Providing research-focused work-integrated learning for high achieving science undergraduates

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Work-integrated learning has become an integral part of many undergraduate and postgraduate degrees, both in Australia and internationally. Such programs vary in structure, timeframe and discipline type, with concomitant amounts of support, assessment and evaluation. Their value to students, industry partners and higher education institutions, while of considerable potential, depends on a range of factors including the level of resourcing (i.e. level of funding, involvement of a project coordinator, strength of communication among participants), how optimally matched students are to projects, and the use of evaluation and reflection tools to refine and improve them. This paper reports on the development, implementation and evaluation of an inaugural research-oriented WIL program for high-achieving science students at Monash University. The research-related nature of this WIL program has been of considerable value to students and industry partners. Further, it has established ongoing links between the University and industry partners, and provides a strong foundation for establishing a faculty coordinated WIL program. (*Asia-Pacific Journal of Cooperative Education, 2013 14(2), 59-73)*

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Where it is available for Australian university students, work-integrated learning (WIL) is most often offered in the upper years of an undergraduate degree, or as part of a graduate degree program. Effective WIL programs enhance the student learning experience and increase their chances of employability after graduation (Abeysekera, 2006). Higher education institutions also benefit from WIL programs through enhancing links with industry (Eames, 2003), via greater opportunities for grant and sponsorship funding (Smith, 2012), and by gaining higher quality students via increased market 'edge' (Eames, 2003). Several issues associated with WIL programs have emerged over the past decade, in particular concerns about the nature of unpaid work in transitions between study and the workplace (Stewart & Owens, 2013) and the longer term value of internship or placement programs to graduate employability (Anakwe & Greenhaus, 2000).

Reeders (2000) maintains that the term 'work-integrated learning' was originally coined to encompass an increasing diversity in vocational learning modes. In a more modern setting, though, WIL can be defined as either 'providing a schooling-to-work pathway to support the employability of graduates' (Calway & Murphy, 2007) or 'a range of approaches and strategies that integrate theory with the practice of work within a purposefully designed curriculum' (Patrick, Peach, Pocknee, Webb, Fletcher & Pretto, 2008). This latter definition is very similar to that provided by the Australian Collaborative Education Network (ACEN, 2012). Thus, while definitions of WIL may vary to some extent, it essentially involves a bringing together of the theory of a discipline and its relevant work practice to provide a range of mutual benefits for industry, universities and students (Little & Harvey, 2006).

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Research-related WIL placements, which can be defined as WIL that requires a student to be located in a particular workplace, are prominent in the science disciplines. These include biology and biochemistry (Gomez, Lush & Clements, 2004; Hejmadi, Bullock, Gould & Lock, 2012), physics (Smith 1985), chemistry (Beard, Coll & Harris, 2001), geography (Cornelius, Medyckyj-Scott, Forrest, Williams, & Mackaness, 2008) and information technology (Venables & Tan, 2009). Computer-assisted software has long been used to quantify the perceived value and effectiveness of such placements (Lee & Xia, 2010). More recently, software packages such as NVivo have been used to analyze qualitative survey data (Buchanan & Jones, 2010; Sheridan, Kenealy, Connolly, Mahony, et al., 2011).

Thorough assessment of the value and effectiveness of WIL placements is an important issue for successful programs (Ferns & Moore, 2012) and for measures of their broader pedagogical value (Smith, 2012). To that end, a number of models have been proposed for an optimized WIL program (Calway & Murphy, 2011), although it is arguable which model is the most effective for placements with different timespans. For example, the length of WIL placement can vary from one year (Gomez, Lush & Clements, 2004; Lee, Barnard & Owen, 2011) to two weeks (Levett-Jones, Lathlean, Higgins & McMillan, 2009; Staniforth, 2009; Taylor, Maharaj, Williams & Sheldrake, 2011) among the various disciplines. Full-time versus part-time placement can also be an issue. For example, in a New Zealand WIL study, while 71 per cent of students on part-time sports science placements were satisfied with the program's non-continuous structure, 75 per cent of participants in regional sports trusts would have preferred to work full-time, in order to gain greater industry experience (Fleming & Eames, 2005). The role of the placement coordinator is considered to be critical in such science placements (Coll & Eames, 2000), as it is in general for any higher education placement program (Hays & Clements, 2011). Perhaps the most important issue in science-related placements is the strength of matching students with the project offered by the industry partner. This matching can have a considerable impact on the worth of the placement in enhancing student learning and skills acquisition, their longer-term career and employability prospects, and value in terms of productive labor and related outcomes to the industry partner (Gamble, Patrick & Peach, 2010).

The term 'capstone' can be defined as 'a course or experience that provides opportunities for a student to apply the knowledge gained throughout their undergraduate degree' (Holdsworth, Watty & Davies, 2009). Capstone schemes can be used to enhance the WIL experience for students and industry partners. For example, in recent years two Australian universities, Griffith University and the Queensland University of Technology, have implemented WIL programs that have garnered international attention (Gamble et al., 2010). Research has also been carried out to assess issues to do with obtaining information useful for evaluating WIL programs (Moulton, 2007). This paper focuses on the development, implementation and evaluation of a short-term research placement scheme, the Science Student Industry Research Placement Program (SSIRPP), for high-achieving undergraduate science students at Monash University. We report on the results of 30 (18 full-time and 12 part-time) student placements for research projects in biology, biomedicine, chemistry, the geosciences, mathematics, computer science and physics.

METHODOLOGY

Aims and Structural Components

The aims of the SSIRPP, developed by the program leaders in conjunction with the Monash Office of the Pro-Vice Chancellor (Learning & Teaching), were to develop industry-related research experience for students; enable students to apply degree-related knowledge and skills to real-life situations; develop and apply student communication skills; and foster collaboration between Monash University and industry research partner organizations. Structural components essential to the establishment of the SSIRPP included the development of a tripartite (University-student-industry partner) workplace agreement, survey evaluation tools for students and placement supervisors, and recognition of student accomplishment through a special unit status on students' graduation transcripts.

Placement procedure

The SSIRPP was designed around industry engagement, in terms of a research capstone scheme for high achieving students in the Science Talented Students Program (TSP). The program was widely advertised by the program coordinator through the learning management system, through phone calls and emails and via social networking sites such as LinkedIn. The SSIRPP charter was sent to approximately two hundred potential research partner organizations throughout Melbourne and following responses from interested organizations, potential research projects were discussed, refined and improved in consultation with the program leaders before being advertised to TSP students (refer Figure 1).

Students who expressed an interest in a project were short-listed by the program leaders and coordinator, with the final placement allocation made on the basis of student year level, the nature of their completed academic major and/or minors, candidate availability, qualifications and academic results to date (Figure 1). In some cases (less than / equal to 10% of total placements), the industry partner reserved the right to screen applicants, through discussions with the program coordinator and/or face-to-face or telephone interviews. After short listing and selection of the successful candidate, the coordinator informed all applicants of the outcome, and organized a preliminary meeting with the successful student(s) and representatives of the industry partner regarding the timing of placement commencement and a workplace/field site visit (Figure 1). These visits were made to ensure work conditions, OHS compliance, the signing of tripartite agreements and any other necessary requirements for successful engagement of students with the nominated project. During each placement, the coordinator maintained contact with both the student and the research partner, either by phone or email, on at least a weekly basis. Following completion of placement, a debrief and evaluation was carried out using student and supervisor surveys (Figure 1). Each survey comprised fifteen questions, similar in nature to those used in other placement programs (McIlveen, Brooks, Lichtenberg, Smith, Torjul & Tyler et al., 2011; Reddan & Rauchle, 2012), with each rated by students and supervisors on a five point Likert scale. Students were paid a stipend of AU$40 per standard 8-hour day, up to a maximum of 80 hours. Of the 30 placements, 12 students were partly or fully paid by the industry research partner with the other 18 being fully subsidized by Monash University.

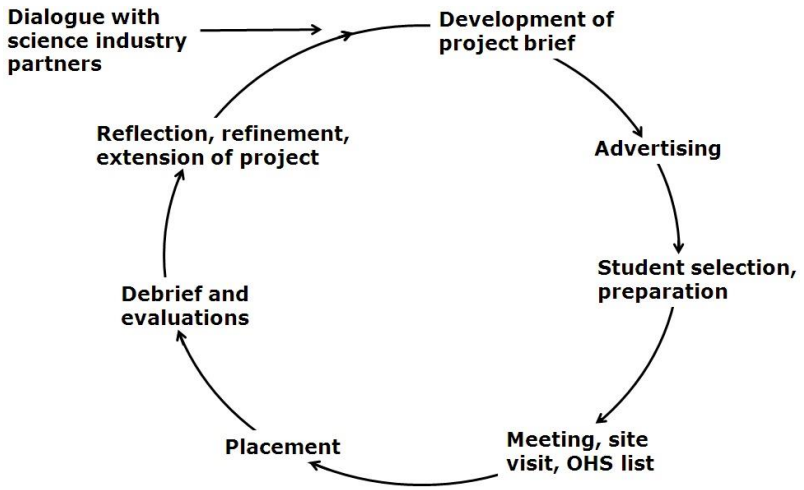

FIGURE 1. Structural components and workflow diagram of the Monash University Science Student Industry Research Placement Program (SSIRPP).

NVivo Analysis

In addition to the quantitative analysis above, three additional open-ended 'comments' categories were incorporated into the student and supervisor surveys. These Learning-related, Working-related and Contact-related comments allowed students and supervisors to make unsolicited comments specific to their individual experience. This mixed method approach (Bryman, 2008), using quantitative and qualitative data, allowed for a more complete assessment of the perceived outcomes of the SSIRPP. NVivo data analysis software (Welsh, 2002) was used to code qualitative data into three categories of comment. Nodes were created to search and assess patterns in the commentary, and positive and negative comments and the drivers of those comments were grouped and assessed.

RESEARCH FINDINGS

Student Perspectives

The range of short-term scientific research projects undertaken by students (19 males, 11 females, all of roughly equivalent age) is listed in Table 1. Of the 30 placements, 18 were undertaken on a full-time basis, with the remaining 12 taken part-time over one to several months. The SSIRPP was very highly regarded by all placement students regardless of gender or whether the placement was completed on a full- or part-time basis (refer Figure 2). On a five point Likert scale, very high proportions of students agreed or strongly agreed that the program was relevant (83%), rewarding (90%), easy to undertake (87%) and provided them with skills and perspectives that would be of benefit in their future careers (97%) (refer Figures 2a and 2b). Ninety-seven percent of students indicated that they had gained insight, in one form or another, through working with industry professionals (refer Figure 2b).

TABLE 1. Discipline-specific projects in the SSIRPP

Project discipline	**Project**
Biology (7 projects)	• Land management plans with bush fire management statements • Options for determining native vegetation offset gains • Monitoring 6-month experimental mangrove seedlings, monitoring wave energy in intertidal zone • Monitoring mangrove seedling growth in in Westernport Bay • Summer Ranger Program – contributions to environmental programs, visitor services and park management • Riparian habitat restoration in western Victoria • Flora survey and carbon accounting
Biomedical sciences (7 projects)	• Recombinant agents for efficient and safe anticoagulation and thrombolysis • Single-chain antibody-targeted nanoparticles for diagnosis of vascular diseases • Targeted virus particles for genetic transfer of fusion proteins to inhibit atherosclerosis • Clinician time and costs associated with insulin pump therapy in Type 1 diabetes • Identification of Sox9 target genes/discovery of candidate genes for disorders of sexual development (DSD) • Identification of regulators of melanoma progression • The effects of vitamin & mineral supplementation formulated with TPM (Vitamin E type) to improve the health and performance of racehorses
Chemistry (3 projects)	• Modeling primary production in Port Phillip Bay using dissolved oxygen concentrations • FTIR characterization and quantification of chemicals and chemical products • Characterization of new injection technologies for gas chromatography
Geosciences (3 projects)	• Geophysical analysis of historic sites in Victoria (2 projects) • Environmental and geochemical investigations for sustainable development
Mathematics / computer sciences (9 projects)	• Verification of rainfall forecasts for the south-west Pacific • Graphical representation of weather forecast verification metrics with Python • Analysis of automatically generated text weather forecasts (2 projects) • Evaluation of model output fields from the ACCESS climate model • Energy efficiencies in the commercial and retail environment • Testing of firmware for a safety critical laser medical device (2 projects)
Physics (1 project)	• Reducing wind effects on overpressure readings

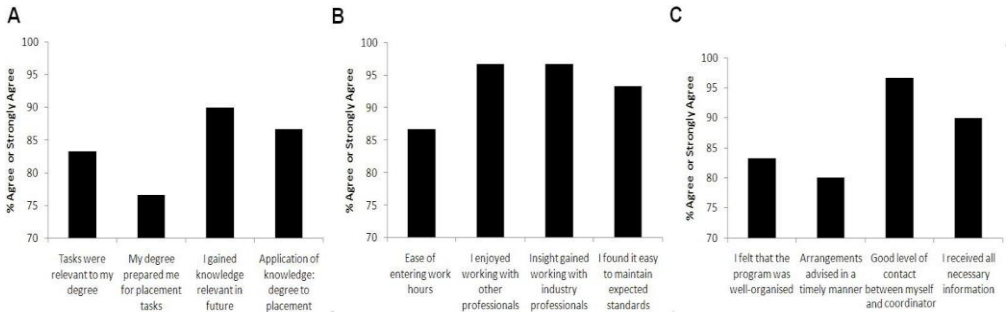

FIGURE 2. Undergraduate student perspectives on their research placement (n=30). Percentage values indicate the proportion of students agreeing or strongly agreeing on a five-point Likert scale on the various questions within each comment category: (A) Learning issues (B) Working issues (C) Contact issues.

In contrast to their responses to other questions, only 77 per cent of students agreed or strongly agreed that their degree had prepared them for the placement tasks (refer Figure 2a). This result is not entirely unexpected given that discipline knowledge may not be strongly aligned with the skills requirements of a placement, particularly where the placement involves the use of equipment, procedures or processes with which the student may be unfamiliar. Nevertheless, a very high proportion of students opined that the SSIRPP was well organized (83%) with a good level of contact with the coordinator (97%; refer Figure 2c), which indicates that placements proceeded smoothly for almost all students.

With regard to personal student comments, 82 per cent of the comments were categorized as positive (refer Table 2). Working-related comments were 88 per cent positive, with 'interaction with workplace personnel' being a very favorable aspect for students (Table 2). Some examples of Working-related comments included:

> Student M1: The most valuable part of the experience was speaking to the supervisor and other students about skills and knowledge relevant to their field.
>
> Student C2: I enjoyed talking to the scientists working at Company X about their job, their past and general life. I learnt a lot from them, a lot that will help me choose a path to follow. I found their advice extremely helpful and insightful.

Of the 26 Working-related comments, only three were categorized as negative, with the student having 'difficulties' of some sort (refer Table 2). More specifically, comments were related to familiarity with the workplace, equipment or the students' ability to perform tasks. However, subsequent comments were more positive in nature, in that the student gained support and assistance from the supervisors to overcome these issues.

TABLE 2. Student survey personal comments

Comment type	Number of comments
Working-related comments	
Positive - flexibility	1
Positive - interaction with workplace personnel	16
Positive - general enjoyment	2
Positive - challenging	4
Difficulties	3
Learning-related comments	
Reflected what my degree had taught me	10
Positive - for future research endeavours	4
Positive - research	4
Positive - procedure	6
Positive - insight into reality of the work & research	5
Neutral - skills required	1
Did not reflect what my degree has taught me	8
Contact-related comments	
Positive - organization of placement	6
Positive - output during placement	5
Positive - general	4
Positive - contact with Monash	7
Positive - communication in workplace	2
Negative - organization of placement	3
Negative - communication issues	2
Total comments	93

Similarly, Learning-related comments were significantly positive (76%; Table 2). However, comments in relation to the students' University degree reflecting or being relevant to the placement were mixed (56%). Ten comments were made stating that the placement was relevant to the University degree; for example:

> Student C2: The context of the tasks were highly relevant to my degree.
>
> Student L3: Real life applications in my placement reinforced many concepts in my studies.

In contrast, eight participants did not perceive any relevance between their undergraduate studies and the nature of placement work (refer Table 2); for example:

> Student A2: The placement was not very specific to my majors and my minors.
>
> Student D3: Many of the skills required of me were learnt outside of my degree (e.g. Software usage, etc.).

However, similarly to Working-related comments by students, a number of Learning-related comments were also followed by positive statements about the placement; for example:

> Student E2: Although the meteorology-based component of this placement wasn't all that relevant to my Mechatronics/Science course, it certainly broadened my horizons.

Students' Contact-related comments were also highly positive (83%; refer Table 2), particularly in relation to the organization of the placement and communication at the workplace and with Monash University. A group of eligible students who did not take part in the SSIRPP was assessed with a self-reporting survey (refer Figure 3), concerning the reasons they chose not to participate. The majority of students (41%) in this group stated that they planned to do it at a later date (post-2012), with approximately 27 per cent reporting that the advertised research projects did not interest them. The remaining students (32%) did not have sufficient time, were not aware of the program or had other reasons for not engaging in the placements.

Supervisor Perspectives

Work placement supervisors were generally extremely satisfied with the knowledge, skills and attributes of the undergraduate student who was placed and who undertook the research project on either a full-time or part-time basis (refer Figure 4). For supervisors who agreed or strongly agreed with specific questions, the standout performances related to students' capacity to adapt to new ideas and procedures (100%), the very high standard of their work (100%) and their ability to work effectively in team-based settings (97%) (refer Figures 4a and 4b). Of the supervisors, 97 per cent were highly satisfied with the information received from Monash University in regard to placements. Similarly, 87 per cent of supervisors agreed or strongly agreed that the SSIRPP was well organized, that the level of contact with the University before, during and after the placement had been handled well (refer Figure 4c).

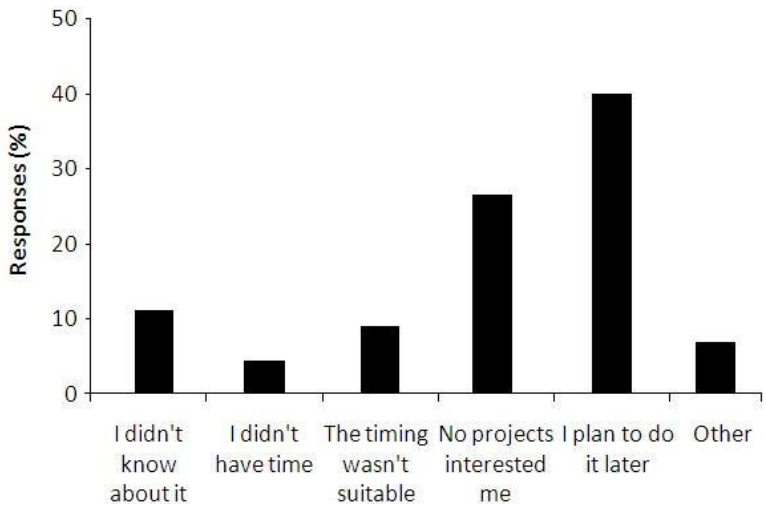

FIGURE 3. Undergraduate student perspectives on not taking part in the SSIRPP (n=41). Percentage values indicate the proportion of students listing the various issues and reasons placement was not undertaken.

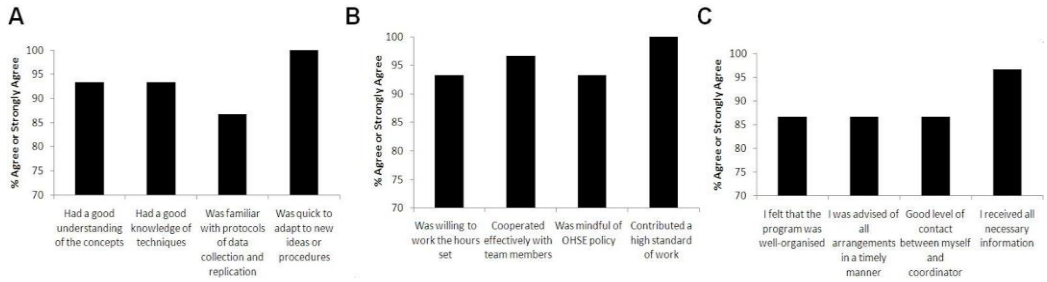

FIGURE 4. Industry supervisor perspectives on student attributes and capabilities (n=30). Percentage values indicate the proportion of supervisors agreeing or strongly agreeing on a five-point Likert scale on the various questions within each comment category: (A) Learning issues (B) Working issues (C) Contact issues.

Overall, supervisor personal comments were very positive (92%; refer Table 3). More specifically, supervisor Working-related comments were 96 per cent positive in relation to the students' high standard of application and attitude (Table 3); for example:

> Supervisor E: The standard of his work was excellent.
>
> Supervisor A: Student X worked extremely hard throughout the week and demonstrated a great capacity for field work. I had no hesitation in assigning data collection tasks as she proved herself to be a methodical and precise worker, and mindful of OHSE issues in the field.
>
> Supervisor D: Student Y was well mannered and enthusiastic and got on well with everyone in the lab.
>
> Supervisor N: Conscientious worker, happy with level of commitment and personal responsibility for outputs.

Ninety-two per cent of supervisors' Learning-related comments were also positive (refer Table 3) and reflected the students' knowledge, interest in learning new techniques and attitude; for example:

> Supervisor A: Showed interest to learn more about the ones she was least experienced in.
>
> Supervisor L: The student demonstrated willingness to learn and understand the principles behind various techniques.
>
> Supervisor D: Student Z took a minimal amount of time to familiarize himself with the technology and was quickly independent.

Supervisors were predominantly positive with regards to the level of communication with Monash University and for future involvement in the project (refer Table 3); for example:

> Supervisor C: Very well organized and ample contact with coordinator.
>
> Supervisor G: I'm really happy to be involved in such a program, both for what it can offer me, and also what it offers the student.

TABLE 3. Supervisor survey personal comments

Comment type	Number of comments
Working-related comments	
Positive - high standard application	13
Positive - attitude	10
Negative - additional involvement required	1
Learning-related comments	
Positive - knowledge brought in	4
Positive - interest to learn new techniques	11
Positive - general	4
Positive - contribution	1
Positive - attitude	3
Neutral - knowledge brought in	2
Contact-related comments	
Positive - future involvement	8
Positive - communication with Monash	5
Negative - communication and notice	2
Neutral - suggestions for future	3
Total comments	67

DISCUSSION

The concept of WIL, which first took hold early in the twentieth century, has over the past one hundred years evolved and been integrated in a vast array of disciplines, institutions and workplaces (Calway & Murphy, 2011). There has recently been a focus on how WIL and other career-development learning programs have been delivered by Australian higher education institutions (McIlveen et al., 2011; Reddan & Rauchle, 2012). Over the course of 2011-2012, the SSIRPP has demonstrated that given the correct combination of industry engagement, project development, marketing and student recruitment and evaluation, this type of research-focused WIL has considerable potential to (a) enhance the undergraduate learning experience through meaningful work placements, (b) enable high achieving students to apply their skills and knowledge in workplace environments (i.e. better alignment of curricula with industry priorities), and (c) increase student employability post-graduation. In regard to (c), while the importance of chance events in longer term career development or decision making (e.g., Bright, Pryor, Chan & Rijanto, 2009) is not to be downplayed, this type of targeted WIL program, with an emphasis on optimal matching of students with industry partner projects, may provide an important bridge between university studies and the workplace.

In addition to having achieved its intended aims, this WIL program also generated a number of unexpected, but positive outcomes. These have included a conference research poster co-authored by a placement student, and other students being offered vacation scholarships or post-placement employment with their industry partner. For these placements, two of the most desirable skills in the minds of the employers were the students' ability and willingness

to learn, which has been reported elsewhere in the research (Coll & Zegwaard, 2006). Previous evidence has been presented regarding the value of student placement programs (either research-focused or other) to each of universities and industry research partners in terms of finance or capacity development generated through such collaborations (Blackwell, Bowes, Harvey, Hesketh & Knight, 2001; Hejmadi et al., 2012). The outcomes of the SSIRPP support the notion that capstone WIL experiences better prepare undergraduate students for life in the workplace, and enable meaningful work-based learning opportunities for students over a broad range of scientific disciplines (Franks & Blomqvist, 2004).

As stated in the introduction, the issue of unpaid internships and work placements has become a major area of concern to governments and higher education institutes (Stewart & Owens, 2013). The provision of a small, tax-free placement stipend was a not insignificant factor in student decision-making about their participation in the SSIRPP. This is consistent with the findings of a range of other internship and work placement programs (Calvo, 2011). Thus, while stipends consumed a considerable proportion of the SSIRPP funding base, and even though students greatly appreciated the opportunity to engage in a short-term placement project, the payment of a stipend provides potential to attract the highest quality students, notwithstanding the underlying principle of compensating students for their time and contribution in the workplace (Calvo, 2011).

In contrast to the above-described benefits of WIL to the parties involved, as other researchers (Gamble et al., 2010; Patrick et al., 2008) have noted, its current integration into Australian undergraduate and graduate programs is far from optimal. This compares with how WIL is viewed and situated internationally, with a UK-based recommendation that all science students undertake some form of work placement before graduation (Rees, Forbes & Kubler, 2006). The slow rate of uptake of WIL in Australian higher education institutions is most likely a consequence of practicality rather than any underlying philosophy, although the proposed National Internship Scheme (Universities Australia, 2008) may generate momentum and is a considerable step in the right direction.

In this study, although eligible students who elected not to participate in the SSIRPP mostly identified traditional issues as a key factor in their choice (Bullock, Gould, Hejmadi & Lock, 2009; Hejmadi et al., 2012), a number of non-traditional reasons were also provided. These included, in one case, the placement stipend not being sufficient to justify the student's involvement in the SSIRPP. Further, only approximately 15 per cent of all potential industry research partners actually engaged with the program, via submitting a short-term mini-research proposal and providing subsequent supervisory capacity. This is lower than a UK-based program which engaged 28 per cent of potential industry partners (Hunter & Clements, 2012). It should be noted that at least a dozen potential industry partners expressed a willingness to be involved in the program if the duration of the research placement was longer than 80 hours. For a small number of potential industry partners, the motivation for involvement appeared to be linked to acquiring students for short-term, cheap labour. In the current economic and fiscal environment, this type of motivation may have dire implications for future work placements of this type. While some costs can be kept to a minimum by universities, the man-hours spent on placements by the industry research partner can represent a financial drain and a loss of resources for the organization in question (Zhao, 2000; Orrell, 2004) and thus limit opportunities for students to benefit from meaningful WIL.

Future expansion of the Monash SSIRPP may include longer-term placements to provide greater incentives for industry partners, and the earmarking of projects that will provide

short- and long-term financial gain. In addition, a follow-up study will be carried out to track ongoing benefits to students of the placement with regard to their career choices, to maximize student gains from this type of program. For example, Hejmadi et al. (2012) found that post-degree employment was generally higher for bioscience students who had completed a WIL placement than students on equivalent non-placement programs. However, the extent of this advantage appears to depend on the bioscience discipline area, with 71 per cent of placed biochemist graduates gaining discipline-related employment, compared to 42 per cent of life science and 47 per cent of molecular cell biology students (Hejmadi et al., 2012). This has important implications for many of the students who took part in the SSIRPP, which included work placements in similar fields of bioscience.

CONCLUSION

This study has found that WIL, as designed by the SSIRPP, can be an activity keenly sought after by students, particularly if the program is appropriately structured and supported through engagement by all participants and through accurate matching of students with industry research projects. The attraction to students of a modest WIL stipend as part of their placement cannot be understated, although the costs of such may be considerable, particularly in the case of longer term research placements. The SSIRPP has become highly regarded by undergraduate science students and the industry research partners, and the program structure provides a suitable model and foundation for a broader faculty scheme. A faculty-sponsored scheme, integrating communications and business development staff, should also provide increased capacity for industry engagement and potential synergies around grants and funding for research at the higher degree and postdoctoral levels. As an inaugural science-based placement program at Monash University, the SSIRPP outcomes demonstrate that there is considerable demand for students to contribute to appropriate work-based research projects, and substantial capacity for this sort of WIL to enrich the value of tertiary study and students' connectedness with future careers across a range of science disciplines.

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REFERENCES

Abeysekera, I. (2006). Issues relating to designing a work-integrated learning program in an undergraduate accounting degree program and its implications for the curriculum. *Asia-Pacific Journal of Cooperative Education,* 7(1), 7-15.

Anakwe, U.P., & Greenhaus, J.H. (2000). Prior work experience and socialization experiences of college graduates. *International Journal of Manpower, 21*(2), 95–111.

Australian Collaborative Education Network. (2012). National WIL portal: What is WIL? Retrieved from http://wil.acen.edu.au/pages/what_is_wil

Beard, S., Coll, R.K., & Harris, J. (2001). Student and employer reflections of an international science and technology work placement. *Asia-Pacific Journal of Cooperative Education*, *2*(1), 6-10.

Blackwell, A., Bowes, L., Harvey, L., Hesketh, A.J., & Knight, P.T. (2001). Transforming work experience in higher education. *British Educational Research Journal*, *27*(3), 269-285.

Bright, J.E.H., Pryor, R.G.L., Chan, E.W.M., & Rijanto, J. (2009). Chance events in career development: Influence, control and multiplicity. *Journal of Vocational Behavior*, *75*, 14–25.

Bryman, A. (2008). *Social research methods* (3rd ed.). Oxford, UK: Oxford University Press.

Buchanan, J., & Jones, M.L. (2010). The efficacy of utilising NVivo for interview data from the electronic gaming industry in two jurisdictions. *Review of Management Innovation & Creativity*, *3*(5), 1-15.

Bullock, K., Gould, V., Hejmadi, M., & Lock, G. (2009). Work placement experience: Should I stay or should I go? *Higher Education Research & Development*, *28*(5), 481-494.

Calvo, J. (2011). *Internships between higher education and work: Theoretical considerations and analysis for reflection*. Kassel, Germany: Organization for Higher Education Co-operation, Research and Development.

Calway, B.A., & Murphy, G.A. (2007). The educational imperatives for a work-integrated learning philosophy. *Journal of Cooperative Education and Internships*, *41*(2), 95-109.

Calway, B.A., & Murphy, G.A. (2011). A work-integrated learning philosophy and the educational imperatives. In P. Keleher, A. Patil & R.E. Harreveld (Eds.), *Work-integrated learning in engineering, built environment and technology: Diversity of practice in practice* (pp. 1-24). Hershey, PA: IGI Global.

Coll, R.K., & Eames, C. (2000). The role of the placement coordinator: An alternative model. *Asia-Pacific Journal of Cooperative Education, 1*(1), 9-14.

Coll, R.K., & Zegwaard, K.E. (2006). Perceptions of desirable graduate competencies for science and technology new graduates. *Research in Science & Technological Education, 24*(1), 29-58.

Cornelius, S., Medyckyj-Scott, D., Forrest, D., Williams, A., & Mackaness, W. (2008). The virtual placement: An alternative to the traditional work placement in the geographical sciences? *Journal of Geography in Higher Education, 32*(2), 287-302.

Eames, C. (2003). Learning to work: Becoming a research scientist through work experience placements. *Asia-Pacific Journal of Cooperative Education*, *4*(2), 7-15.

Ferns, S., & Moore, K. (2012). Assessing student outcomes in fieldwork placements: An overview of current practice. *Asia-Pacific Journal of Cooperative Education*, *13*(4), 207-224.

Fleming, J., & Eames, C. (2005). Student learning in relation to the structure of the cooperative experience. *Asia-Pacific Journal of Cooperative Education*, *6*(2), 26-31.

Franks, P., & Blomqvist, O. (2004). The World Association for Cooperative Education: The global network that fosters work-integrated learning. In R.K. Coll & C. Eames (Eds.), *International handbook for cooperative education: An international perspective of the theory, research and practice of work-integrated learning* (pp. 283-289). Boston, MA: World Association for Cooperative Education.

Gamble, N., Patrick, C-J. & Peach, D. (2010). Internationalising work-integrated learning: Creating global citizens to meet the economic crisis and the skills shortage. *Higher Education Research & Development*, *29*(5), 535-546.

Gomez, S., Lush, D., & Clements, M. (2004). Work placements enhance the academic performance of bioscience undergraduates. *Journal of Vocational Education and Training, 56*(3), 373-385.

Hays, J., & Clements, M. (2011). Supervision in work experience for learning programs. In *Proceedings of the 17th World Conference on Cooperative and Work-Integrated Education (WACE)*. Retrieved from http://www.waceinc.org/philly2011/conference_proceedings/Refereed%20Papers/Australia/JAY HAY~1.PDF

Hejmadi, M.V., Bullock, K., Gould, V., & Lock, G.D. (2012). Is choosing to go on placement a gamble? Perspectives from bioscience undergraduates. *Assessment & Evaluation in Higher Education*, *37*(5), 605-618.

Holdsworth, A., Watty, K., & Davies, M. (2009). *Developing capstone experiences*. Melbourne, Australia: Centre for the Study of Higher Education, University of Melbourne, Australia. Retrieved from http://www.learningandteaching.unimelb.edu.au/__data/assets/pdf_file/0005/278906/Capstone_Guide_09.pdf

Hunter, G., & Clements, J. (2012). *Undergraduate placements: Smoothing the transition from education into the workforce*. National HE STEM Programme, Centre for Collaboration and Partnership, University

of Brighton, UK. Retrieved from http://www.hestem.ac.uk/sites/default/files/undergraduate_placements_smoothing_the_transition_from_education_into_the_workforce_final_report.pdf

Lee, G., & Xia, W. (2010). Toward agile: An integrated analysis of quantitative and qualitative field data on software development agility. *MIS Quarterly, 34*(1), 87-114.

Lee, Y.H., Barnard, A., & Owen, C. (2011). Initial evaluation of rural programs at the Australian National University: Understanding the effects of rural programs on intentions for rural and remote medical practice. *Rural and Remote Health, 11*(2), 1602.

Levett-Jones, T., Lathlean, J., Higgins, I. & McMillan, M. (2009). The duration of clinical placements: A key influence on nursing students' experience of belongingness. *Australian Journal of Advanced Nursing, 26*(2), 8-16.

Little, B., & Harvey, L. (2006). *Learning through work placements and beyond*. A report for the Higher Education Careers Service Unit and the Higher Education Academy's Work Placements Organisation Forum. Accessed from http://ww2.prospects.ac.uk/downloads/documents/HECSU/Reports/Workplacement_Little_Harvey.pdf

McIlveen, P., Brooks, S., Lichtenberg, A., Smith, M., Torjul, P., & Tyler, J. (2011). Perceptions of career development learning and work-integrated learning in Australian higher education. *Australian Journal of Career Development, 20*(1), 32-41.

Moulton, M.B. (2007). Towards an improved understanding of methods for obtaining information relevant for evaluating work integrated learning programs. *Proceedings of the Australian Technology Network of Universities Evaluation and Assessment Conference, Brisbane, Australia, 29-30 November 2007*. Accessed from http://epress.lib.uts.edu.au/research/bitstream/handle/10453/3171/2006014760.pdf?sequence=1

Orrell, J. (2004). Work-integrated learning programmes: Management and educational quality. AUQA Occasional Publication, *Proceedings of the Australian Universities Quality Forum 2004. Adelaide, South Australia, Australia*. Retrieved from https://tls.vu.edu.au/vucollege/LiWC/resources/Orrell.pdf

Patrick, C-J., Peach, D., Pocknee, C., Webb, F., Fletcher, M. & Pretto, G. (2008). The WIL (work-integrated learning) report: A national scoping study. Paper presented in the *Australian Learning and Teaching Council Final Report. Queensland University of Technology, Brisbane, Australia.* Retrieved from http://eprints.qut.edu.au/44065/1/WIL-Report-grants-project-jan09.pdf

Reddan, G., & Rauchle, M. (2012). Student perceptions of the value of career development learning to a work-integrated learning course in exercise science. *Australian Journal of Career Development, 21*(1), 38-48.

Reeders, E. (2000). Scholarly practice in work-based learning: Fitting the glass slipper. *Higher Education Research & Development, 19*(2), 205-220.

Rees, C., Forbes, P., & Kubler, B. (2006). *Student employability profiles: A guide for higher education practitioners*. The Higher Education Academy, UK. Accessed from http://www.heacademy.ac.uk/assets/documents/employability/student_employability_profiles_apr07.pdf

Sheridan, N.F., Kenealy, T.W., Connolly, M.J., Mahony, F., Barber, P.A., Boyd, M.A., Carswell, P., Clinton, J., Devlin, G., Doughty, R., Dyall, L., Kerse, N., Kolbe, J., Lawrenson, R., & Moffitt, A. (2011). Health equity in the New Zealand health care system: A national survey. *International Journal for Equity in Health, 10*, 45.

Smith, E.V. (1985). An evaluation of the attitudes of sandwich course undergraduates in applied physics to their one year in professional training. *Journal of Further and Higher Education*, *9*(1), 71-77.

Smith, C. (2012). Evaluating the quality of work-integrated learning curricula: A comprehensive framework. *Higher Education Research & Development*, *31*(2), 247-262.

Staniforth, M. (2009). Work-integrated learning in maritime archaeology: An Australian approach. *International Journal of Learning, 16*(8), 519-528.

Stewart, A., & Owens, R. (2013). *The nature, prevalence and regulation of unpaid work experience, internships and trial periods in Australia. Report to the Fair Work Ombudsman*. Adelaide, Australia: The University of Adelaide.

Taylor, S.J., Maharaj, P., Williams, K., & Sheldrake, C. (2011). Pharmacy students' intention to practise in a rural setting: Measuring the impact of a rural curriculum, rural campus and rural placement on a predominantly metropolitan student cohort. *Australian Journal of Rural Health, 17*(6), 305-309.

Universities Australia. (2008). *A National Internship Scheme: Enhancing the skills and work-readiness of Australian university graduates*. Position Paper No.3/08. Deakin, ACT, Universities Australia. Retrieved from http://www.universitiesaustralia.edu.au/page/360/submissions---reports/policy-papers/a-national-internship-scheme/

Venables, A., & Tan, G. (2009). Realizing learning in the workplace in an undergraduate IT program. *Journal of Information Technology Education: Innovations in Practice, 8*, IIP17-IIP26.

Welsh, E. (2002). Dealing with data: Using NVivo in the qualitative data analysis process. *Forum: Qualitative Social Research, 3*(2), Art 26.

Zhao, F. (2000). University-industry partnerships in Australia: A strategic perspective. *Pacific-Asian Education, 12*(2), 57-66.

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The Asia-Pacific Journal of Cooperative Education publishes peer-reviewed original research, topical issues, and best practice articles from throughout the world dealing with Cooperative Education (Co-op) and Work Integrated Learning/Education (WIL).

In this Journal, Co-op/WIL is defined as an educational approach that uses relevant work-based projects that form an integrated and assessed part of an academic program of study (e.g., work placements, internships, practicum). These programs should have clear linkages with, or add to, the knowledge and skill base of the academic program. These programs can be described by a variety of names, such as work-based learning, workplace learning, professional training, industry-based learning, engaged industry learning, career and technical education, internships, experiential education, experiential learning, vocational education and training, fieldwork education, and service learning.

The Journal's main aim is to allow specialists working in these areas to disseminate their findings and share their knowledge for the benefit of institutions, co-op/WIL practitioners, and researchers. The Journal desires to encourage quality research and explorative critical discussion that will lead to the advancement of effective practices, development of further understanding of co-op/WIL, and promote further research.

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