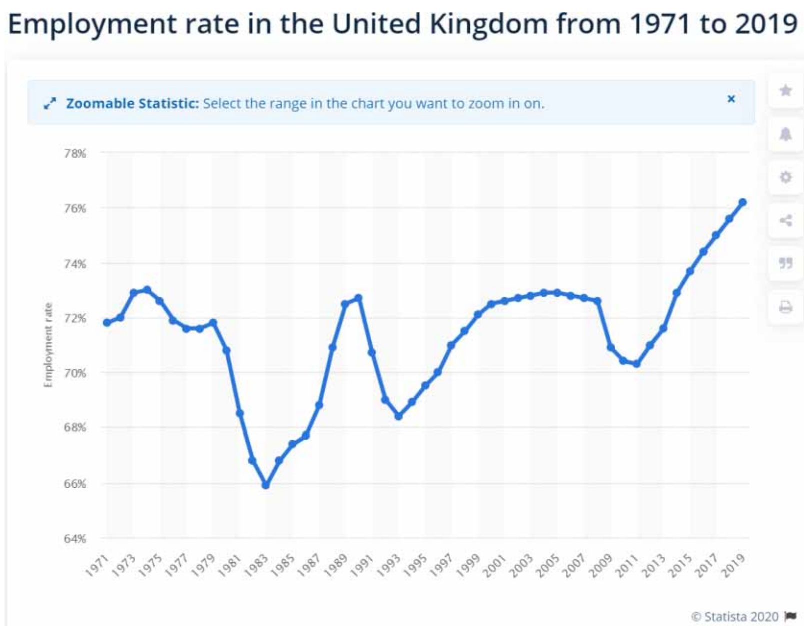
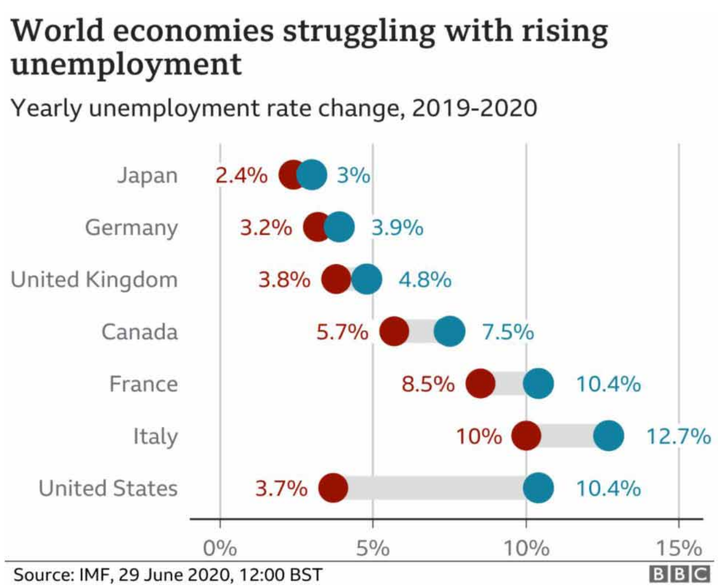
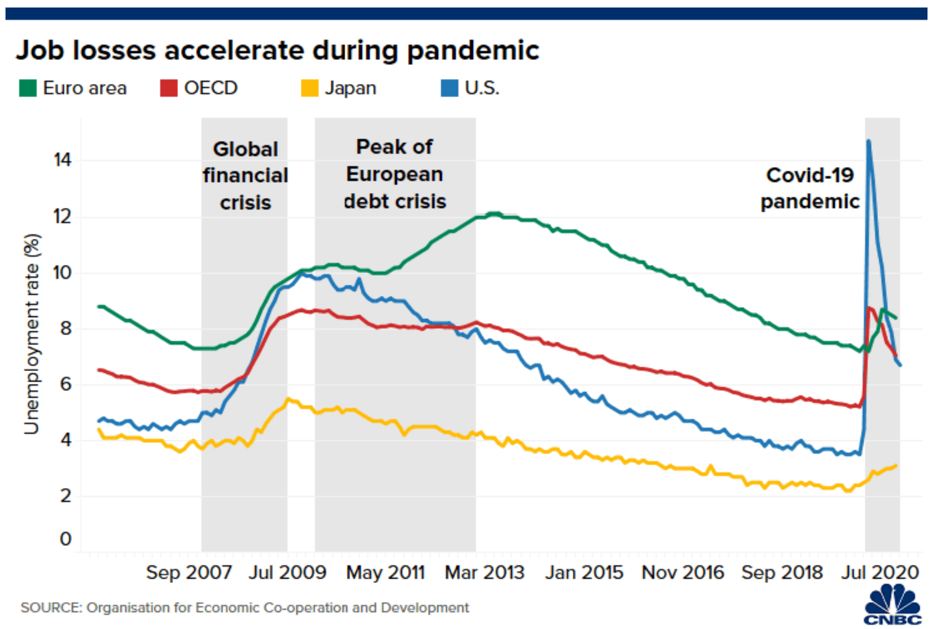


Figure 3. World unemployment
Source: Jones, Palumbo, and Brown (2020)



Chapman (2020) for the Independent newspaper reported that the falls in employment were greatest among the youngest and oldest workers, along with those in lower-skilled jobs. In addition to those affected the worst, Lyon and Dhingra (2020) in their report, suggest sectors which entail more human contact such as airlines, restaurants, hotels and arts and entertainment have been hardest hit by the pandemic. The report further suggests that sectors affected by Brexit are generally different to those currently impacted by COVID-19.

Figure 4. Global job losses during the pandemic
Source: CNBC (2020)



The Australian Financial Review's report from a recent graduate outcomes survey, undertaken by UK jobsite Indeed, highlights COVID "as limiting their employment prospects in what they've studied," Boddy (2021), with graduates believing that the job market holds very little in terms of opportunities for them. Globalisation and technological advances have created a more apparent need to improve graduate outcomes. This places even greater responsibility on HEIs to be able to develop graduate attributes and competencies which can contribute to an individual's success in the knowledge economy.

THE AIM AND PURPOSE OF THE BOOK

The timing of a publication depicting work integrated learning from around the world could not be timely. Formal and intentional models and processes utilizing experiential learning methods and pedagogy are often referred to as Work Integrated Learning (WIL). However, the editors acknowledge that there is vast cross-conceptualisation evident within the field between concepts such as Work-Related Learning (WRL), Workplace Learning (WPL), Work-Based Learning (WBL), Work Integrated Learning (WIL) and Experiential Learning (EL). Furthermore, there are vast differences between different applications such as apprenticeships, higher degree apprenticeships (HDA), co-operative education (Coop), internships, placements, projects, sandwich courses, practicums and so on. Therefore, there exists a need for an edited collection of original research in this area in order, through practice examples, to shed further light on the similarities and differences in these practices. The editors feel a critical comparison of practice, in the form of case studies from around the world, and with a specific focus on the impact of WIL on the future labour force of generation Z and Y, will achieve this aim. Not only will such comparative case studies share information and good practice, it will also provide opportunities for global practitioners to engage in conversation with each other.

This book aims to:

1. Critically engage with the educational and theoretical concepts related to 'WIL' and Gen Z and Y students as a workforce including, but not limited to, the types of WIL, the VET sector and Higher Education, practice and publications from around the world, mode 2 knowledge, employability and career development, widening access to Higher Education, professional development and reflection;
2. Critically explore the types of 'WIL' and the implications for Gen Z and Y students within comparative case studies including, but not limited to, WRL, WPL, WBL, Chartered Management Degree Apprenticeships (CMDA), Advanced Practice, Internships, HDAs, Placements, and Projects;
3. Critically analyse WIL and educational themes among Gen Z and Y students as case studies including, but not limited to, Citizenship, Widening Participation, Teaching and Learning, Continuing Professional Development and Corporate Social Responsibility;
4. Critically compare WIL Innovation among Gen Z and Y students as case studies including, but not limited to, WIL in entrepreneurship, WIL research and publications and WIL and national and worldwide organisations.

The target audience of this book will be composed primarily of academics within Higher Education; students engaged in WIL; lecturers in the VET sector; staff within teaching and learning, career development departments and Human Resources Management departments, and other practitioners related to the general field. Other audiences also include policy makers and politicians, employers of Gen Z and Y, and industry consultants.

This book is divided into four themes, each providing a study, investigation and analysis into WIL, its relationship to the Gen Y and Gen Z populations, its local, national and global impacts, and the potential for further exploration.

Section 1: Educational Concepts and Theories Related to WIL, Gen Y and Z Students

Beyond Discipline-Based Work-Integrated Learning Placements in Engineering and Science

This opening chapter explores how WIL has influenced STEM education to enhance academic performance, employability skills and prospects which best prepares Gen Z graduates. The chapter provides a focus on how this looks in Australia, where two STEM disciplines - engineering and science - have the largest numbers of graduates and makes a case for a broader conception of WIL in STEM. STEM has been an explicit strategy to enhance more advanced skilled labour forces.

Putting Industry Into WIL Teaching Praxis Engaging Creative Industries for Lifelong Employability

A longitudinal study within Australian Higher Education (HE) and industry provides the backdrop to this chapter, which identifies Gen Z students from multiple academic disciplines to carefully assess the disciplinary skills acquired. This is a collaborative approach with industry and academic practitioners which has developed this approach into a marketable asset for employability. Here, the author identifies a gap which connects the HE curriculum to graduate outcomes, the chapter therefore identifies WIL as the instrument to bridge that gap.

The Acquisition of Skills and Expertise: Work-Based Learning

Equipping Gen Y and Z individuals with the skills and expertise needed to be able to respond to the changing demands of the workforce is investigated in this chapter, recognising that this needs to be done within an environment which is challenged with the decreasing amount of time spent in the formal learning environment, and suggests a new model for consideration by those responsible for curriculum design and delivery.

Exploring Learning Preferences of Gen Z Employments: A Conceptual Analysis

A conceptual approach to understanding the learning styles and preferences of the Gen Z workforce is offered within this chapter. With a focus on technologically-driven approaches in the learning and workplace environments, the chapter explores the implications for this approach, particularly within Covid-19 pandemic, and identifies technology-enabled learning, gamification, knowledge sharing, feedback, peer-to-peer mentoring, personalised learning and collaboration as tools to support Gen Z learners. The chapter demonstrates the wider application of WIL within a more Human Resource Management WPL approach.

Section 2: Exploring the Types of WIL and the Implications for Gen Z and Y Students

A Critical Analysis of Multi-Logical Synergies

This chapter illuminates the generational challenges facing Gen Y and Z in preparing for the labour force and their appropriate fit within industries in a landscape facing constant and often rapid change. The author suggests the skills in being able to negotiate this volatile labour market are necessary and identifies leadership and ethics as two elements that will play a major role in managing this transition. The chapter also includes auto/biographical reflections on the process of WIL by the students and supervisor.

Designing Work-Based Learning Approaches for Gen Y, Gen Z, and Beyond

Work-based pedagogies can be used to address the challenges of planning degree apprenticeships for Gen Y and Gen Z asserts this chapter. The case study addresses the vital impact that degree apprenticeships have in ensuring assessments remain relevant in and out of the academy, responding to the changing context of the workplace by effectively using a degree apprenticeship model, located in the Business School of the institution, current learning resources, and the student voice.

Entrepreneurial Work-Integrated Learning

Entrepreneurial work-integrated learning (EWIL), a pedagogy developed by the University of Toronto, features in this chapter and is used to analyse a specific modality of WIL. This case study discusses the institution's engagement of students with entrepreneurial activities to develop their knowledge of entrepreneurship, and challenges presented with adapting this new pedagogic approach.

Preparing Gen Y and Z for the Future of Work Through Cooperative Education

This chapter examines a model of work-integrated learning at the University of Waterloo, Canada, and explores how, through its co-operative education program, their approach supported students' success in the future of work by using activities such as a competitive employment process and professional development courses, which included learning and reflection for workplace success and a peer support model as just two of its guiding principles.

Section 3: WIL and Educational Themes Among Gen Y and Z Students

From Graduate to Employee: The Birth of the Fully-Fledged Lecturer – A Case Study of the Teaching Fellows Programme

Framed within WBL philosophy, this chapter uses the case study of a uniquely different UK teacher training programme, the *Teaching Fellows Programme*, which provided Gen Y and Gen Z graduates with an understanding of the institution, its strategy, its environment, and its stakeholders. Reflective practice, mentorship and a Community of Practice featured heavily in the graduates' development of professional and personal skills, with the chapter also highlighting a number of insights experienced by each of the Teaching Fellows, contributing to the development of their capacity to investigate problems, make judgments on the basis of sound evidence, taking decisions on a rational basis, and understanding what they were doing and why it was vital. So began the journey leading to the 'birth of the fully-fledged lecturer'.

Practice and Perspectives of First Year WIL Activities: A Case Study

This chapter examines the first-year experiences of undergraduate students, their transition into the world of work, often, as underprepared individuals. Through personal experience and underpinning research, along with a case study approach of students on a pre-service trainee teachers on the first year of their degree programme, the author asserts that by engaging them with practice-based, authentic activities within the curriculum, this therefore supports the preparedness of Gen Z students for the workplace. With a focus on Australian higher education, the responsibility for this is firmly placed in the laps of those who design the first-year curriculum.

Examining Feedback Practices in WIL Subjects

Gen Z, recognised as the 'internet generation' represents a significant student sector moving through education into the eventual workplace. This chapter takes a case study approach within Australia's University of Wollongong, and examines at the perceptions of pre-service teachers, in ensuring the curriculum is fit for purpose, and how the feedback process can impact its design.

Section 4: WIL and Innovation Among Gen Y and Gen Z Students

Developing Gen Y Competencies for the New Work Environment: Comparing and Contrasting Four Work-Integrated Learning Approaches Across National Contexts

Integrating the curricula with workplace learning is the focus of this chapter. It highlights a number of strategies and perspectives of WIL through the use of a number of case studies in Cyprus, Italy, France and the United States. This analyses the impact and benefits on Gen Y's learning experiences, competency development and effectiveness for employability. Academic reflection also supports the findings.

Global Calls to Action for Work-Integrated Education: The WACE Charter and Applications for Gen X and Gen Y

This chapter identifies challenges within the workplace and calls for a recognition of work-integrated learning programmes world-wide, to recognise their unique potential for bridging academia and the world of work. Through the implementation of a Charter, the chapter proposes international work integrated placements, providing employees and students with opportunities to develop intercultural understandings and contributions.

THE DEFINITION OF WIL FOR THIS BOOK

Most of the authors express an understanding of WIL as an umbrella term for any learning that integrates a real work experience as part of that learning. In most cases this involves Higher Education. One chapter makes the distinction between learning for work (future employment), in work (in work seeking upskilling) and about work (short to medium experiences of work that are not permanent). This publication therefore views WIL as an umbrella term to predominately describe learning in a Higher Educational context which integrates the world of work in order to apply theory in practice and inform the shaping of the professional.

UNDERSTANDING GEN Y AND Z AS A CONCEPT

It is clear that generational studies have their critics and that there is some disagreement about the demarcations of these classified generations. This book will use the theory and classification found more generally accepted by Strauss and Howe who define the Millennial Generation (GenY) as those born from 1982 to 2004 and the Homeland Generation (GenZ) as those born from 2005 to present.

In many ways, the UK (the home nation of both editors) in particular continues to face the same challenges as before, now only enhanced by the pandemic and potential Brexit outfall, namely the young, old, vulnerable and economically deprived. Adult education and the philosophy of lifelong learning has an extensive history of employing pedagogy which addresses widening access to education, providing employability skills development through work integrated and work-based learning models and strategies, and empowering learners to achieve their aspirations (Gerhardt, 2019; Osho, 2018). Changes, due to the pandemic, may actually have provided Higher Education with the solutions already. Adult learners, according to the Digital Marketing Institute (2018) prefer online courses used for career advancement, re-entry to work or career change; micro-learning, where there can be instant application, and experiential learning pedagogy, which allows skills transference to real-life workplace experiences.

Measures under national lockdown have already imposed online teaching on many universities and, with that, a re-imagining of the delivery of their pedagogy. However, this creates new challenges for the effective application of WIL. The continuation of these innovations may just be a solution for many unemployed looking to upskills and re-enter the labour market.

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Chapter 2
Beyond Discipline-Based Work-Integrated Learning Placements in Engineering and Science

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ABSTRACT

Drawing on the work-integrated learning (WIL) literature, particularly that which is STEM-related (science, technology, engineering, and mathematics), and on the Australian census data, it was found that many Australian engineering and science graduates from Generation Y (and prior) work outside of their fields of study, and that many of them will have had to if they wished to work at all. For Generation Z (and beyond) students, it is proposed that a broader conception of WIL in science and engineering is needed if they are going to be adequately prepared for post-graduation employment. This chapter details a program example of how an out of field WIL placement, offered as an elective unit, can be implemented for engineering, science (and other contexts) without requiring major changes to existing curricula. This chapter also contributes to the very limited existing literature on out-of-field WIL.

INTRODUCTION

It is largely an article of faith that work-integrated learning (WIL) offers a range of benefits to STEM (science, technology, engineering and mathematics) students, including enhanced academic performance, improved graduate employability, and increased likelihood of employment (Artess et al., 2017; Surridge, 2009; Wilton, 2012). Similarly, there are many examples in the literature offering advice on how to address the supposed particular needs of different generation cohorts (X, Y, Z, etc.) of students in higher education, including in relation to WIL activities (Pilgrim, 2011; Rothman & Sisman, 2016; Visser et al., 2017). This chapter is not an assessment of the fundamental value and purpose of WIL in

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STEM education, nor is it a critique of the concept of generations; both of these things can be found elsewhere in the research literature.

Instead, in this chapter, a pragmatic approach is taken as to how WIL can best prepare students from generation Z for the world of work. The focus is on the two STEM disciplines in Australia with the largest numbers of graduates – engineering and science. Recent national and international investigations relating to WIL in STEM are considered and the importance of WIL in engineering and science education is acknowledged. The evidence regarding where generation Y bachelor graduates from these programs actually work is examined. The Australian national census, which includes information about the educational qualifications and occupation for virtually the entire population provides a key reference point in this regard. Understanding this offers valuable insights for those with a responsibility for aspects of university curriculum design, including the purpose and place of WIL in STEM field study programs for those generation Z students currently at university, or who will arrive to study in the next decade.

Responding to the finding that many Australian engineering and science graduates work out of the discipline that they studied, this chapter makes the case for a broader conception of WIL in STEM that encompasses out of field WIL placements as inherently valuable. This chapter presents the details of one possible model for how an out of field WIL placement, offered as an elective unit, can be implemented for engineering, science (and other contexts), without requiring major changes to existing curricula. The description includes details of the rationale, implementation, assessment and student take-up of the out of field WIL placement option. Participation in WIL is a significant undertaking for all parties involved – students, industry and universities. This chapter also proposes methods for the evaluation of the contribution of WIL to both student employability and graduate employment. Additionally, as this chapter looks forward to the career prospects of generation Z students currently at or approaching university study, some consideration is given to emerging issues related to WIL.

The central aim of this chapter is a critical reconsideration of the WIL types that STEM programs traditionally endorse, for the purpose of suggesting a revision of the conception that traditional, discipline-specific placement-based WIL experiences are the only viable and valuable theory-to-practice model of work-integrated learning valued in engineering and science education. Finally, at the time of writing, it is impossible to ignore the context of the Covid-19 pandemic in matters relating to higher education. Many aspects of university education have been transformed almost overnight. The practicalities, and even possibilities, of different forms of learning and teaching have been crystallised through necessity, including WIL. The circumstances of Covid-19 add an urgency to the need to reconsider the perception of what counts when it comes to WIL placements.

THE IMPORTANCE OF WIL IN ENGINEERING AND SCIENCE

Graduate employability is now a key strategic concern for universities in many countries, and particularly in Australia (Collis, 2010; Johnson et al., 2019; Rayner & Papakonstantinou, 2015). Employability is defined in a multitude of ways (Mason et al., 2003), with many common definitions featuring a set of skills that will enhance the labour market success of graduates, e.g., "A set of achievements – skills, understandings and personal attributes – that make individuals more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy" (Yorke & Knight, 2006, p.3). Smith (2016) notes the emergence of the concept of graduate employability from the graduate attributes agenda that held sway in Australian higher education from the 1990s, and that WIL has become the mechanism of preference for producing graduates who are 'employment ready'. A work placement in industry is seen as a way for students to envision a potential future career (Rothman & Sisman, 2016), and as a means for students to demonstrate their capabilities and build their professional network (Ferns et al., 2014). In STEM, WIL is often framed as an opportunity for students to apply discipline-specific knowledge in a workplace context (Rayner & Papakonstantinou, 2015), and it is widely held that STEM students who complete WIL achieve better employment outcomes (Prinsley & Baranyai, 2015).

In Australia, there have been several recent national investigations into different aspects of WIL in STEM. In a Federal Office of Learning and Teaching-funded project designed to improve access to WIL for students in science and mathematics, Johnson et al. (2019) observed that WIL is acknowledged in Australia as a crucial pathway for improving graduate employability, and the need for its widespread adoption is accepted by university and business leaders. In a consultation undertaken by the National Centre for Vocational Education Research to investigate employer perspectives on WIL in STEM disciplines, Atkinson et al. (2015) identified a range of possible benefits to STEM students from participation in WIL. They suggested that WIL improves a set of what they refer to as generic and employability skills, including communication, teamwork, problem-solving, self-management, technology, lifelong learning, initiative and entrepreneurship, numeracy, professional behaviour, and information literacy. They also suggested that WIL provides academic, personal, career and skills development. In a report on WIL in STEM in Australian universities commissioned by the Office of the Chief Scientist, Edwards et al. (2015) concluded that WIL is an effective means for preparing university students for active participation in the workforce on completion of their studies.

In Australia, the treatment of WIL across STEM disciplines has varied significantly (Atkinson et al., 2015; Johnson et al., 2019). Entry to the engineering profession is governed by the accreditation body Engineers Australia which requires that qualifying programs of study expose students to the equivalent of 12 weeks of professional practice. This exposure generally incorporates some form of industry placement; all Australian university engineering programs have adopted this requirement as a prerequisite for graduation (Edwards et al., 2015). Historically, this 12-week placement would be organised by the student, be completed over a summer break, be assessed without credit on a pass-fail basis, and would have limited connection to the formal engineering curriculum. In comparison to engineering, there are typically no profession-related requirements for science students to participate in WIL as part of their studies, so the presence of WIL in science programs has been more variable. Those science WIL opportunities linked to the curriculum that have existed have tended to be in the form of elective units of study, leading to comparatively low student take-up (Edwards et al., 2015). Many science WIL opportunities have also been primarily research-related in nature (Atkinson et al., 2015).

The treatment of placement WIL in engineering in Australia is changing. It is now common to find the 12-week professional practice requirement carrying program credit and/or links to the curriculum (Atkinson et al., 2015; Edwards et al., 2015). Another mandatory feature of all Australian engineering qualifying programs is the inclusion of a substantial capstone project. There are examples of programs that permit this major project to be industry-based (with joint academic and industrial supervision) and to satisfy the professional practice requirement for the program (Edwards et al., 2015). While industry placements in science programs have historically been available on a more ad-hoc basis than engineering, the treatment of WIL in science in Australia is also changing. The Australian Council of Deans of Science commissioned a national investigation into model WIL practices in science (Johnson et al., 2019), from which a range of public online resources were developed[1]. It has been observed that science (and other

STEM disciplines) can potentially learn from the more systematic embedding of WIL in the curriculum that can be found in engineering in Australia (Edwards et al., 2015). The Australian Chief Scientist has previously called for every STEM program to maximise the opportunities for industry placements or projects for academic credit (Prinsley & Baranyai, 2015). Beyond professional and other disciplinary requirements for WIL, it is available to universities to simply make WIL an institutional priority, and to commit the resources required to support appropriate student WIL experiences (Johnson et al., 2019).

While WIL can take many forms, the starting point used in this chapter is placement WIL – where a student undertakes an experience in a workplace setting, for an extended period, with structured assessment linked to their study curriculum, and for program credit. Of course, if the opportunities for student WIL in higher education are to be expanded, the issue arises as to how and where additional appropriate placement opportunities will be found (Peach & Gamble, 2011). Previous sector and discipline investigations have cited these questions as reasons for caution regarding the expansion of WIL programs (Webb et al., 2017). In national investigations into WIL in STEM education in Australian, both educators (Edwards et al., 2015) and students (Johnson et al., 2019) have also articulated these concerns. A number of Australian universities now use commercial intermediaries to facilitate WIL placements for students (Sachs et al., 2016), including in STEM disciplines (Edwards et al., 2015). Unless the number of appropriate WIL placement opportunities increases proportionately, then movements to increase the number of students completing one or more placements means that there is essentially a zero-sum competition for placements between students within and across institutions and disciplines.

THE UTILITY OF THE GENERATIONAL LENS

Hooley (2019) notes that much of the debate about the changing world of work, including in relation to specific generational cohorts, has been fuelled by a body of grey literature (policy and research reports from think tanks, consultants, technology companies and recruiters, blogs of commentators, etc.), of which individual items have limited lasting impact, but collectively have led to discussions about the future of work, young people, students and education. There is literature to be found that addresses higher education and WIL in the context of generational cohorts. Chicca and Shellenbarger (2018) canvas an array of literature to identify the "generational influences and distinctive characteristics" of generation Z nursing students and propose a range of specific educational strategies to support this student group in higher education. Similarly, Schwieger and Ladwig (2018) draw on many sources to propose an extensive list of the characteristics of generation Z, as well as employer expectations for this employee group, and they use these to synthesise recommendations to aid higher education in attracting and preparing these students for their future careers.

More specifically relating to WIL, Rothman and Sisman (2016) propose that internships are critical for generation Y business students to help them clarify their possible job interests, to gain a realistic understanding of employer expectations, and to reflect on their personal fit for a particular job or industry. Visser et al. (2017) suggest that generation Y employees are perceived by employers as "high maintenance and difficult to manage". They conclude that organisations should develop an integrated talent management strategy that includes WIL as a key mechanism for developing desirable attributes in students such that they become graduates with the potential for a long-term, sustainable career in industry. Pilgrim (2011) reports on a session from the inaugural Australian Council of Deans of ICT Learning and Teaching Network Forum that was dedicated to WIL in Information and Communication

Technology (ICT) degrees. In the session, generation Y students, now at universities, were purported to be cynical of what they are told by older generations, to reject continual employment, to display different approaches to learning, to have a strong preference for flexible learning, and to value learning that occurs outside of the classroom.

As observed by Hooley (2019), in this investigation it was also found that the literature above regarding 'generations' in higher education often relies substantially on non-peer-reviewed, and often self-published, grey literature as the justification for the existence of differences in characteristics that delineate the generations. Treuren and Anderson (2010) undertook a review of both the popular and academic literature regarding generations and found much of it to be weakly conceptualised and uncritical. They also conducted a survey of students at their university, where enrolment spanned a wide range of student ages, and found no significant differences in expectations of future employment conditions between generation Y students and those of prior generations. Rudolph and Zacher (2020) note the difficulty of disambiguating conceptions of generation cohorts from age characteristics and the influence of events and other factors that were or are contemporaneous with a specific time period.

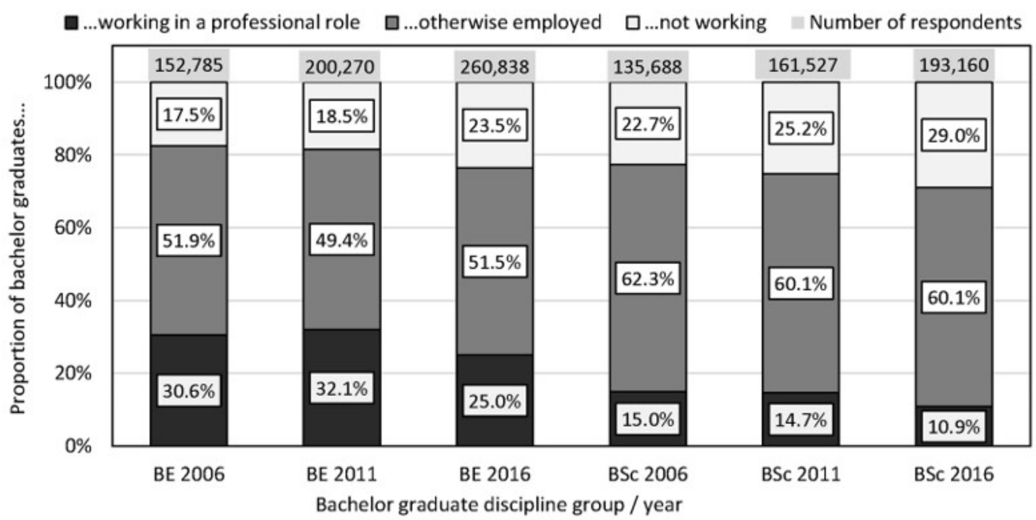
Ultimately, rather than getting bogged down in contested and potentially stereotyping characterisations of generation Y and Z, in this chapter these demographic constructs are pragmatically and usefully employed to identify cohorts of students based on age, and to consider the prima facie implications arising from that for graduate occupational outcomes and WIL opportunities for engineering and science bachelor students in Australia. While there may not be universal agreement regarding the year boundaries between the generations, the precise delineation has little impact on the investigation presented here. The commonly held starting points of approximately 1981 for generation Y - sometimes referred to as 'Millennials' - (U.S. Bureau of Labor Statistics, 2018) and 1997 for generation Z (Pew Research Center, 2019) were adopted here. Accepting those temporal divisions, or something similar, means that generation Y are that group who have now almost all graduated from university, with many having been in the workforce for a decade or more, and, generation Z are that group that might currently be of university age, although for the majority of them higher education is still in the future at the time of writing. This view of generational cohorts provides a valuable and generative lens for structuring an investigation into the occupational outcomes for Australian university graduates in the previous decade, and using that to inform consideration of how to effectively prepare current university students for the best occupational outcomes in the next decade.

OCCUPATIONAL OUTCOMES FOR ENGINEERING AND SCIENCE GRADUATES IN AUSTRALIA

Case studies investigating STEM graduate occupational outcomes drawing on national census data can be found (Healy et al., 2013; Trevelyan & Tilli, 2010). Here, previously developed methods to use the Australian Bureau of Statistics (ABS) census data to understand where Bachelor of Engineering (BE) (Palmer et al., 2015) and bachelor of science (BSc) (Palmer et al., 2018) graduates work in Australia are extended. Using the ABS census online TableBuilder service (Australian Bureau of Statistics, 2020) it is possible to access the publicly available data from the 2006, 2011 and 2016 Australian national censuses. The census data include the highest qualification by field of education, and the occupation (including not working), reported by respondents. The TableBuilder census data contain 477 separate occupational categories, 12 of which are clearly associated with professional engineering (PE) roles.

While science is not strictly a profession, there are ten census occupational categories related to 'professional' science (PSc) practice (i.e., titled 'scientist' or similar). Figure 1 shows, for each of the three census data sets, the total number of respondents reporting holding a BE or BSc qualification, and, the proportions of those respondents working in a professional role associated with their study discipline, working in another role and not working.

Figure 1. Occupational outcomes for BE and BSc graduates in 2006, 2011 and 2016

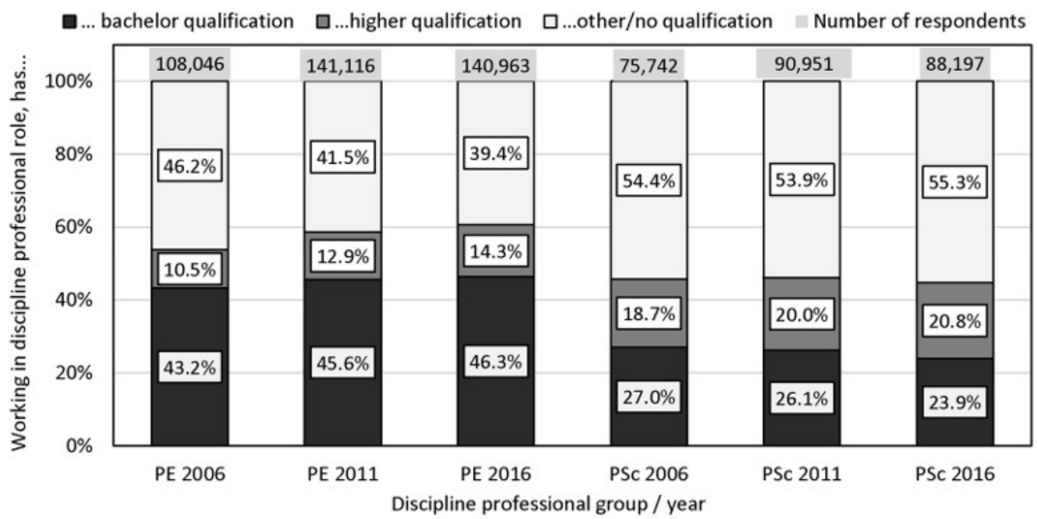


Note that the census data reported here include all bachelor graduates, not just recent graduates. The presence of significant numbers of new graduates can be inferred by the increases in numbers of respondents between 2006 and 2016 – a growth of nearly 110,000 for BE graduates and nearly 60,000 for BSc graduates. For both BE and BSc, the proportions of graduates working in professional roles associated with their study discipline ('in the field') were comparatively low, but held constant between 2006 and 2011, and then declined significantly by 2016. The decline in 2016 was matched by an increase in the proportions of graduates not working. For both BE and BSc, the proportions of graduates working out of field are significantly higher than the proportions working in their respective professional fields.

It is possible to look for other sources of data to triangulate with the census data presented above. In a survey of Australian university graduates with more than 9200 respondents, Coates and Edwards (2009) investigated experiences of graduates in the five years following graduation. They found that graduates from certain fields, including engineering and science, were more likely to be working across a range of industries/fields. Using Australian census data, Trevelyan and Tilli (2010) found that across the period 2001-2006, about half of all bachelor or higher engineering graduates aged 25-55 years were not working in engineering-related jobs. Based on a sample of 805 Australians claiming a background in science, Harris (2012) found science graduates were working in a diversity of occupations. Recent analysis of Australian higher education outcomes concluded that Australia is oversupplied with science bachelor graduates, and that this is in part driven by lack of access to more highly sought-after degrees as students enrol in 'second preference' study programs (Norton & Cakitaki, 2016).

As a complement to the data on which occupations BE and BSc graduates work in, it is possible to look at who works in PE and PSc occupations, and to see what highest qualification they reported. Figure 2 shows, for each of the three census data sets, the total number of respondents reporting working a PE or PSc role, and, the proportions of those respondents holding a discipline bachelor's degree, a higher degree in the same field, and any other qualification (including no qualification).

Figure 2. Qualifications of PE and PSc job holders in 2006, 2011 and 2016



The numbers of respondents reported here are effectively a measure of the size of the Australian PE and PSc workforces. While the PE and PSc workforces expanded significantly between 2006 and 2011, both were essentially static in size between 2011 and 2016. For both BE and BSc graduates, there is significant competition for PE and PSc job roles from both those with higher degrees in the same field, and from those with out of field qualifications (including no qualification).

The Australian census graduate outcomes data reveal an important reality for engineering and science graduates. Over the last decade, employment in those disciplines has declined. Graduates in work are also less likely to work in the discipline area that they studied. It is not merely that the production of 'better' graduate engineers and scientists is required. The census data also show that there are significantly fewer professional job roles available than there are qualified graduates. Many generation Y engineering and science graduates have had to work outside of their discipline if they have wished to work at all (Palmer et al., 2018; Palmer et al., 2015), and it seems likely that the future engineering and science graduates of generation Z will face similar circumstances.

A PROPOSAL FOR A BROADER CONCEPTION OF WIL FOR ENGINEERING AND SCIENCE

There have long been calls for undergraduate education to strike a better balance between discipline-specific knowledge and generic skills that employers often report as deficient in graduates (Rayner &

Papakonstantinou, 2015). A contemporary view of employability development argues for the need to move beyond employer-driven lists of skills and models of vertical career progression, to consideration of preparing graduates for horizontal career movement, uncertainty and adaptability (Rowe & Zegwaard, 2017). WIL is traditionally framed as an opportunity for students to apply discipline-specific knowledge in a workplace context (Rayner & Papakonstantinou, 2015) – "… a nexus between canonical knowledge of the discipline and the activities constitutive of professional/workplace practice" (Smith, 2016, p. 346). It has also been argued that WIL offers a context in which to learn and practice generic skills that can enhance graduate employability (Peach & Gamble, 2011; Sachs et al., 2016).

Engineering and Science have traditionally responded to the balance of discipline-specific and generic skill content across a program somewhat differently. It has been suggested that a modern science program has much in common with 'generic' degrees such as a Bachelor of Arts (Edwards et al., 2015). Science is, "… a generalist degree which provides core competencies that employers can use as a base for training graduates in more specific technical and industry specific skills" (Coates & Edwards, 2009, p. 69). In the UK, Atkinson and Pennington (2012) noted the emerging view that not all students studying STEM intend to work in STEM, and their advice to university engineering programs from employers included "Developing curricula to better reflect the realities of an engineering career" (p 13). In STEM, in Australia, this thinking has driven new ideas.

A large investigation of UK STEM graduates and employers, Mellors-Bourne et al. (2011) found that only half of all final-year STEM students 'definitely' wanted a career in their study area, and that many STEM students were not presuming a long-term STEM career. A survey of Australian science students found differing views on the preference for their curriculum experiences (placements) that prepare for work-readiness and their careers – some students wanted the opportunity to develop discipline-specific technical skills, while others were open to broader placement experiences (Jorre de St Jorre et al., 2019). In Australia, the proportions of graduates working in and out of the field revealed by the census data above indicate that many BE graduates are also using their undergraduate qualifications in many types of careers. A survey of Australian engineering graduates found that many of them were equivocal about staying in engineering in the medium to long-term, with nearly half of the respondents seeing themselves remaining in engineering for less than ten years (Department of Education Employment and Workplace Relations, 2009). These surveys and other data indicate that a broader conception of WIL in STEM would accommodate not just a range of student placement objectives, but also broader graduate destinations without the associated stigma of working out of field being a sub-optimal outcome.

It has been observed that science education makes a broad contribution to Australian society, regardless of where science graduates work (Harris, 2012). There are significant personal and social benefits in having a science literate population. The finding that many science graduates work outside of science, "…empower[s] university science to set a broader goal for science education, beyond discipline specialties and technicalities" (Harris, 2012, p. vii). An Australian government investigation into labour market outcomes for engineering graduates found that the majority of graduates employed in occupations other than engineering in Australia in 2008 were working in highly skilled occupations, and that engineering graduates working out of field still had the potential to deliver a range of benefits to the Australian society and economy (Department of Education Employment and Workplace Relations, 2009).

The actual occupational outcomes for Australian engineering and science graduates, as revealed by the census, suggest that an undergraduate curriculum that is representative of life and work is one that deliberately addresses graduate employment outcomes beyond the profession in its: philosophy; learning outcomes; learning designs; program content; assessment; and, its career education, including WIL.

There is no doubt that WIL can be a setting for the development and application of discipline-specific knowledge in a workplace context, and there is also evidence that students place a higher value on the development of discipline-specific technical skills (Billett & Henderson, 2011). However, going forward, for the current students and future graduates of generation Z, a broader conception of WIL in engineering and science is required.

WIL is known for having a range of purposes and forms. It can include the development of occupational-specific capacities, as well as assist graduates to engage both within and beyond their chosen occupation (Collis, 2010; Greenbank, 2002; Peach & Gamble, 2011). The available research literature on out of field WIL is extremely limited – where out of field WIL is mentioned, it is often noted only incidentally in passing. While rare, alternatives to strict discipline-based WIL placements can be found described in the literature (Anderson et al., 1992), including through the mechanism of cross- and trans-disciplinary WIL projects (Sachs & Clark, 2017). As with any WIL placement, supervision remains important, and out of field placement supervision needs to be carefully managed (Greenbank, 2002; Robinson, 2016). Out of field WIL activities may offer unique benefits to students, such as developing an enhanced sense of social and civic responsibility (Sachs et al., 2016). For students intending to work in sectors less likely to offer traditional, linear career paths (i.e., the creative industries), it is important for WIL programs to reflect, and to prepare students for, this likely employment future (Collis, 2010).

Given the graduate occupational outcomes of the last decade revealed by the census data, if WIL placements for engineering and science students are intended to be accurate representations of graduate practice, then they need to encompass options for contexts beyond only engineering and science workplaces. Setting aside philosophical views about the appropriate form and content of WIL in relation to the discipline, even if there is a willingness to countenance out of field WIL placements, achieving this in practice may be difficult where discipline-based forms of WIL already hold a place in the mandated core curriculum of a program.

A NEW MODEL FOR STEM WIL AT DEAKIN UNIVERSITY

The model most recognised in WIL for real-world, highly proximal/authentic WIL experiences (Kaider et al., 2017) – placement WIL – was adapted by the Faculty of Science, Engineering and Built Environment (SEBE) at Deakin University in Australia, via a broadening of the traditional perspective. They focused on employability-readiness preparation for the next generation's post-graduate prospective employment choices, rather than course domain-to-field readiness. They relaxed the rule that placements had to be undertaken in-field for theory-to-practice learning. They also enabled a student's current part-time work to be counted as an industry placement activity (providing they could provide evidence of a new trial role or new areas of responsibility). This work represents industry/community placement activity that is largely currently excluded in WIL in higher education. A summary of the rationale, implementation, assessment re-design and student enrolment numbers for the Faculty elective WIL units are presented below.

Rationale

Influenced by the literature on employability the researchers developed a program to enhance the next generation's employability for work-readiness with a sharp focus on the application and practice of transferable skills in real-world work contexts. The rationale was grounded by the notion that employability is the ability for a student to, "discern, acquire, adapt and continually enhance the skills, understandings and personal attributes that make them more likely to find and create meaningful paid and unpaid work that benefits themselves, the workforce, the community and the economy." (Oliver, 2015, p. 59)

Implementation

The novel approach was implemented via the provision of elective for-credit WIL units of study. It is important to note that the STP ('STP' derives from the Faculty policy of systematically naming units of study with a three character plus three number identifier) placement units are not the primary mechanism for most students to complete the WIL requirements of their program. Most SEBE students enrolling in an STP placement unit have already completed a mandatory discipline-based WIL placement unit and are choosing to complete an additional placement unit as an elective to expand their exposure to WIL, including out of field WIL, for credit.

In 2006, the Faculty commenced offering for-credit elective WIL units for SEBE students (study plan permitting). The intention was to 'fill the gap' for program curricula that, at that time, did not provide placement-based WIL opportunities. Since then, the suite of SEBE WIL units has evolved to meet the changing needs of the Faculty, Schools, and students, as well as the employers offering placements. In recent years, as the four Schools within SEBE have introduced a compulsory for-credit discipline-based placement-based WIL unit in almost all undergraduate programs, the SEBE elective WIL unit offering has consolidated into two elective placement units and a compulsory preparatory unit:

- **STP301 Industry Based Learning** (elective unit) – a 6–12 week WIL placement that allows students to develop their knowledge and skills of the discipline in a discipline-specific workplace to enhance their employability;
- **STP341 Career Placement** (elective unit) – a 112–160 hour pre-professional WIL placement that allows students to prepare for their portfolio careers and apply transferable skills in a broad range of workplaces to enhance their employability (Deakin University, 2019); and,
- **STP010 Career Tools for Employability** (core unit) – a 6–8 hour zero-credit point foundation career education unit that allows students to develop their career awareness in relation to the context of their program (Young et al., in print).

Students wishing to complete an elective WIL placement can enrol in STP301 up to three times as a repeatable unit for longer-term paid placements in the area of study, or they can enrol in STP341 if the placement is out of field.

Assessment Re-design

The learning outcomes for STP341 do not require students to report on discipline-specific knowledge and/or skills. Instead, the outcomes align with transferable skills (such as communication, teamwork, problem-solving, etc.) via the Deakin University Graduate Outcomes framework. Students explore and test their current professional capacity via critical reflections upon their in-employment practices. They engage in an ongoing self-critique of their values, attitudes, identity, knowledge, skills and workplace performance to gain a holistic view of their employability. The meta-cognitive connection between learning, developing capacity and work-place performance is reinforced through the following suite of inter-connected assessments: placement goals; weekly work logs; a mid and end of placement self and industry supervisor performance evaluation, a placement outcomes industry presentation, a thank you letter to their employer, and finally, an employability skills reflection. The suite enables an individual student-centric iterative gathering of evidence related to enlivening students' meta-cognition of their distinct understanding of their current and future employability. The researchers encourage different modes of reflective practice, resulting in fit-for-purpose outputs (i.e., drafts of meeting notes, curated written reflections, audio recordings, videos, selection criteria responses and prompted template responses).

Critical to the commencement of the meta-cognitive journey is the first assessment - the placement goals. It provides a timely mechanism (just before, and on the first few days of placement) for each student to formalise their objectives for the entire experience (the placement and the unit). Students are guided to include their personal goals aligned to a negotiated set of organisational and, if applicable, project-specific goals, all of which must be specific, measurable, achievable, realistic and timely (SMART). Work logs then function to record work-task completions and must include curated reflections on learning related to tracked progress. The principle of connecting learning and performance is revisited via the mid and end of placement industry evaluations, and the end of placement presentation (whereby the student presents, to their industry supervisor and team (if applicable), their learning milestones, challenges, successes and impact. To consolidate the student's professional capacity, the final assessment – the employability skills reflection – requires a review of job advertisements and the submission of selection criteria responses. Here the student reflects on their developing employability skills applied to real world contexts (i.e., their placement) as practice for applying for future employment opportunities.

Academic feedback is provided on all assessments, but where possible, industry feedback is also encouraged. An instance of compulsory industry feedback occurs when the industry supervisor is tasked with providing critical performance feedback to the student based on benchmarked industry expectations. Here indications as to whether they are operating to an acceptable pre-graduate (or higher) level are provided. Feedback is enriched when it is provided by industry and academe. For example, with the goal assessment, the first submission is a draft set of goals requiring formative feedback from both industry and the academic mentor. It is refined and re-submitted as a final set of revised placement goals for summative assessment. Including industry in the assessment design provides a valuable element of authenticity around student work-readiness which is fundamental in a unit geared to enhancing student employability. The principle of co-created curricula is extended via a hurdle assessment (a thank you letter) where the student formally acknowledges in a personal way the influence industry has had on their professional capacity building.

An outcome of the novel approach from a faculty-wide curriculum perspective has been the re-vision of assessments across all units within the Faculty. Indeed, the majority of assessment requirements for placement units across the undergraduate programs in all SEBE Schools are now similar in purpose and framing to STP301 and STP341. The Faculty-wide approach to placement-based WIL assessment has been shared with the Schools (Young et al., 2019; Young et al., 2017), and as a result the WIL placement assessments show variances in output based on placement experiences more so than program-specific contexts. The value of both the STP301 and STP341 elective units within a study program for a student is the provision of endorsed opportunities for multiple placements that support STEM-based as well as more general WIL outcomes.

Student Enrolment Numbers

The unit STP010 is designated as a career development learning unit, as distinct to a 'just-in-time' induction and on-boarding preparation for industry placement. There are, on average, approximately 2500 students per year enrolled in STP010, indicating the reach of enrolment in STEM placement-based activity in the Faculty for undergraduate programs.

In 2018, 102 SEBE students completed one of the placement STP WIL units. While most enrolments were in STP301, 20 (19.6% of STP enrolments) were in out of field WIL placements via STP341, indicating a student demand for a broader conception of WIL in STEM. Interestingly, an additional 15 enrolments in 2018 in STP341 came from outside of SEBE across the wider university, indicating that there is also demand from students beyond STEM for a more flexible for-credit placement WIL offering. In 2019, 27.3% of STP unit enrolments were in out of field WIL placements. Given that many Bachelor of Information Technology students take STP301 in place of a mandatory IT-specific program WIL unit, the actual proportion of STP unit enrolments taken as an elective out of field WIL placement is effectively higher than the headline percentages reported above.

Implications

It is anticipated that this broader approach will ensure that the diversity of preparation required for exposing and orientating students to multiple employment pathways will increase the prospects of generation Z students (and beyond) to secure various graduate-level versions of meaningful paid and unpaid work.

EVALUATING THE IMPACT OF WIL IN ENGINEERING AND SCIENCE EDUCATION

Many benefits are attributed to WIL, and there is currently significant competitive marketing pressure to incorporate WIL activities into university study programs. Given the effort and cost of participation in WIL – for institutions, students and industry – it is important for institutions to conduct their own evaluations of the impact of WIL (Rowe & Zegwaard, 2017), and to understand their own local objectives, conditions and contexts in relation to WIL (Tanaka & Carlson, 2012). The activities and stakeholders involved in implementing WIL are many, and evaluation should consider processes as well as outcomes (Rowe et al., 2018).

Although it is a contested concept (Artess et al., 2017; Bridgstock, 2009), the development of 'employability' in students arising from the participation in WIL activities during their studies can be considered as a process measure of the effectiveness of WIL. A range of instruments that purport to measure aspects of employability can be found in the literature (Okay-Somerville & Scholarios, 2017; Savickas & Porfeli, 2012; Wright & Frigerio, 2015). In a relevant Australian context, Smith et al. (2014) described the development, piloting and large-scale validation of a 45 item survey that measured six 'employability dimensions' - collaboration, informed decision making, commencement readiness, lifelong learning, professional practice and standards, and integration of theory and practice. Respondents rated their ability/capacity for each item on a five-point response scale. The details they reported show that two of the items in each dimension had particularly high factor loadings, suggesting that an economical version of the original instrument could be constructed using just those two items per dimension.

In keeping with the pragmatism promoted in this chapter, adopting and adapting the pre-existing and validated survey from an Australian context, a parsimonious version of this employability assessment instrument is shown in Table 1.

Table 1. Proposed employability survey instrument

Employability dimension	Response item
Collaboration	1. Interact effectively and respectfully with people from other cultures
	2. Learn from and collaborate with people representing diverse backgrounds or viewpoints
Informed decision making	3. Use information and my professional or workplace knowledge to come to reasonable decisions and then act on these
	4. Weigh up risks, evaluate alternatives, make predictions from data and apply evaluation criteria to options
Lifelong learning	5. Identify the knowledge I lack / need to improve to be effective in the workplace
	6. Identify the skills I lack / need to improve to be effective in the workplace
Professional practice & standards	7. Recognize ethical practice in the workplace
	8. Identify the standards of performance or practice expected in the workplace / my profession
Integration of theory & practice	9. Judge the applicability of the knowledge gained in my studies to the workplace
	10. Apply knowledge and skills gained in my studies to the workplace
Commencement readiness	11. Ready to commence work in your field or discipline
	12. Able to obtain work relevant to your studies

Using this form of the instrument, based on the fact that the reported item pair factor loadings were virtually identical, a score for each of the six employability dimensions could be derived by averaging the scores for its two component items. Also acknowledging the importance of local conditions, an institution employing this or a similarly derived employability instrument should, in the longer-term, conduct its own validation of the survey for potential contextual refinement. While the dimension scores from an employability instrument such as this might be used in a number of ways, an obvious scenario would be to have students complete the survey prior to, and after, their WIL experience(s), and observing any development in the item scores. Additionally, the pre-and-post WIL experience score development could also be compared between cohorts of students who have completed different types of WIL experience, i.e., between those that have undertaken a traditional discipline-based placement, and those that have completed an out of field WIL placement.

The association between participation in WIL and improved graduate employment outcomes is also complicated and contested, with varying results and relationships observed in practice (Brooks & Youngson, 2016; Okay-Somerville & Scholarios, 2017; Wilton, 2012). It is noted that student personal characteristics (Bridgstock, 2009; Divan & McBurney, 2016) and/or external employment market conditions (Artess et al., 2017) may be at least as important as anything that a student does during their studies in determining whether a graduate is successful in the job market. However, in many countries, university graduate employment outcomes are published annually, so for better or worse, graduate employment results, because of the often implied association between participation in WIL activities and enhanced employment prospects, can be considered an outcome measure of the effectiveness of WIL.

In Australia, graduate employment outcomes, based on an annual national survey of students a few months after they complete their studies (the Graduate Outcomes Survey – GOS), are published online for all broad fields of study for all higher education providers[2]. Universities also receive more detailed versions of the survey results that indicate, for their student respondent group, what fraction of their graduates are in full-time or part-time employment, and what occupational categories they are working in. Within institutions, via student identification numbers, the GOS results are also able to be linked to individual student academic records.

In Australia, this data set is already collected and available, has a long history, and is nationally comparable between institutions. Hence, once again, pragmatically, it is recommended that universities use the GOS results as an outcome measure against which they can assess the association between a student's participation in WIL activities and any possible contribution to graduate employment success. Depending on if/how participation in WIL is included in a student's academic record, it may be possible to explore the impact of participation in any WIL activity per se on employment outcomes, or, if the program structure and student academic record details permit, it may be possible to investigate the differential impact of different types of WIL experience on employment outcomes. As noted, individual student characteristics may also contribute to graduate employment outcomes. Many individual demographic items are also available in institutional student records, so, in addition to participation in WIL, it may also be possible to concurrently examine the separate contribution that personal factors (discipline area of study, prior academic performance, age, disability status, etc.) might have on graduate employment outcomes, to better understand the magnitude of any unique contribution of WIL to this outcome measure.

EMERGING DIRECTIONS IN STEM WIL

The concerns over the availability of sufficient industry placements noted above may lead to the consideration of different models of WIL. Recent research in Australian university settings identified a number of emerging alternative WIL models, including:

1. *Micro-placements: short periods in the workplace where students work independently or collaboratively on projects*.
2. *Online projects: involve students and industry working online communicating via digital platforms*.
3. *Hackathons, events and competitions: involve students working in teams on one-off intensive activities where universities partner with organisers of external events*.
4. *Incubators/start-ups: is a workspace that provides mentoring, information, networks, office space and resources for the early-stage development of new business ventures*.
5. *Consulting: involves students (individually or in teams) providing consultancy services and information to fellow students, industry partners and/or community organisations*. (Ferns et al., 2018, p. 46)

Such alternative WIL models pose two main challenges. Firstly, for those administering study programs to find ways to recognise and accommodate such activities within existing program governance rules and policies. Secondly, for teaching teams to connect the non-traditional models with existing formal placement-based curricula. Regardless of whether the placement is discipline-specific, discipline-related, or discipline-agnostic, it is fundamental to connect the range of placement experiences and models to student learning.

Many students already work during their studies outside of any formal WIL placement scheme (Webb et al., 2017), with more than 30% of full-time Australian domestic undergraduate students reporting working 20 or more hours per week (Arkoudis et al., 2018). This work represents substantial existing industry placement activity that is currently generally ignored in higher education, and even where students are working in their discipline field, they may be specifically excluded from using this work setting as the basis for assessable WIL. However, in STEM, many employers note that student work experience is considered positively when recruiting graduates (Atkinson et al., 2015; Atkinson & Pennington, 2012; Jorre de St Jorre et al., 2019). As the competition for WIL placements increases, the value of this existing WIL-like activity that many students currently undertake, whether it is in the discipline of their study or not, is likely to eventually be seen as a valuable opportunity for workplace learning.

Self-employment is on the rise (Hooley, 2019), and for university graduates, self-employment has always been a possible career option (Greenbank, 2002). Recent investigations internationally (Webb et al., 2017), and in STEM WIL in Australia (Atkinson et al., 2015; Johnson et al., 2019) have noted pilot initiatives to support students in different forms of commercial start-up ventures. Start-ups might conjure entrepreneurial images of new technology products or mobile software applications. However, for STEM graduates, particularly in engineering, a professional services consulting enterprise can be a sustainable and rewarding, if less glamorous, self-employment option. WIL opportunities that engage students with entrepreneurial industry settings, or at least the possibilities and practicalities of self-employment, could be a path to both expanding student WIL opportunities and graduate career options.

The full effects of the Covid-19 pandemic on graduate employment and career outcomes generally are still to be seen (Rudolph & Zacher, 2020). For WIL specifically, Covid-19 has highlighted the potential value of remote and virtual placements and related forms of WIL. In remote placements, students undertake some or all of the activities that they might otherwise complete in an industry setting, but do it remotely, at university and/or at home, using enabling ICTs. In virtual placements, the tasks undertaken by students generally form part of a simulation modelled on typical industry practices, with ICTs again often playing a key role. It has been suggested that a preference for learning remotely/virtually is a specific characteristic of generation Z (Chicca & Shellenbarger, 2018). However, Shirley et al. (2006) observed that ICTs have already transformed both higher education and work, that many workplaces already include employees who never physically attend an office, and that virtual teams collaborating via digital tools and environments already represent ‘real’ practice in many industries. While it might be conceptually easier to understand how a STEM discipline such as information technology might be able to offer WIL placements remotely, compared to say engineering and science, the large-scale and rapid shift to remote working in most professions in response to Covid-19 has shown that more is possible now than many had thought previously. A remote WIL placement, and the skills that it develops, are likely to provide students with valuable experiences and capabilities that will serve them well in the post-graduation world of work. Interestingly, across the period March to October 2020, during the significant Covid-19 restrictions that were in place in Australia, more than 80 per cent of student placements in STP units in SEBE were remote – referred to locally as ‘at a distance’.

Cornelius et al. (2008) noted that virtual placements/internships already occur in some industries, including software development, writing and journalism. Potential benefits attributed to virtual WIL include that it can provide an experience of international mobility where physical relocation is too expensive or otherwise not practical (Op de Beeck et al., 2011), and a virtual WIL environment can be integrated into the university's learning management system, linked directly to an e-portfolio, or connected with other institutional digital environments for access to electronic learning resources, assessment, etc. (Shirley et al., 2006). Edwards et al. (2015) note that virtual WIL student projects are already undertaken in STEM disciplines in Australia, and that the challenge for the future is to scale up such activities to make them more widely available to students. In a national investigation into good practice in WIL for the Australian Department of Education and Training, Sachs et al. (2016) made a number of recommendations, including that resources be allocated to pilot programs in a number of disciplines to test the appropriateness of simulation-based and technology-based WIL. Based on an international survey of university staff who support WIL, including 258 respondents from Australia, Kay et al. (2018) reported that respondents identified a need for professional development in the area of supporting virtual WIL. Models and examples of remote and virtual WIL in STEM do exist, but further capacity building is required to scale up levels of activity more systematically.

CONCLUSION

Viewing placement WIL in the STEM disciplines through the lens of generational cohorts provides a valuable and productive approach for structuring an investigation into the occupational outcomes for Australian university graduates from generation Y in the previous decade, and using that to inform consideration of how to prepare current and intending generation Z university students for the best occupational outcomes in the next decade and beyond. Recent Australian national investigations have again supported the proposition that WIL is effective for the development of student employability in the STEM disciplines. Placement WIL in STEM has evolved from being largely ad-hoc and disconnected from student learning, to having a more central role in the formal curriculum. As explored in detail earlier, for Australian engineering and science graduates, the census data reveal that over the last decade employment in those disciplines has declined, and that those graduates in work are also less likely to work in the discipline area that they studied. There are however known limitations with the census data – they don't include international graduates who have left Australia, they are somewhat dated even when first released, and the publicly available data include small random adjustments to prevent potential respondent re-identification. However, the purpose of the analysis presented here is not to extract the third significant figure, rather, it is to show the long-term, large-scale trends in the actual occupational outcomes for Australian engineering and science graduates. This method of using census occupational outcomes data is likely to be valuable in other disciplines with an interest in where their graduates actually work. While the details presented in this chapter are based in an Australian context, many of the issues addressed are not unique to Australia, and readers from other regions may find value in the work presented.

In Australia, many generation Y engineering and science graduates have had to work outside of their discipline if they have wished to work at all, and it seems likely that the future engineering and science graduates of generation Z will face similar circumstances. In recognition of these outcomes, it is proposed that the focus of traditional discipline-based placement-based WIL needs to be broadened to encompass out of field topics and settings likely to benefit many graduates in practice. This chapter details one example in which a broader conception of placement-based WIL was implemented in engineering and science, via an elective unit that allows an out of field WIL, without requiring major changes to existing curricula. Other examples of similar initiatives are also in evidence elsewhere in the sector, and the findings presented here support the value of those initiatives. The out of field WIL model described here is not proposed as 'the answer' to the significant proportion of STEM graduates that work out of field, rather, it is one mechanism for students to gain an insight into career opportunities beyond their current discipline of study, and to reflect on how their discipline-based studies might have broader application in the job market. Given the effort and cost of participation in WIL for all parties involved, it is important for institutions to conduct their own evaluations of the impact of WIL. Methods for the evaluation of the contribution of WIL to both student employability and graduate employment were detailed.

Once the conceptual challenge of placement WIL being more than just discipline-based theory-to-practice learning is accepted, it is also possible to reconsider other curriculum activities to explicitly incorporate knowledge and skills from beyond the immediate discipline field in ways that are valuable to student learning and employability. Embedding aspects of industry practice into the curriculum to develop students' ability to work to learn and learn to work via simulations, laboratory work, project-based learning, case studies, field trips, virtual placements, guest presenters and career development learning may provide a sustainable model for enhanced employability of our future generations. Indeed, the occurrence of the Covid-19 pandemic has transformed and expedited new and adapted forms of WIL in higher education. Subsequently, new conceptions of what is possible under the umbrella of WIL have now been expanded for the better and for good.

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KEY TERMS AND DEFINITIONS

Employability: A set of skills, understandings and personal attributes that make individuals more likely to gain employment and be successful in their chosen occupations – see (Yorke & Knight, 2006).

Generation Y: The generational cohort born in or about 1981.

Generation Z: The generational cohort born in or about 1997.

Out of Field: Working/practicing in a different occupational area to the discipline originally trained in.

Placement WIL: WIL based on work undertaken in a 'workplace' in which there is a host and student agreement and the student is supervised by the host organisation.

Profession: The members of a group who have completed specialised education and training, who exercise this knowledge and these skills in the public interest, who commit to a collective code of ethics governing their practice, who undertake to maintain their competence to practice, and who submit to the governance and sanction of a representative body.

STEM: Collectively, the disciplines of science, technology, engineering, and mathematics.

Work-Integrated Learning: An umbrella term for a range of approaches and strategies that integrate theory with the practice of work within a purposefully designed curriculum – see (Patrick et al., 2008).

ENDNOTES

1 See https://www.acds-tlcc.edu.au/wil-guide-for-science/

2 See https://www.compared.edu.au/