Integrating Work Integrated Learning

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Abstract - **Work Integrated Learning is a feature of many engineering degree programs. The accreditation of Australian undergraduate engineering degrees requires the inclusion of certain Work Integrated Learning activities. Effective use of Work Integrated Learning requires embedding the Work Integrated Learning activities in the program design, not just adding a Work Integrated Learning activity to the program. The WIL Industry Affiliates Program which has operated in microelectronic for 18 years has recently been introduced into all engineering undergraduate programs at Griffith University. The Industry Affiliates Program is now being extended to all Science, Environment, Engineering and Technology undergraduate programs. The Industry Affiliates Program for engineering is a "semester-in-industry", in the first semester of the final year, during which students work on a joint industry-university supervised project. The positive impact of the inclusion of this "semester-in-industry" Industry Affiliates Program on the program structure and content, from first year to final year, will be discussed.**

Index Terms – program structure, work integrated learning. About four, alphabetical order, key words or phrases, separated by commas (for suggestions: Camera-ready, FIE format, Preparation of papers, Two-column format).

I. INTRODUCTION

The Australian engineering accrediting body, Engineers Australia states "Exposure to professional engineering practice is a key element in differentiating a professional engineering degree from an applied science degree." [1]

To be eligible for accreditation, all Australian professional engineering degree programs are required to provide this professional practice. Once expressed as a minimum duration of experience working at various levels in the engineering industry it is now seen as an aggregation of exposure to industry practice that can built up from a varied number of activities.

Work Integrated Learning (WIL) is a term Griffith University, and many other Australian universities, are using to refer to activities that integrate the work (industry) experience with formal studies. WIL activities can range from periods of work experience, internships, site visits, industry based projects, case studies using industry experience, to having industry experts provide guest lectures. In the professional engineering context all of these provide the necessary exposure to professional engineering practice.

II. THE GRIFFITH UNIVERSITY CONTEXT

Griffith University is a multi-campus university of some 36,000 students. There are two larger comprehensive campuses of about 14,000 students each: Gold Coast and Nathan (about 65km apart); and three smaller more specialized campuses.

On the academic side, Griffith University is organized into four Groups: Arts, Education and Law; Business; Health; and Science, Environment, Engineering, and Technology. Each Group is managed by a Pro-Vice Chancellor. Within Science, Environment, Engineering, and Technology are four teaching schools: Biomolecular and Physical Sciences, Information and Communication Technology, Griffith School of Engineering, and the Griffith School of Environment. The Group offers its major programs on both the Gold Coast and Nathan campuses.

III. INDUSTRY AFFILIATES PROGRAM

When Griffith University was designing its Bachelor of Engineering in Microelectronic Engineering program for 1990 introduction, the decision was made to break away from the Australian traditional approach to professional engineering practice. At that time the accreditation requirement was expressed as a minimum of 60 days work (employment) experience in the engineering industry with a significant amount at the end of the penultimate year under the supervision of a professional engineer. The quality of the experience gained as vacation employment varied considerably and was very dependent on economic conditions. The change that was taking place in professional engineering employment was also affecting outcomes. The traditional large employers of engineers in Australia, government and semi-government bodies, were changing to outsourcing. Most engineers were now being employed in small to medium sized organisations that found it more difficult to organise vacation employment.

The Microelectronic Engineering approach was to integrate the professional experience with the traditional final year project or thesis. This different approach was called the Industrial Affiliates Program (IAP). The name was intended to show that during the program the student became affiliated with an industrial organisation.

IV. IAP STRUCTURE

The IAP is a period that combines the professional experience of working in an industry setting with the academic rigour of investigating and reporting expected with a thesis or dissertation. It has achieved a high level of industry acceptance [2]. The experience embeds the development and practice of many of the generic, or non-technical skills, that professional practice requires. [3] To allow full concentration on the experience, the IAP takes up a full semester of the student's program. For reasons that will be discussed below, the IAP experience occurs in the first semester (February – June) of the student's final (fourth) year.

The inclusion of a full-time period in industry in engineering degrees is not a new concept. There are many such programs in existence. However most have the format of a sandwich program in which the period in industry is "sandwiched" between periods of normal university study, with the length of the program being extended by the length of the industry placement. The IAP approach is to include the 15 weeks of full-time industry placement as structured industry/university partnership within the normal academic program. The period of the IAP placement is in addition to the industry experience engineering students are required to gain during university vacations as part of their degree requirements.

During the IAP the student spends 15 weeks full-time, 5 days a week, in an industry setting working on a project nominated by the industry partner. It should be noted that students are required to attend university on some Mondays during the program to attend and give seminars on progress or meet with their academic supervisor.

The IAP student receives technical supervision from the industry partner and academic supervision from a university supervisor. At the end of the IAP the industry partner owns the project outcomes while the student also produces an academic thesis on the project which is assessed academically.

The IAP is a formal University course (subject) under the convenorship of a senior academic staff member. The organisation of the IAP is undertaken by a team of IAP co-ordinators under the guidance of the IAP Manager. When the IAP program is not actually running, this management team actively seek out IAP positions for the next cohort of students.

TABLE I
IAP SCHEDULE

Schedule	Activity
October (of year before)	Student briefing on IAP expectations Preparation of CVs
November	Project topic list released Student apply for project(s)
December – January	Students interviewed and selected for project
February	Pre-industry workshops Student and industry partner sign IAP agreement. Agreement assigns IP for the project to the industry partner Student prepares project milestones
February – June	IAP experience
	Regular monitoring of project plan by industry and university
June	IAP Expo Thesis submitted

The operation of the IAP is cooperatively based around the responsibilities of the three partners: the industry partner, the student, and the university.

The responsibilities of the industry partner include such things as:

- To provide resources for the project
- To provide technical supervision for the student (Industry can contract the provision of some technical advice to university)
- To provide a suitable workplace for the student –it is expected to be similar to that provided for commencing engineers. The student should be integrated into the professional culture of organization.

It is not the responsibility of the industry partner to pay the student.

The responsibilities of the student include such things as:

- To manage the project
- To meet the dress and attendance standards of the industry partner.

The responsibilities of the university include such things as:

- To select suitable projects
- To help match students to projects
- To provide academic supervision of students including visiting student in industry placement to ensure both industry partner and student are meeting requirements.

V. EMPLOYMENT OUTCOMES

Approximately 50% of IAP students receive a job offer from the organization with which they are placed. It is not an expectation on an industry partner that they will be employing graduates that year. However after what is effectively a fifteen week interview, many do decide to try and find a position for their student.

VI. AFFECTS ON STRUCTURE

A. Affect on Microelectronic Engineering Program Structure

The position of the IAP in the degree program affects the structure of the proceeding semesters. IAP is undertaken by all students, not just the best. It is a formal part of the program and counts one semesters' credit (and carries one semesters' fees) of the four year, 8 semester, Bachelor of Engineering.

To get the best out of IAP students have to be "industry ready" when they undertake the experience. This means IAP should be taken as late in the technical program as possible. The technically ready requirement implies all core discipline studies have been completed.

The IAP experience teaches students to "fly". By successfully performing in industry the students realise just how well they can do. To get the best out of IAP students should undertake the experience as early as possible so they can leverage their success in their future studies.

The solution adopted by Microelectronic Engineering was to place the IAP in the first semester of final year, with the final semester made up of engineering electives. The positioning of IAP at the beginning of final year means that students must be "industry ready", or ready to carry out a professional engineering project, at the end of their third year rather than at the end of their degree (end of 4^{th} year) in a more conventionally structured program. Instead of having the usual four years to develop the core discipline (technical) skills, students have only the three years before their IAP experience.

This has a major impact on the program structure. Traditionally, Australian professional engineering degree programs have been built around a common, or almost common, first year. In the first year students learn engineering fundamentals while being exposed to the various engineering disciplines. This allows them to make an informed choice of which discipline to follow. Studies of Australian commencing undergraduate engineering students had shown that approximately 50% have not decided which engineering discipline to pursue. In addition much of the development of generic skills (socials skills, communication skills, management and team work) takes place in the first year. The common first year is then followed by three years of technical skill development capped by a project/design course.

Within the Microelectronic engineering program, the IAP took over much of the generic skill development and the role of the project/design course. However technical skills normally taught in final year had to be "pushed forward" into third year, etc. This meant that to keep the same level of technical skill development as amore conventionally structured engineering program, some formal technical skill development, which is specialist to Microelectronic engineering, had to move forward into first year. This necessary inclusion of specialist content in first year, means a common first year with other engineering disciplines was no longer possible.

Another constraint on program structure was that students had to be prepared for IAP in third year. A course in project management and business planning was added to the curriculum.

B. Affect on Combined Engineering Program Structure

When revising and unifying its seven engineering programs for 2007, Griffith University decided to include the IAP in all engineering disciplines. This had a number of impacts on the program structure.

The IAP takes up a whole semester in the program. Staff from other engineering disciplines initially saw this as a semester out of the "teaching program". In actual practice, the IAP replaces a semester of structured learning with a semester of student centred learning where students learn to great depth in a field of interest. While students will have different individual technical knowledge outcomes, they will all have the essential discipline skills along with highly developed generic skills including excellent project management skills.

The most significant impact was on the structure of first year as "essential" discipline content was pushed down into the first year. To meet all the program outcome requirements it was no longer practical to offer a common first year. This meant the issue of catering for undecided students would have to be addressed in another way.

To allow students the opportunity to sample the various engineering options while including core discipline studies in first year has lead to a first structure called phased choice with early specialisation. The phased choice suits the 50% of students still to decide on area of specialisation, while the early specialization suits the other 50% who have already decided. Phased choice occurs with students making an initial choice for first semester between electronic engineering and the other disciplines. They then study three common subjects plus an introductory discipline subject. For second semester they specialize more. At the end of first semester students can change their choice. After second semester they re committed to either electronic engineering or the other disciplines, Those in the "other disciplines" path can backtrack on their choice at the end of second semester.

C. Affect on Three Year Program Structure

Based on the success of the IAP as a WIL program, outcome, the Science, Environment, Engineering and Technology Group of Griffith University has decided to adopt the IAP as the model for formal WIL programs within the Group.

For 2006 the IAP experience was trialed as an elective in the Bachelor of Information Technology. When looking at the inclusion of IAP in three year programs it was felt that taking a whole semester for IAP was not practicable. The decision was made to go with a "half sized" version of that included in the engineering program. A two day per week IAP program was trialed, with the experience occurring in the first semester of the final (third) year [4].

The trial revealed that migrating a successful program from one area to another requires a significant upskilling of all the staff involved. Things that were taken for granted in the engineering school had to be made explicit in IT. There were two major staff issues identified from the trial:

- The need for the discipline expert screening potential projects to develop the understanding, gained through experience, of what makes a good IAP project.
- The need to educate staff about expectations of the academic supervisor's role with IAP. Most staff took the role to be the technical guider of the project rather than the academic pastoral care it is meant to be.

In addition to the staff training needs, there was an obvious need to educate industry as to what makes a good IAP project. Most initial industry projects were more like internships rather than to produce a measurable outcome.

Another major issue was the industry readiness of the students. A significant part of the IAP is management of the project and it was soon realized that the IT students were not as strong in this area as the engineering students. This issue will be solved in future years by the inclusion of formal project management in a second year course.

Based on the experience gained in the 2006 trial, a "half sized' IAP is being offered as an elective to science and environment students in the second semester of final year.

The final semester may not be the best place for students to receive full benefit in their studies from undertaking such a program. However the major imperative is to ensure students undertaking many different majors are all IAP project ready. A potential benefit of the final semester placement of IAP is that it will serve as a transition to professional employment.

The IAP experience is being offered as an elective in the trials while the market is being tested for the availability of suitable industry partners. So far there have been more projects/placements offered than students to take them up.

VII. CONCLUSION

The integration WIL into a degree program has many impacts on the program structure. The positioning of some of the discipline specific content has to be changed to ensure students are project ready. In addition project management skills have to be formally included in the program.

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REFERENCES

[1] Engineers Australia Accreditation Board, "Accreditation Criteria Guidelines", Engineers Australia, 2006 http://www.engineersaustralia.org.au/shadomx/apps/fms/fmsdownload.cfm?file_uuid=0B19D0FF-0BC5-BAC1-DB36-6FB8599DDE67&siteName=ieaust

[2] Industrial Affiliates Program, "What is it?", Griffith University, Australia, 2007 http://www3.griffith.edu.au/03/iap/

[3] Crebert, G, Bates, M., Bell, B., Patrick, C--j, & Cragnolini, V., "Developing generic skills at university, during work placement and in employment: graduates perceptions". *Higher Education Research and Development*, vol 23, no 2, Carfax Publishing, UK, 2004

[4] Webb, F., Howe, C., Vlacic, M., & Patrick, C-j. "Impact of learning environments on student perceptions of industry relevant skills". *Australian Collaborative Education Conference* , September 2006.