



Improving graduate employability skills in the integrated resource sciences

An initiative of the Consortium for Integrated Resource Management (CIRM)

By Rhonda Scoullar and the CIRM Graduate Employability Working Group

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A report prepared by Rhonda Scoullar and the Graduate Employability Working Group*
for the Consortium for Integrated Resource Management

*Membership of the CIRM Graduate Employability Working Group is listed in Appendix 2 of this report.

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Contents

Executive summary	v
1. Introduction	1
2. Scope of this work	4
3. Methodology	5
4. Research findings	7
4.1 Current internship and work placement programs	7
4.1.1 Three models in teaching, medicine and engineering	7
4.1.2 Undergraduate work placement programs within CIRM partners	8
4.1.3 Other examples of work placement and internship programs	8
4.1.4. Cooperative Research Centres' undergraduate programs and scholarships in integrated resource sciences	8
5. Analysis of research findings	9
5.1 Ingredients for skills development programs	9
5.1.1 Commitment to collaborative solutions	9
5.1.2 Need for extended programs	10
5.1.3 Employers support opportunities for improving work readiness	10
5.2 Attributes of current programs	10
5.3 Work integrated learning	12
5.4 Conceptual approach to model design	13
6. Key considerations in progressing a successful model	15
6.1 Overcoming barriers to implementing a model for WIL	17
6.2 Employer expectations	18
6.2.1 Sustainability and capacity of industry to engage	19
6.3 University expectations	20
6.3.1 Cost analyses	21
6.4 Student expectations	22
6.4.1 Maximising student engagement	22
6.5 Student preparedness for successful work placement	23
6.6 Matching work placement with skill development	24
6.7 The changing student cohort and pathways to university	25
6.7.1 Implications of changes in the senior phase of schooling in Queensland	25
6.7.2 Changes to the senior science syllabi	26
6.8 Innovative approaches to university learning	26
7. Key findings and recommendations	28
8. Conclusions	30
9. Appendixes	31
Appendix 1 What is CIRM?	31
Appendix 2 Key participants for developing work placement and internship model	32
Appendix 3 Key themes from discussions/interviews with stakeholders	34
Appendix 4 Survey questions	42
Appendix 5 Three existing work placement and internship models	45
Appendix 6 Industry accreditation	48
Appendix 7 Undergraduate work placement programs within CIRM partners	50
Appendix 8 Excerpt from <i>A National Internship Scheme – discussion paper</i>	53



Executive summary

In 2005 the industry partners of the Consortium for Integrated Resource Management (CIRM)¹ raised concerns that university graduates did not possess the full set of skills needed for future work in natural resource management (NRM). In response, CIRM established a nine-person, academic and industry oriented, multi-agency working group² to identify:

1. likely causes of perceived deficits in the skills of recently-trained graduates and postgraduates, and
2. ways to enhance their work readiness.

The resulting report published in December 2006³ outlined those options most likely to improve the employability of NRM/environmental science graduates. This report can be found on the CIRM website at <www.cirm.org.au>. One option outlined in the report, building practical experience into degree programs, was chosen by CIRM for further analysis with two specific proposals being (a) the development of work placements as part of the course work; and (b) internships with industry partners.

This study examines the strengths and challenges of establishing successful work placements/ internships, and assesses the support for implementing effective models with key stakeholders. Consistent with contemporary terminology the work has adopted integrated resource sciences⁴ to include NRM/environmental sciences, while processes including internships and work placements are classified under a generic term of work integrated learning (WIL)⁵.

This report outlines the study's scope and key findings – including a description of a contemporary model for work placement and internship programs for integrated resource science courses – and makes recommendations for a role for CIRM.

A key finding of this study is that solutions to the dual problems of graduate employability skills and recruitment can be found through greater involvement of employers and students throughout the education process. Having industry partners directly engage with student education and work experience has been shown to improve graduate employability.⁶ Similarly, exposure to the variety of work opportunities available across the sector can assist in the decision process for students when choosing their study and work options.

1 See Appendix 1 for a description of CIRM, its partner organisations and its activities.

2 The CIRM Graduate Employability Working Group was formed in June 2006 and continues to lead this work. It is chaired by Professor Helene Marsh, James Cook University. A list of members appears in Appendix 2.

3 Wright, Amanda et al. (2006) *Options for improving the employability of natural resource management and environmental science graduates in Queensland*, CIRM Occasional Papers, NRW, Brisbane, Qld, Australia.

4 Integrated resource sciences cover a range of courses offered by universities, including agriculture, natural resource management, environmental science and engineering.

5 Work integrated learning (WIL) is the term given to an activity or program that integrates learning with its application in the workplace (< www.rmit.edu.au/bus/acclaw/wil>).

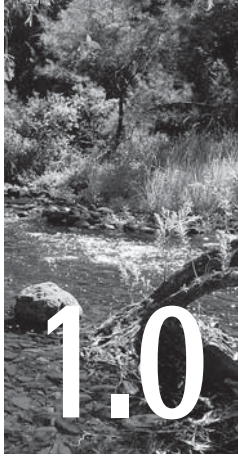
6 Radcliffe, J. (2007) *Tomorrow's agricultural scientists – Meeting industry and resource management needs: A summary of presentations*, SA Division AIAST Conference, Adelaide, March 2007; and Mangione, L., Emmons, L., Carpenter, D., VandeCreek, L., Mellvried, J and Nadkarni, L. (2006) Unique internship structures that expand training opportunities, *Professional Psychology, Research and Practice*, vol. 37(4): 416–422.

Several other findings are fully explored in the report while a number of recommendations have been posed for industry, governments and universities to collectively and individually tackle this challenge.

From this report a set of guidelines, *Guidelines for good practice in work integrated learning for the integrated resource sciences* was developed; these guidelines are available on-line and in print for use by WIL practitioners and other stakeholders.

Recommendations for continued activities by CIRM are:

1. Promote the *Guidelines for good practice in work integrated learning for the integrated resource sciences* to universities, industry and government.
2. Advocate for strategic policy and investment support at all levels of government.
3. Take a strategic role in future discussions related to the integrated resource sciences, including review of the Smart State Innovation Skills Internship Program and the Universities Australia National Internship Scheme discussion paper.
4. Identify and build strategic partnerships with major employers in integrated resource sciences to achieve improved work-readiness of graduates in this sector.
5. Use CIRM's collaborative role and its networks to influence investment in this critical area.
6. Offer a multi-stakeholder, collaborative role in new efforts to coordinate WIL programs across universities.
7. Support existing WIL projects within CIRM partners such as the Griffith University Industrial Affiliates Program or the Co-operative Education for Enterprise Development (CEED) Program, while exploring collaborative opportunities, specifically the Australian Collaborative Education Network (ACEN) WIL project.



Introduction

This report builds on the findings of the previous CIRM report *Options for improving the employability of natural resource management and environmental science graduates in Queensland*, which highlighted the perceived problems of graduate employability skills and suggested a range of options that could address this issue. In that report it was shown that the issue of workforce skills development and enhancement has been a persistent challenge for industry, research institutions, government and community alike, at least for the past 15 years. From a research and government agency perspective, young university graduates seem currently to lack the skills necessary to equip them to be future managers, policy makers, and research and development scientists.

The focus of this paper is on a strategy, via work integrated learning, to address that problem and on the required engagement between industry and the universities for implementation.

Just as in the 2005 analysis by CIRM, the current investigation raised a corresponding and associated issue, the recruitment and retention of science graduates in the integrated resource science fields. While this challenge is dealt with briefly in the section below, it is the challenge of exploring practical strategies to address the perceived skills gap of those entering a career in NRM/environmental science – which is the primary focus of this paper.

Decline in Australia's science knowledge base

While governments strive to accomplish goals in resource management and protection, declining enrolments in resource science-based higher education programs across the nation challenge future workforce capability and stability. Recent reports on science education within Australian universities show a persistent decline in enrolments in science courses relative to all other courses, especially in the traditional enabling sciences such as chemistry, physics and mathematics.¹

In January 2007, *The Australian* newspaper highlighted the serious waning of science education at both secondary and tertiary levels in this country. The following excerpts from reports by education writer Justine Ferrari document some of the problems²:

*The number of school students studying science across the nation has dropped by one-third in five years, and the proportion of university students with a maths qualification is less than half the OECD average (4 January 2007)*³

In turn, this creates a long-term crisis:

*Australia has already lost its scientific knowledge base, creating a problem that will take two decades for the education system to redress (17 January 2007)*⁴

1 Dobson, I. (2004) *Science at the crossroads? The decline of science in Australian higher education*, Paper prepared for the European Association for Institutional Research 2004 Forum, Barcelona, Spain.

2 Quoted in Dobson, I (2007) *Sustaining science: University science in the twenty-first century*, Report for the Australian Council of Deans of Science.

3 Ferrari, J. (2007a) 'Maths, science figure low in students' plans', *The Australian*, 4 January.

4 Ferrari, J. (2007b) '20 Years to fix science', *The Australian*, 17 January.

The result of this is that universities are reducing their entry requirements:

*Studying traditional Chinese medicine, fashion design or sports management at university requires a higher score than undertaking a science degree, fuelling concerns among leading scientists that Australia risks losing its "clever country" status (2 January 2007)*⁵

If economic growth and international competitiveness are to be driven by new knowledge, this decline needs to be halted.

The crisis is only exacerbated as current high levels of employment and remuneration in many industries offer greater choice than in the past to students in their career selection. According to Professor Ian Rae, Director of the Royal Australian Chemical Institute Incorporated, "Science is hard graft to study and as a career. Smart young people know they can work their way up through business and management and achieve salaries and lifestyles that they desire. They make a rational decision in today's society."⁶

Furthermore, the 1945–60 generation of "baby boomers" are either in or approaching retirement. The number of available jobs in the integrated resource sciences is certain to increase dramatically when this generation begins to exit the profession in large numbers from about 2010.

Another problem confronting the integrated resource sciences area is the low recruitment and retention of workers in rural and regional areas; nor are career pathways in the integrated resource sciences clearly enunciated. Professional practitioners in the area tend not to be proactive in promoting the positive aspects of these occupations, or clarifying the variety and scope of interests possible within this field.

The 2006 Australian Government *Audit of science, engineering and technology skills*⁷ shows an escalating demand for graduates in the integrated resource sciences (see Table 1). This clearly illustrates the need to address the issue of improved employability skills and job readiness.

A gap in the set of skills required by employers

While recruitment in this sector is a challenge in itself, one strategy that offers solutions to both the graduate employability skills and recruitment problems is a greater involvement of employers and students throughout the education process. Stakeholders in different resource management sectors indicate that having industry partners directly engage with student education and work experience provides a proven means of improving graduate employability.⁸ Similarly, experience suggests that exposure to the variety of work opportunities available across the sector can assist in the decision process for students when choosing their study and work options.

Changes in curriculum approaches for science degrees are currently under discussion nationwide, with calls for more integration across disciplines, across universities and within the professional community.⁹

5 Ferrari, J. (2007c) 'Science scores mock clever country', *The Australian*, 2 January.

6 Rae, I. in K. Lees (2007) 'Right chemistry missing', *The Weekend Australian*, 29–30 September.

7 Department of Education Science and Training (2006) *Audit of science, engineering and technology skills*, Summary report, DEST, Canberra.

8 Radcliffe, J. (2007) *Tomorrow's agricultural scientists – Meeting industry and resource management needs: A summary of presentations*, SA Division AIAST Conference, Adelaide, March 2007; and Mangione, L., Emmons, L., Carpenter, D., VandeCreek, L., McIlvried, J and Nadkarni, L. (2006) Unique internship structures that expand training opportunities, *Professional Psychology, Research and Practice*, vol. 37(4): 416–422.

9 Hamilton, S. (2004) 'The BSc in Australian universities: Is it providing the best education for our future scientists?' <www.brightminds.uq.edu.au/TRC/papers/paper6.pdf>.

Table 1: Projected employment growth in the agriculture sector, 2004–05 to 2012–13

Category	% change
Environmental studies	45%+
Forestry studies	44%+
Fisheries studies	41%+
Other agriculture and environment	38%+
Horticulture and viticulture	35%+
Agriculture	32%+
Total agriculture	36%+

Traditionally, the so-called "professional degrees" such as engineering, architecture, teaching and medicine have engaged directly with employers, and incorporated practical experience into university programs. The experiences of these sectors can also assist in the identification of mechanisms for change in the corporate cultures of both the universities and the employer bodies in the integrated resource sciences sector.

This experience will be especially relevant since the challenge of improving the employability of graduates is acknowledged nationally. By engaging students early in their studies at both an interdisciplinary and professional level, the intention is to motivate them to complete and continue their studies in the integrated resource sciences, while being work-ready to tackle the challenges of employment.



Scope of this work

This work examines some existing internships/work placements and devises a model for WIL which will directly improve the work readiness of graduates. The inclusion of industry, academics, students and recent graduates in the development of a practice-based learning model, across different institutions, aims to ensure relevance both for industry and for an increasingly diverse student body.

In developing a model consistent with CIRM's principles, the study aims to achieve:

- A better understanding of the needs of employers, of students, and of universities in relation to work placements
- More targeted work placements for future students involved in the integrated resource sciences
- New, more productive, partnerships between universities and employers of integrated resource scientists
- Increased awareness of job opportunities in the integrated resource sciences
- Improved employability of graduates of integrated resource sciences programs.

By formulating a model for context-based higher education learning, the work has a focus on the integrated resource sciences sector, but will have application to other scientific and non-scientific disciplines at both state and national levels.



Methodology

A research approach known as triangulation¹⁰ was chosen. A literature review was followed by a survey, while in-depth interviews and focus groups have refined and compared existing evidence. The CIRM Graduate Employability Working Group has provided leadership and direction for the study.

The study scope was refined at the first focus group meeting held in June 2007, when, drawing on the expertise and experience of those working within work placement and internship programs, it was agreed to:

- Define the parameters of work placement and internships
- Identify strengths and challenges in existing and potential models
- Develop the framework for a model appropriate to integrated resource sciences, including:
 - identifying and engaging partners
 - establishing common goals
 - elucidating appropriate interventions
 - identifying existing models
 - refining the framework to meet specific needs.
- Use work integrated learning (WIL), the generic term for a range of potential activities that engage students with employers and employers with students throughout the degree program. This term is explored fully in Chapter 4.

The approach loosely follows the Australian Engineering Accreditation process, with the following performance indicators:

- enabling skills and knowledge development
- in-depth interdisciplinary competence, and
- personal and professional skills development.

As part of the analysis, key individuals, representatives from government, industry and education sectors were interviewed to identify the essential ingredients for success of work placement strategies. The main points of these discussions can be found in Appendix 3.

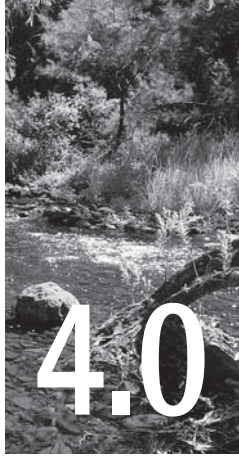
In addition, papers and policies from key organisations and individuals were examined for their relevance and contribution to the objectives of the current study.

This examination was refined by a survey of employers, students and university representatives. Three specific surveys were prepared, one for each of the identified key stakeholder groups. The survey questions for each group can be found in Appendix 4.

¹⁰ Triangulation carries a number of meanings, specifically in social science, one of which is the comparing of results from two or more different methods of data collection or two or more data sources. The researcher looks for patterns of convergence to develop or corroborate an overall interpretation (Blaikie 2000; Neuman 2003; Silverman 2000).

The final tool was refined through comment from CIRM partners and other stakeholders. These were distributed through a number of networks, including CIRM members and partners.

A description of the research findings follows in the next chapter.



Research findings

Many models of work placement and internship exist within the Queensland and Australian tertiary education sectors in professional discipline areas. This section describes existing programs at both undergraduate and graduate level, both from CIRM partner organisations as well as from other institutions.

4.1 Current internship and work placement programs

For the purposes of this discussion, internships are considered as that work experience which contributes to the professional development of a recent graduate. This concept of internship reflects current professional standards, accreditation and registration, which is discussed in more detail in Chapter 6.

An internship may also be considered as an indentured period of time during which a graduate works to redeem the value of an investment by an employer in the form of a scholarship or other financial support for the period of study. This approach is not dissimilar to the cadetship programs offered by governments and large employers in the past. Such programs also ensure a degree of return on investment for the employer.

Interns are historically remunerated at an entry level for the profession, and increase their income over time. This concept has value for students seeking a defined career path and an element of job security upon graduation.

The term "work placement" refers to all other forms of work-based learning undertaken by students during their degree courses.

4.1.1 Three models in teaching, medicine and engineering

In courses such as engineering, law, architecture, teaching, journalism and health-related degrees, work placements are integral and compulsory components of the basic course. Three well established, well documented and embedded models within the teaching institutions and associated professions are:

- Teaching (Queensland College of Teaching)
- Medicine (School of Medicine, University of Queensland)
- Engineering (School of Engineering, University of Queensland).

It is helpful to examine these examples when developing a model for integrated resource sciences, although they should not be seen as a template for the current study. Considered valuable in stimulating ideas and further discussion, they are described in detail in Appendix 5. In this context, work placements and internships do not replace honours or other postgraduate studies.

The teaching and medicine models are relatively homogeneous in both course and work applications, compared to the integrated resource sciences, which cover a vast array of disciplines and workplaces. This dissimilarity is in itself a hurdle for developing a consensus

model, but a flexible model – one that adapts readily to the variations and restrictions imposed by the rintegrated resource sciences employment context – would be workable.

The teaching, medicine and engineering professions also require some form of professional accreditation or registration, the possible value of which is discussed in greater detail in Appendix 6.

4.1.2 Undergraduate work placement programs within CIRM partners

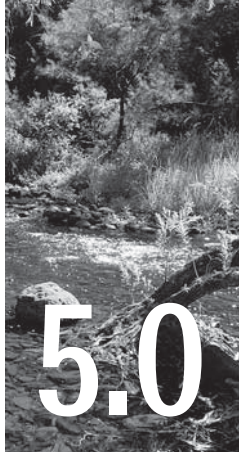
Queensland universities offer a variety of opportunities for both internal and external "real science" experiences within their undergraduate courses. These are outlined in Appendix 7. Many of these programs are an optional rather than compulsory component of the degree program. Reasons for this are explored in a later chapter. CIRM agency partners provide various options to support student participation in the work environment. These are also described in Appendix 7.

4.1.3 Cooperative Research Centres' undergraduate programs and scholarships in integrated resource sciences

Many of the Cooperative Research Centres (CRCs) across Australia offer a range of WIL options. These include scholarship and traineeship opportunities, as well as short work placements, and offered at both undergraduate and post graduate levels. Lack of continuity may be a problem with these partners, as they have a defined time frame of operation. Details of current programs can be found on the CRC website: <www.crc.gov.au/Information/default.aspx>.

4.1.4 Other examples of work placement and internship programs

Although there is no coordinated approach to work experience programs across the integrated resource sciences, there are many ad hoc projects operating across the tertiary education sector. The learnings from a number of programs across Australia have contributed to the development of the model in this report.



Analysis of research findings

5.1 Ingredients for skills development programs

The process of determining the key ingredients for successful skills development programs and strategies resulted in the emergence of several common themes. These are outlined below.

5.1.1 Commitment to collaborative solutions

- There is an increasing awareness across government, industry and universities that programs to improve the work readiness of graduates need to be implemented.
- Opportunities for scholarships, particularly for internships, exist and are expanding in both business and government organisations.
- Governments at all levels are keen to support and progress these developments.
- There is benefit in interdisciplinary and varied work experience for improving the skills of the student.
- Mechanisms for improving engagement between universities and employers need to be given a high priority.

At a 2004 conference held at the University of Queensland, options for improving science teaching in Australian universities¹¹ were specifically explored, while Hamilton (2004)¹² called for strong interdisciplinary and collaborative approaches to subject and course design and selection.

These views are reiterated in the policies of several government departments. The Australian Department of Agriculture, Fisheries and Forestry (DAFF) identifies activity areas for capacity building in natural resource management to include:

- Development of tools for the identification of skills and knowledge gaps
- Development of new, and modification of existing, training materials and
- Strategic delivery of training based on identified skills and knowledge gaps and strategic partnerships with training, industry etc.¹³

The Department of Education, Science and Training (DEST) has also identified training as significant in attracting and retaining graduates with science, engineering and technology (SET) skills¹⁴. They identify the importance of developing linkages between the main stakeholders as a major focus for support.

11 Mattick, L. and M. McManus (2004) 'Science teaching and research: Which way forward for Australian universities?' <www.brightminds.uq.edu.au/TRC/downloads/Conference_Report_May_05.pdf>.

12 Hamilton, S. (2004) 'The BSC in Australian universities: Is it providing the best education for our future scientists?' <www.brightminds.uq.edu.au/TRC/papers/paper6.pdf>.

13 Department of Agriculture, Fisheries and Forestry (2006) National natural resource management capacity building framework, <www.daff.gov.au/_data/assets/pdf_file/0018/29106/capacity-building-framework.pdf>.

14 Department of Education Science and Training (2006) Science, engineering and technology skills audit summary report <www.dest.gov.au/NR/rdonlyres/AFD7055F-ED87-47CB-82DD-3BED108CBB7C/13065/SETSAsummaryreport.pdf>.

The Government recognises the importance of collaboration to increase 'interconnectedness' of the system and provide more varied pathways for research to be used and commercialised. A fundamental objective of "Backing Australia's Ability" has been to boost collaboration between the key players in the innovation system: business, universities and publicly funded research agencies.

The Queensland Government also identified similar needs when in 2005 it launched the Smart State University Internships Funding Program for universities to create new or enhance existing industry internship programs for science, engineering and technology undergraduate students. This program assisted undergraduate students in the science, engineering and technology disciplines to develop work-ready skills through industry internship placements. This program is to be reviewed in 2008.

Several other Queensland Government agencies – including CIRM partners, Natural Resources and Water, Primary Industries and Fisheries and the Environmental Protection Agency – are also offering a range of scholarships and graduate programs to encourage students to work in the identified areas of specific skills shortages as previously outlined.

5.1.2 Need for extended programs

Existing scholarship schemes tend to target only a narrow student group, and are few in number and uptake. To be truly effective, work-based programs need to be broad-based and sustainable to cater for as many students as possible within the disciplines, notwithstanding the problems of placement availability within the employer group, which are discussed in Chapter 6.

5.1.3 Employers support opportunities for improving work readiness

Survey responses, although not statistically significant, indicated a strong commitment from employers to participate in and contribute to improving graduate work readiness. The findings from employer survey responses reinforce the subsequent focus group views and are summarised below:

- Employers strongly supported the concept of some element of work experience being included in university science courses.
- Work placements should be compulsory components of the degree program.
- There was general support for paid internships as a pre-employment activity.
- Employers were willing to work with universities to contribute to course development.
- There was general support for the development of an accreditation body for the integrated resource sciences.
- There was no clear preferred time of year across all employers for activities. Schedules would need to be negotiated on an individual basis.

5.2 Attributes of current programs

The desktop investigation identified attributes for success in current internships and work placements in a wide range of disciplines. These appear in summary form in Table 2 and are based on an analysis of those programs listed earlier in this report.

Table 2: Attributes of existing, successful work placements and internships

Attributes common to both work placements and internships	
<ul style="list-style-type: none"> • Offer high levels of independence wherein students can take full responsibility for a project in a supported environment. • Create opportunity for student/graduate to develop professional identity within chosen profession. • Support and supervising/mentoring the work of each student provided by the host management and the institution's adviser. • Provide companies with the opportunity to observe the student's performance as a potential employee. • Contribute specialist or generalist skills to the organisation's day-to-day operations. 	
Attributes of work placements	Attributes of Internships
<p>Generally compulsory professional experience during which students plan, implement and evaluate a program under the supervision of their mentor, work placements:</p> <ul style="list-style-type: none"> • Provide sufficient experience to enable students to develop the required knowledge, skills and attributes, and provide adequate opportunities to demonstrate attainment of these against agreed performance indicators. • Are carried out assisting, or under the immediate direction of, a professional supervisor. • May be quite structured and project-based or may be any work, including work of a manual or technical nature, carried out in a relevant environment. • May require students to source this work experience themselves. • Usually have an agreed equivalent in credit value to standard courses for projects undertaken. • May be paid or unpaid. • May be part-time or full-time. 	<p>Usually closely aligned with induction into a profession, internships:</p> <ul style="list-style-type: none"> • Require the institution to attest to each student's fitness to undertake an internship with the support of a mentor. • Provide collegial workplace support to the student. • Require responsibility for the oversight and management of the programs by assigned mentors • May be limited to a proportion of full-time equivalent workload. • May permit students to work in specified area(s) only. • May vary from 2 to 12 months duration. • May provide professional experience after successfully completing the required minimum of academic studies and experience of an undergraduate program. • May expose the graduate to a range of work situations and environments as part of the initial on-the-job apprenticeship-style training process. • May require successful completion for professional registration.

5.3 Work integrated learning evaluated

A meeting in June 2007, hosted by CIRM, brought together key external stakeholders including CIRM Graduate Employability Working Group members, those workshop members contributing to CIRM's 2006 study and other key contributors (see Appendix 2). The purpose was to identify both major attributes for and impediments to achieving an effective work placement/internship model suitable to the integrated resource sciences.

The key outcomes from this meeting are summarised in Table 3.

These findings reinforce the opinions expressed in other university programs and as clearly enunciated in the Flinders University model, which can be found at: <<http://www.flinders.edu.au/teach/t4l/practicum/examples/bestpractice.php>>.

Table 3: An evaluation of work integrated learning (WIL)

Value of WIL	Impediments to WIL	Attributes for success
<ul style="list-style-type: none"> • Significant improvement of student outcomes • Improved communication between employers and universities • Value placed on student learning by all stakeholders • Transfer of knowledge between universities and industry • Positive cost benefit to employers and can create jobs through innovation • Develops professional elements of work and personal development 	<ul style="list-style-type: none"> • Sustainability and capacity of industry • University course structure • Employer acceptance and expectations • Bridging theory and practice • Costs to students • Maintaining academic rigour 	<ul style="list-style-type: none"> • Prior preparation of student for work placement • Develops relationships between employers and universities • Industry input into curriculum design • Compulsory component of course • No financial cost to the university • Student input value greater than industry costs • Increased professional recognition • Clarity of agreement between parties

5.4 Conceptual approach to model design

As the final outcome of the June 2007 meeting, a conceptual approach was proposed to aid the design of a work placement/internship model suitable to the integrated resource sciences. This is described in Figure 1 and has the following components:

- Horizontal integration across universities and industry
- Vertical integration throughout the degree process
- Increased student contribution over time
- Flexibility to adapt and evolve as necessary
- Continued involvement and mentoring etc. by university.

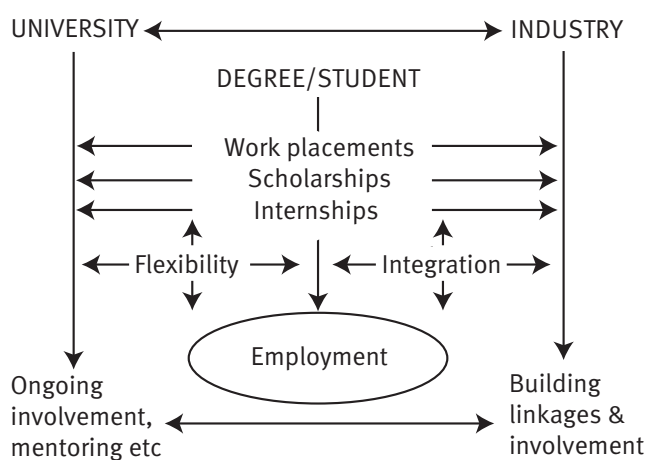


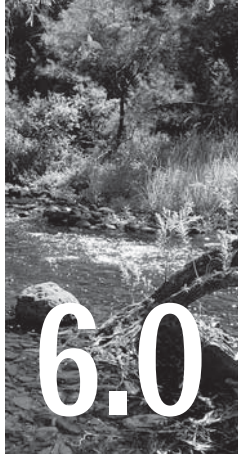
Figure 1: Conceptual approach describing integration within work integrated learning derived from focus group meeting

Critical to the success of this conceptual approach is the early participation by the employer, continued mentoring by the university, and increasing acceptance of the student into the professional community. This approach requires some curriculum changes by universities, and a clear definition of intent and expected outcomes by all parties. The concept is not unique or exceptionally radical but encapsulates much knowledge from experiences gained through practical engagement with WIL programs by numerous contributors.

Using this conceptual approach, the design of the model can include variations between organisations and disciplines, as well as regional differences and requirements. Table 4 describes components that may enhance the usefulness of the model for the major stakeholders and will be explored in more detail in Chapter 6.

Table 4: Desirable components of a practical WIL program

Student	Employer	University
Credit value toward degree	Significant input to project design	Academic validation
Financial assistance	Value greater than cost	Funding-neutral
Identify career direction	Opportunity to assess future employees	Provide basis for theoretical learning
Practical application of learnt skills and theory	Input of new ideas and technologies	Opportunity to field test new concepts
Connect to professional community	Promote professional standards	Enhance professional value
Valued input	Valued service	Valued industry links
Contribute new ideas and applications in a real-world context	Opportunity to partner with universities for research and development programs	Opportunity for research partnerships with industry and agencies



Key considerations in progressing a successful model

Some practical aspects for implementing a work integrated learning program based on the experience of many practitioners are summarised in Table 5.

Table 5: Practical aspects related to the implementation of WIL programs

Feature		
Various approaches to WIL	<p><i>Work placements</i></p> <p>Work following from 1st year: unpaid or paid; ½ or 1 day per week; 1 semester or whole year</p> <p>Summer semester work experience: hands on paid/unpaid work, including labour; not accredited subject or minor accreditation for later work; not graded; between 1st & 2nd year</p> <p>One semester work placement: 12 weeks, 1 or 2 day per week; accredited subject with graded project/thesis report; 2nd semester, 2nd year or 1st semester 3rd year; unpaid or paid</p> <p>8 weeks summer semester work placement/ paid work: accreditation for course based on project report/thesis</p> <p>Voluntary work experience: unpaid, and not for credit</p>	<p><i>Internships</i></p> <p>Internship on completion of final exams: 3 months to 1 year unpaid or paid at base level; may include many aspects of work</p> <p>Internship as part of final year course requirements: project-based alternative to practical course requirements</p> <p>Internship component of professional accreditation</p>
Common implementation processes for WIL	<ul style="list-style-type: none"> • May be elective or core part of student's academic program • May be undertaken during summer break and/or semester time if integral to the completion of the undergraduate program • May be a selection process based on the student's academic record and an interview • May or may not be remuneration for the work performed by the student • May be a fee payable by the placement organisations to participate in the scheme 	

Feature	
Elements of model implementation	<ul style="list-style-type: none"> • Course and curriculum design to incorporate work experience options • Project group needed to ensure all stakeholder interests are addressed • Identify appropriate areas to incorporate work placements • Develop mentoring and assessment procedures • Identify processes for alerting employers to program • Develop position description for employers to assist in project development and assessment • Help with supervision procedures • Establish communication procedures to project coordinators and mentors
Common impediments to WIL	<p>Resources:</p> <ol style="list-style-type: none"> 1. Time – supervisor, employer, student 2. Course commitments – university, supervisor, student 3. Costs – university, employer, student 4. Availability – employer 5. Skills – supervisor, student, employer <p>Workplace health and safety issues Quarantine and biosecurity issues Insurance cover –May be the responsibility of the University or the employer depending on type of placement undertaken. Must be clearly established. Location related issues:</p> <ol style="list-style-type: none"> 1. Metropolitan, regional, remote 2. Transport 3. Accommodation
Funding options	Employer (e.g. CEED); Paid employment (e.g. CEED, CRCs, government graduate programs); Scholarships (e.g. Smart State; CEED; CRCs; government graduate programs); Commonwealth grants; University (e.g. Griffith Industrial Affiliates Program)

Factors that will influence the successful outcome of any model include a commitment by the professional community to support student members, the willingness of the academic community to accept input from industry and the capacity for the student to undertake work placements without financial disadvantage. In addition, the work of the student must be valued by both the university and the employer. The significance of these factors will vary depending on the nature of the WIL, whether it is undertaken during or post the degree course and if it has credit point value or leads to professional accreditation. The influence of these factors will vary depending on the type of WIL, whether it is during or post the degree, if it has credit point value or leads to professional accreditation. The work of the student must be valued by both the university and the employer.

By incorporating (i) the conceptual approach described in Figure 1 with (ii) the desirable characteristics identified, and taking into account (iii) the identified impediments to success, a structure can then be developed. Some of the key issues and opportunities arising when building the resulting model are examined below.

6.1 Overcoming barriers to implementing a model for WIL

An analysis of the impediments to successful WIL models highlighted some common threads across disciplines, and some unique to particular industries. Generic obstacles include the following:

1. Resources:

- Time – All stakeholders (supervisors, employers, students) have competing demands from other activities.
- Course commitments – There are specific expectations of the course loads and outcomes and by the university, supervisors and students.
- Costs – The expense of WIL programs has different implications for each of the stakeholders, but these are significant at each level.
- Availability – As more courses adopt WIL programs the demands on employers become quite significant. The competition will be more intense in regional areas which suffer from fewer and more temporally variable employment opportunities. A corollary to this is that some locations such as the Great Barrier Reef and Wet Tropics environments are considered desirable by numerous universities as they offer unique research and training opportunities.
- Skills – The skills of the supervisor, student and employer to engage in WIL programs will vary extensively. For success, the skills mix should be established prior to any work placement activity.

2. *Workplace health and safety issues need to be addressed prior to and during any WIL program.* It is essential that students are aware of the significance of these matters before entering a workplace, and that the importance of work safety is reinforced and is location-specific. Insurance cover also requires attention in constructing a WIL program. In accredited WIL programs this should be part of the agreement. However, in the case of independent arrangements or voluntary work experience, all parties should be aware of their obligations and rights in this area.

3. *Quarantine and biosecurity issues may be location-specific or relevant in areas of interest within integrated resources sciences.* The requirements pertaining to locations and workplaces need to be clearly identified prior to any WIL commitment.

4. *The location of the workplace may be critical.* Due to the nature of integrated resource sciences, much of the work is undertaken outside metropolitan areas. Employment may be in regional cities and towns or rural and remote locales. This creates distinctive problems for stakeholders and requires creative solutions. Some of the most relevant issues include:

- Transport – How do students and supervisors get to the work sites? Some students may not have any private means of transport, and there may be no public transport available. Some students may not have driving licences.
- Accommodation – What type of accommodation is available and what are the associated costs? In some of the more rural and remote locations, accommodation is supplied by the employer. However, in regional towns and cities this is less likely, yet the students may have to absorb additional expenses compared to their regular living arrangements.
- Current employment commitments of students – Many students now work increasingly long hours to support their studies and their lifestyles. This issue is discussed in detail in section 6.4.

These problems are not insurmountable, but require clear definition and solutions prior to committing to WIL projects. Some of these problems may be resolved at a generic level whereas others will require specific responses.

Given these circumstances an integrated, state-wide approach to WIL in the integrated resource sciences would deliver firm benefits. It would provide for input and expertise from a wide range

of contributors, achieving solutions at both macro and local levels. This integrated approach would benefit from the *Guidelines for good practice in work integrated learning for the integrated resource sciences*, the final output from this study, which complements this report.

Specific impediments will be encountered by each of the stakeholders, and will need attention in the program development. Some of these are outlined in the next section.

Employer-related challenges include:

- Capacity and sustainability of industry participants
- Employer acceptance and expectations of model
- Different "fits" in university–industry interface
- Different employment realities across industries
- Differing employer acceptance of embedding model into work place
- Challenge of effective promotion of agencies as an attractive employment option within integrated resource sciences
- Realistic expectations by industry of subject grade¹⁵ achievement by students they sponsor.

Major considerations for the universities include:

- Maintaining academic rigour
- Assessment demands and expectations
- Costs of implementation
- Course flexibility at university
- Likelihood of incentives to rearrange course
- Maintaining course throughout enrolment fluctuations
- Bridging theory and practice.

For students, barriers include:

- Costs to participate in program
- Achieving sufficient credit towards final degree
- Loss of income if dependent on part-time work
- Uncertain benefits for professional and career advancement.

The barriers/challenges described above are issues that need immediate consideration, are likely to remain in part at least as impediments to any model uptake, and will require regular review. Those which assume special significance in achieving a successful WIL model are dealt with in greater detail in the next section.

6.2 Employer expectations

In many professions work placements and internships are accepted and embedded within the professional culture but this is not so in the integrated resource sciences. To effect change, both professional bodies and employers must take responsibility to communicate effectively with education providers to describe the changing requirements of their employment sector. The benefits of WIL for employers must be explicitly and positively presented to advocate adoption of the program.

¹⁵ WIL coordinators' experience suggests that industry expects high grades from their students although the reasons have not been explored fully and are not clear.

There needs to be clear and regular dialogue between the parties involved and strong, positive relationships between sectors should be sought, in an effort to avoid any disconnect described thus: "universities were often seen as agribusiness (sic) user unfriendly" (Thomas, 2007)¹⁶. This view is reinforced by Hay¹⁷ whose experience suggests that the university organisational structure and departmentalisation does not make approaches for collaboration by industry clear or simple.

This study clearly identifies the university expectation that industry needs to lead the demand for curriculum enhancement and the inclusion of WIL programs. Industry, too, is clear and agreeable about their commitment, as long as the value of the program outweighs the actual costs involved.

One area where industry can benefit from involvement is the exposure to universities and the ability to progress partnerships, especially in areas of research and research grant funding availability. Work integrated learning should be seen as:

An opportunity to grow business potential with very little outlay while employing inventive, industrious students who want to maximise their exposure to new industries and technology (Stephen Sushames, DataShield)¹⁸

Opportunities to enhance communication should be sought at all levels. Any perception of "siloining" should be eliminated. There is an opening here for government agencies and professional organisations to broker the development of relationships across industry and education. These bodies have a greater capacity to deliver on such objectives. However, negotiations can only proceed with a clear conviction of the benefits in such partnerships, and these can be identified and defined in the development of guidelines for the program. The Co-operative Education for Enterprise Development Program¹⁹ identifies the following as some of the specific benefits to employers:

- Ownership of the project results (and intellectual property)
- Access to university staff and physical resources, in a routine and businesslike manner
- Costs are predetermined, contained and commercially competitive.

The expectation by employers that students participating in WIL projects will achieve high grades is, in fact, a double-edged sword. Evidence suggests that students who do take part in such programs do consistently improve their credit point average. However, there is no guarantee that this will be the case in all situations. Employers need to be assured that there is no expectation of them to be responsible for improved grades, while at the same time ensuring that the quality of the work is maintained.

6.2.1 Sustainability and capacity of industry to engage

Some industries and professions, often the larger agencies and companies, have well established relationships with the relevant educational institutions. However, the relationships may reflect the current state of the economy. In buoyant economic times, such as the present "resources boom", companies are able to invest the resources required to attract and retain graduates and to absorb the costs of new employee training to work-ready levels. And, even through economic lows, government agencies and large companies will generally accommodate the costs for the longer-term benefits and effectiveness of the process. In addition, governments have a well-recognised and accepted responsibility to contribute to the long-term sustainability of

16 Thomas, A (2007) 'Agribusiness and the new graduate' in J. Radcliffe, *Tomorrow's agricultural scientists – Meeting industry and resource management needs: A summary of presentations*, SA Division AIAST Conference, Adelaide, March 2007.

17 Mick Hay, Director, Rimfire Resources (2007) pers. comm. (see Appendix 3).

18 <<http://www.griffith.edu.au/industrial-affiliates-program/partnerships-collaboration>>

19 <<http://www.corptech.com.au/aboutCeed.asp>>

environmental and economic wellbeing through a variety of policies including graduate and staff support programs.

Smaller organisations, such as environmental and resource management consultants or agricultural companies particularly in regional and rural industries, have less capacity and resources to sustain such policies and partnerships at the human and financial resources levels, including hidden costs such as insurance, workplace health and safety and biosecurity compliance. In these cases alternative processes need to be found to ensure that employment capacity in the integrated resource sciences is not driven only by external factors such as a resource sector boom.

It has been stated that the capacity of industry to carry the costs of introducing WIL into the resource sciences varies depending on the size of the organisation. However the cost of *not* introducing such processes may be greater in an economic and social context.

An assessment of the specific needs and limitations for employment from regional NRM bodies, rural industry peak bodies and local councils, etc., is vital to devise relevant solutions. One of those solutions to better prepare students for work in this area is to consider partnerships with vocational education and training programs at local TAFE colleges and at other campuses and institutions, such as the Australian Agricultural College Corporation, with the potential to fill specific gaps in the curriculum. This concept is explored later in this chapter.

The perceived attitude of new graduates towards their first job, seen often as just a stepping stone to another, preferred position or indeed a means of paying for an overseas experience or HECS debt is an associated disincentive to employers. Most employers in the integrated resource sciences expect some degree of employee loyalty in return for their expenditure. The idea of new staff bonds is a likely solution to this emerging reality.

Practical work integrated learning also presents an opportunity to employers and universities to engage with Indigenous communities to establish relationships of mutual benefit and to encourage young people to enter relevant university courses with direct benefit and links to their natural and cultural heritage.

6.3 University expectations

A major consideration for the university partners is retaining academic integrity within project content. It is clear from this study that rigorous educational control must reside with the educational institutions. This requires close association with industry in the development of curricula, and clearly spelt out criteria and requirements for acceptable projects.

A component of this rigour is assessment. Projects undertaken in a workplace may not be totally within the areas of expertise of the university course coordinator, and to overcome this problem the assessment criteria must also be clear and unambiguous. All parties need to understand the importance of the quality and standardisation of assessment.

Course structures at university may be relatively inflexible, and may take considerable time to reorganise. This factor will vary depending on the nature of the course and the organisation. It should be explicit that the introduction of new courses and new approaches will take considerable time to implement and integrate into the degree program. It may require discussion with industry and graduates to provide sufficient incentive to the universities to rearrange their products.

Another potential hindrance which might confront the university sector is the ability and necessity to maintain courses throughout enrolment fluctuations. It frequently reflects the

current economic conditions and the perceived future employability by the student or the community as a whole. An example of this is the current decline in enrolments in agricultural science, due in part to the view that employment in time of drought is reduced. Universities have difficulty in maintaining courses when confronted by these realities. Industry has a role in part in ensuring that correct and reliable information is circulated through the greater community, particularly where it may influence the decision of school students in future study.

From the university perspective, the significant benefit of WIL is providing student opportunities for bridging theory and practice. Finding appropriate placements for this purpose may be problematic where there are limited employment sources. The rationale for the experience may need to be revisited to broaden the terms of engagement. Opportunities for practical experience may exist, or be simulated within the classroom situation. However, in such circumstances all efforts must be made to ensure the authenticity of the experience. Practical work is an integral component of all science degrees.

6.3.1 Cost analyses

A consistent theme in this study has related to the cost of introducing WIL projects, and the limited capacity, particularly within universities to absorb such expenditure.

Universities Australia²⁰ proposes a model summarised in Table 6 for cost-effective introduction of WIL programs into university courses through a national internship scheme:

Table 6: Approximate costs and benefits of a national internship scheme (Universities Australia 2007)

Budget cost and public benefits	
<i>National internship scheme</i>	<i>Cost estimate</i>
80 internship officers working centrally as coordinators in industry, community associations and universities	\$12 m annually in direct and on-costs
Each university creates a sub-Dean role in each individual faculty or school (say 10) with liaison responsibilities, and offered higher duties payment for such administration and for liaison on curriculum and placement and wherever appropriate	\$10,000 per sub-Dean per annum, plus support costs, giving a total annual cost of \$5.7 m
A 10% wage subsidy to employers for interns	\$105 m annually. Again, an administrative cost component would be incurred.
Benefit to government budget	
<i>Cost saving</i>	
Reduced direct income support costs to the Commonwealth under existing support arrangements such as Austudy.	\$213 m based on 30% of current support recipients
Benefit to industry	
Reduced skill shortages and enhanced productivity assessed at a 15% improvement or margin in commencing graduate earnings for ex-interns	\$330 m annually per cohort for the first year post-graduation; and perhaps a 7.5% margin in second year post-graduation equalling \$165 m, or a total of \$495 m per intern cohort
Total estimated cost saving	\$585.3m per intern cohort

²⁰ Universities Australia (2007) *A national internship scheme*, <<http://www.universitiesaustralia.edu.au/documents/publications/discussion/A-National-Internship-Scheme.pdf>>

The initial set up costs of such a scheme are greatly outweighed by the long-term benefits to government, industry and society. The cost-benefits ratio of the scheme is well within the guidelines for public investment in such a venture. Other aspects of the scheme include ongoing relationships between business and universities, greatly enhancing the productivity of both sectors.

The full discussion paper is available at the Universities Australia web site, and the processes for estimating these figures are spelt out in more detail in Appendix 8.

6.4 Student expectations

Krause et al. (2005)²¹ studied first year students at universities over a ten-year period (1994-2004), including an exploration of why students chose their particular field of study. Their results show that interest in the field and improved job prospects have remained the key reasons for course selection, remaining relatively unchanged since 1994.

The Krause study also confirmed that course costs remain a major concern for students.

The last decade has seen full-time students progressively spending fewer days on average on campus and reduced hours in class each week (17.6 hours per week in 1994 compared with 15.9 hours per week a decade later). This trend is accompanied by a significant rise in the proportion of full-time students committed to paid employment (47% in 1994 compared with 55% in 2004).

In these circumstances, the allocation of time to participate in a work placement could mean loss of income and financial disadvantage, particularly if the student is required to relocate to undertake the work experience and therefore cannot continue to attend their regular job. However, the intrinsic value of the experience of real work should also be considered.

Other costs are likely to exist when undertaking work experience, some of which have been discussed earlier, including transport and accommodation. In these instances the value of scholarships or paid work becomes critical.

A successful program needs clear pathways and advantages for professional and career development. Students are more likely to participate if the experience contributes credit towards the final degree. Other strategies for success are investigated in the next section.

6.4.1 Maximising student engagement

In modern educational practice there is an increasing expectation by students to be more involved with learning practices. At all levels of education students are no longer passive participants.

Building exposure to real-world experiences into the program increases student engagement and can positively change student attitudes, helping them to interact more effectively with others and with their studies. Practical participation, in effect, helps to "get them in and keep them".

The potential for enhancing Indigenous involvement in resource management sciences should be explored to its full extent. Much of the landscape subject to research and management is closely linked to Indigenous heritage and culture, and the study would benefit from active participation with these communities.

²¹ Krause, K., Hartley, R., James, R. and McInnis, C. (2005) *The first year experience in Australian universities: Findings from a decade of national studies*, Department of Education, Science and Training.

6.5 Student preparedness for successful work placement

Student preparation prior to undertaking work placement activities has been widely recognised as an important step to good practice. A study by Cullen²² identified twelve essential competencies required by environmental science graduates, derived from the examination of position descriptions for graduates who participated in a cooperative education program. These competencies are outlined in Table 7.

This reflects *Longitudinal Survey of Australian Youth* (LSAY) data, which listed generic employability skills.²³ Some of these competencies may be achieved by developing a series of core skills or work-enabling courses initiated within the universities, such as:

- Communication skill development
- Team-building processes
- Problem-solving approaches
- Project management processes
- Workplace literacy
- Assertiveness and confidence training
- Workplace health and safety knowledge
- Legal and ethical obligations and responsibilities
- Cultural awareness and values.

Initial contact between employers and students could involve guest lectures and workplace visits. Exposing students to a range of options at this stage can help generate ideas for career paths.

Some aspects of the practical competencies required for a career in resource management are outside the prior experience of most students and the jurisdiction of the institutions. These skills may include use of boats, heavy machinery or industry-specific equipment, particularly in non-metropolitan areas. Some students may have a rural background and/or be familiar with these activities, but most will not. Similarly, while some organisations have the capacity to induct new graduates in these areas, others do not.

There may be an opportunity to develop partnerships with vocational education providers to supplement the academic course content. For example, the Australian Agricultural College Corporation²⁴ (AACC) has facilities at five campuses across Queensland that could offer residential course components for skills-based activities. Universities could negotiate certificate level qualifications to complement the degree programs.

To provide alternative pathways for practical experience in, for example, veterinary and agricultural science, students have opportunities for structured work in commercial scale operations at AACC campuses. AACC also offers courses in practical conservation and land management. Natural resource management activities involve a lot of work at a practical and technical level outside the capacity of the universities. Students gain qualifications, such as Certificate II or III in natural resource management or environmental studies. The possibility also

22 Cullen, M. (undated) *The role of cooperative education in developing environmental science skills*, School of Environmental Science and Management, Southern Cross University, Lismore.

23 The Longitudinal Survey of Australian Youth (LSAY) has been conducted at three-yearly intervals since 1995. The survey interviews participants from 15 years of age in the first cohort, adding new participants each period. This data is reported in Precision Consultancy (2007) *Graduate employability skills*, prepared for BIHECC, DEST <<http://www.dest.gov.au/NR/rdonlyres/E58EFDBE-BA83-430E-A541-2E91BCB59DF1/18858/GraduateEmployabilitySkillsFINALREPORT.pdf>>. Comprehensive data can be found at <http://www.ncver.edu.au/publications/search.html?breadth=all&searchwords=&search_title=All%20LSAY%20publications&criteria=any&findpubtypes=All&sources=LSAY&lsaypage=brief&submit=Search>.

24 <<http://www.agriculturalcollege.qld.edu.au/>>

Table 7: Summary of essential competencies required for environmental science graduate placements (Cullen, undated)

Essential competencies required	Number
Communication skills	34
Practical skills (e.g. car licence, boat licence, first aid etc.)	28
Computing skills (other than GIS)	19
Knowledge of government, legislation and regulations, safety and ethics	18
Project planning and implementation, including time management	16
Flora/fauna survey skills	12
Ability to work in a team	10
Interest and/or awareness in general area	11
Ability to work independently	8
GIS skills	6
Workplace issues – appearance, punctuality, confidentiality	4
Social survey skills	4
Total number of instances where required in position descriptions	136

exists for graduate certificates or diplomas similar to those for teaching qualifications. This path may then lead to defining professional accreditation schemes (see Appendix 6).

The Queensland Rural Industry Training Council (QRITC) is developing a range of new projects based on promoting "cluster" approaches to skill development, as well as expanding its role in the brokerage of training packages for rural industry. Among their targeted projects are natural resource management and environmental conservation training for Indigenous communities in Cape York. Links with this organisation could help to foster a two way sharing of course development and unit accreditation at university level.

6.6 Matching work placement with skill development

As students progress through their studies, the possibility to engage more meaningfully with the employer increases. With adequate preparation, students should be able to play a useful role within a workplace towards the end of their second year of undergraduate study. Short term placements should prepare students for longer-term commitments in later years. The tasks assigned should be relevant and achievable within the time available. However, while jobs should be within a specific work environment, they may not necessarily be directly associated with professional duties. This correlates to the model of professional placements within engineering degrees. Options for initial work experience could include:

1. Short block participation during semester of, say, 2 weeks in work situations; assessment based on journal and report
2. One or half day placements in the workplace over one term or semester; assessment as for 1, above
3. Vacation work placement, time frame and assessment negotiable, based on expectations of participating stakeholders
4. Variations and combinations of the above scenarios may be useful.

In the final year(s) of study, greater depth of understanding by the student and a contribution to their profession of choice should exist. At this stage, a specific project can be assigned with

parameters agreed by all stakeholders requiring the supervision of a professional practitioner and mentoring by the university coordinator.

Options for extended professional placements include:

1. Block placement (term or semester) for designated project; significant report expected for assessment purposes; subject credit value to be determined
2. Vacation placement as above; less flexible than block placements
3. Part-time placements (one day at a time, or more, to be determined) over whole year; assessment as for block placement
4. Voluntary or paid work experience at student/employer discretion.

The nature of integrated resource science activities may dictate that the student spends time in regional or remote locations, out of direct contact with their academic advisor. Placements for credit occurring over vacation periods also have specific problems relating to academic control and assessment. Guidelines must therefore be established to deal with contingencies in these circumstances.

An example of engagement with and exposure to potential employers is demonstrated through the Grad-Link program organised nationally by Rimfire Resources²⁵. This one-day workshop allows selected final-year students to participate in a highly targeted career event with industry-specific employers. Evidence suggests that from this workshop about 25–30% of students obtain employment, while the other participants benefit by gaining knowledge about the potential careers and opportunities available in their chosen area.

6.7 The changing student cohort and pathways to university

Education from prep to university is a constantly evolving process, and the culture and society in which the students develop is also changing at an increasing rate. To cope with and adapt to these changes educators need to be familiar with the processes occurring across the full spectrum of the education sectors, particularly those concerned with the transition phases.

6.7.1 Implications of changes in the senior phase of schooling in Queensland

From 2006, changes have occurred within senior learning in Queensland secondary schools that may begin to impact on university entrance from 2008.²⁶ The following excerpt from the Education Queensland web site describes the new arrangements:

The new senior phase of learning provides young people with more options and flexibility for completing Years 11 and 12, or their equivalent.

During this time young people can mix and match a range of learning options including:

- *programs undertaken at school*
- *vocational education and training at TAFE or with another registered training organisation*
- *university subjects*
- *an apprenticeship or traineeship (including school-based apprenticeships and traineeships)*
- *employment skills development programs.*

²⁵ See Mick Hay's comments, Appendix 3.

²⁶ <<http://education.qld.gov.au/etrf/senior-options.html>>

The new Queensland Certificate of Education also recognises a broader range of learning which can be counted towards a qualification.

The Queensland Studies Authority has developed a discussion paper²⁷ to invite responses to the new legislation (Education and Training Reforms for the Future) and clearly outlines the need for readdressing the present pathways to tertiary education. There will be greater options for tertiary entrance than presently available to most students. This may result in students entering university with a greater practical experience and wider range of skills than has been the case in the past.

Many of the alternate pathways to university may include significant elements of work-related learning and tertiary courses will need to include a progressive sequence of experiences throughout their programs. Students are increasingly expecting that there should be a concrete return for the cost of obtaining a university qualification. The general expectation of the current generation for a defined but varied career path is also a significant factor influencing which discipline is chosen.

6.7.2 Changes to the senior science syllabi

All Queensland senior science syllabi will undergo changes from 2008. A significant component of the subjects will include one or more context-based units of work. These require the students to undertake activities that demonstrate specific scientific principles through practical investigation and research. For example, the 2007 senior chemistry syllabus states²⁸:

At least two substantial units [at least 20 hours of timetabled school time], one in Year 11 and one in Year 12, must identify and demonstrate a context-based approach. Other units of work should be between 10 hours and a semester in length.

Such activities include extended experimental investigations, which are described (in chemistry) as follows:

The focus is on planning the extended experimental investigation and problem solving using primary data generated through experimentation by the student. Experiments may be laboratory-based or field-based. An extended experimental investigation may last from four weeks to the entirety of the unit of work.

Many schools that have already adopted the new syllabi are exploring partnerships with industry to develop these learning opportunities. Students who exit high school with these experiences will expect similar engagement in their tertiary studies.

6.8 Innovative approaches to university learning

These changes to the school environment invite the tertiary sector to re-examine some of their traditional approaches to learning. Many are already engaged in this review. At the same time a blurring of the definitions of "work" and "study" is happening with the adoption of wide-ranging WIL programs. Savage (2005)²⁹ says:

27 *The QSA's role in facilitating young people's transition from school to tertiary courses: A policy discussion paper*, <http://www.qsa.qld.edu.au/learning_priorities/te_procedures/docs/discussion-paper-school-to-te.pdf>.

28 QSA (2007) *Senior syllabus, Chemistry*, <http://www.qsa.qld.edu.au/yrs11_12/subjects/chemistry/chemistry_syllabus_2007.doc>.

29 Savage, S. (2005) *Urban design education: learning for life in practice*, *URBAN DESIGN International* (2005), vol. 10, 3-10, <<http://www.palgrave-journals.com/udi/journal/v10/n1/pdf/9000130a.pdf>>.

It is inevitable that the knowledge required to participate in the life-world of practice following graduation is emergent, and probably unlearnable, prior to engagement with practice ... Learning practice knowledge, whatever practice might entail in the future, requires immersion in the authentic, complex problems which practice presents.

The University of Southern Queensland (Fraser Coast) has recently introduced an innovative workplace-based learning Master of Professional Studies and in 2008 a Doctorate of Professional Studies, with flexible, individualised learning opportunities for students who would not normally participate in postgraduate education³⁰.

It is conceivable that similar processes that recognise the changing educational circumstances described above could be introduced at an undergraduate level. Such students could even continue to work full-time, with the workplace as the focus for their study. The universities would mentor and assess the standard and quality of the output for credit towards a specific degree.

³⁰ Fisher, M. (2007) *New forms of workplace-based learning*, Eidos Emerge Conference, 10 September 2007, Brisbane



Key findings and recommendations

This study has explored the work-skills gaps in recent graduates of integrated resource sciences and has concentrated on one strategy for success – the work integrated learning (WIL) intervention. In doing so it has revealed a number of key elements to achieving improved work readiness in graduates.

One such key finding is that solutions to the dual problems of graduate employability skills and recruitment can be found through enhanced student engagement and involvement with employers throughout the education process. Having industry partners directly engage with student education and work experience has been shown to improve graduate employability.³¹ Similarly, exposure to the variety of work opportunities available across the sector can assist in the decision process for students when choosing their study and work options.

Other findings include:

- Many models for work placements and internships exist across science disciplines, but there is no coordinated program for the integrated resource sciences.
- Work placements and internships occur within, across and outside university semesters with varying levels of engagement by employers and universities.
- Of those well-established models, some contain attributes that could be adapted to suit the aim of this particular study.
- All Queensland universities offer some options for WIL experiences, but not in all disciplines and not with consistency.
- There is a growing commitment to WIL processes within all universities, while employers in the integrated resource sciences are generally very supportive of WIL practices.
- Many Cooperative Research Centres (CRCs) and government agencies offer scholarships and graduate programs to undergraduate students on a competitive basis.
- Professional industry bodies generally support the concept of discipline-specific professional accreditation being introduced with predetermined requirements for quantity and quality of work experience.
- Independent organisations that currently facilitate WIL programs have the experience and capacity to potentially deliver programs based on guidelines resulting from this study.

The study has found that a successful framework for WIL needs to be flexible to suit different stakeholders, with increasing connection between stakeholders growing over time. To develop and implement the proposed model outlined in this study, the following factors are critical to success:

1. Significant funding is needed.
2. Clarity of commitment from industry is required.

³¹ Radcliffe, J. (2007) *Tomorrow's agricultural scientists – Meeting industry and resource management needs: A summary of presentations*, SA Division AIAST Conference, Adelaide, March 2007; and Mangione, L., Emmons, L., Carpenter, D., VandeCreek, L., McIlvried, J and Nadkarni, L. (2006) Unique internship structures that expand training opportunities, *Professional Psychology, Research and Practice*, vol. 37(4): 416–422.

3. Capacity and commitment of CIRM partners to participate actively needs to be defined.
4. Effective engagement mechanisms between educators and employers must be established.
5. A range of flexible models can be built around the framework's key principles.
6. There is a need for a coordinated, state-wide or, ideally, national approach to WIL programs in the integrated resource sciences across universities.
7. The continually changing aspirations and motivations of students need to be understood.
8. Changes in the Senior Phase of Learning and other curriculum innovations in Queensland secondary schools may affect any proposed model in the future.

To complement this study and report CIRM has also produced *Guidelines for good practice in work integrated learning in integrated resource science undergraduate degrees*, containing practical information for stakeholders wishing to participate in work integrated learning projects.

Several recommendations have been posed for government, universities and industry to individually and collectively institute functional and effective work integrated learning strategies and thus see actual reductions in the recurring work skills gap. This study has also revealed several well designed and functioning work integrated learning programs already operating across Queensland universities.

The recommendations are:

That CIRM as a consortium of partners continue its strategic collaborative role in advocating for and taking leadership to:

1. Promote the *Guidelines for good practice in work integrated learning for the integrated resource sciences* to universities, industry and government.
2. Advocate for strategic policy and investment support at all levels of government.
3. Take a strategic role in future discussions related to the integrated resource sciences, including review of the Smart State Innovation Skills Internship Program and the Universities Australia National Internship Scheme discussion paper.
4. Identify and build strategic partnerships with major employers in integrated resource sciences to achieve improved work-readiness of graduates in this sector.
5. Use CIRM's collaborative role and its networks to influence investment in this critical area.
6. Offer a multi-stakeholder, collaborative role in new efforts to coordinate WIL programs across universities. The process outlined by Marsh et al. (2007)³² for optimising the allocation of resources in specific circumstances may be adapted to suit these conditions.
7. Support existing WIL projects within CIRM partners such as the Griffith University Industrial Affiliates Program or the Co-operative Education for Enterprise Development (CEED) Program, while exploring collaborative opportunities, specifically the Australian Collaborative Education Network (ACEN) WIL project.

³² Marsh, H., Dennis, A., Hines, H., Kutt, A., McDonald, K., Weber, E., Williams, S., and Winter, J. (2007) Optimising the allocation of management resources to species of wildlife, *Conservation Biology*, vol. 21: 387-399.



Conclusions

This paper follows on from the 2006 CIRM occasional paper *Options for improving the employability of natural resource management and environmental science graduates in Queensland*. It has explored a range of existing work integrated learning programs across universities and affiliated organisations within the disciplines associated with the integrated resource sciences across Australia and outlined the commonalities essential for successful programs.

Arising from this study is a set of *Guidelines for good practice in work integrated learning for the integrated resource sciences*. These guidelines are organic in nature and CIRM also invites stakeholders to contribute information to populate resource documents accompanying the Guidelines.

It is clear that a wave of interest in authentic and real-world contexts for learning is sweeping across all education sectors, and that this report and complementary material are timely for their contribution to this debate in the area of integrated resource sciences. There is potential for a national adoption of the processes described in this study.

Importantly, CIRM's collaborative, cross-organisational constituency provides a powerful mechanism to facilitate a cross agency and university approach for implementing coordinated programs throughout the State.

CIRM is in a position to assist partners to progress the proposed programs and to provide support for the advancement of the recommendations through the auspices of the CIRM membership.



Appendices

Appendix 1: What is CIRM?

Tackling tomorrow's natural resource management challenges today

Managing natural resources for sustainability and ecosystem health is increasingly part of the decision-making by government, research, community and industry stakeholders alike. Such decision-making requires an integrated approach for success. This can be a challenge, as competing interests and needs strive to be accommodated. Through its collaborative partnerships, the Consortium for Integrated Resource Management (CIRM) is tackling this challenge.

CIRM is an unincorporated joint venture of 10 organisations. It operates as a formal linkage for facilitating collaborative planning and coordination of research and development (R&D) initiatives. Strength through partnerships is the key to CIRM's success.

The consortium was formed in 1993 and now in 2007 has the following partners:

Department of Natural Resources and Water (Qld)
Department of Primary Industries and Fisheries (Qld)
Environmental Protection Agency (Qld)
James Cook University
University of Queensland
Central Queensland University
Griffith University
University of the Sunshine Coast
Queensland University of Technology
CSIRO.

It is a conduit for research, providing flexible, accessible pathways for collaboration and communication between the CIRM partners.

This approach is designed to:

- understand ecological, social and productive systems, and
- deliver multi-organisational agreement to invest in effective R&D related to those systems.

Appendix 2: Key participants for developing work placements and internship model

Contact name	Organisation and role
Focus group	
Graham Willett	CEED
Carol-joy Patrick	Industrial Affiliates Program Griffith University
Andrew Clark	NRM recent graduate
Bob Ward	Rural Skills Australia
Emma Wimberley	Queensland Resources Council
Peter Dare	NRSM UQ Gatton
Wendy Ashton	EPA
David Manning	EPA
Karin Schiller	IAIST CEO
Wolfram Dressler	UQ School of Social Sciences
Alison Moore	CIRM Executive Officer
Amanda Wright	CIRM Senior Project Officer
Rhonda Scoullar	CIRM Project Officer
Interviews and discussions	
Joe Baker	DPI&F (CIRM Board member)
Melanie Gray	Office of Queensland Chief Scientist
Peter Peterson	DAFF Capacity Building in NRM
Geoff Thomas, Charlie Drew	IAIST (National Skilling & Accreditation)
Jodie Kowaltzke	Centre for Rural and Regional Innovation
Jackie Mergard	EPSA UQ
Natasha Doherty	Queensland Office of Chief Scientist
Geoff McGlashan, Noel Ainsworth	SEQ Catchments
Adam Gromadzki	CSIRO (Work Following)
Geoff Lawrence	UQ School of Social Science
David Russell	University of Tasmania
Cameron Archer	TOCAL Agricultural College NSW DPI
Belinda Barr	Australian Centre for Plant Functional Genomics
Prof Peter Gregg	Cotton Catchment Communities CRC
Suzanne Morris	CRC for Sugar Industry Innovation through Biotechnology
Deidre Marczynski	CEED
Peter Smith	SKM Environmental Consultants
Felicity Organ-Moore	Young Scientists of Australia (recent graduates)
Elizabeth Billings, Sharon Bellingham	NRW Graduate Recruitment Workforce capability
Delphine Bentley	North Australian Pastoral Company (industry employers)

Contact name	Organisation and role
Dick Steel	DPI&F Industry Development
Amy Voller	CSIRO Recruitment Consultant Qld & NT
Rowena Crouch	QDO & Vet. Science Work Experience provider
Aaron Harvey	EIANZ Professional Development Committee
Mick Hay	Rimfire Resources
Working group membership	
Helene Marsh	JCU (Working Group Chair), CIRM Director
Bob Miles	CQU, CIRM Director
Graham Willett	CEED
Carol-joy Patrick	Industrial Affiliates Program Griffith University
Marie Wascha	Griffith University, CIRM Director
Brad Scholz	State Development Innovations Program
Lyris Snowdon	University of the Sunshine Coast
Karin Schiller	IAST CEO
Amanda Wright	CIRM Senior Project Officer
Malcolm Mackay	Australian Agricultural College Corporation
Beth Weldon	Qld DPI&F
Michael D'Occhio	The University of Queensland, Gatton

Appendix 3: Key themes from discussions/interviews with stakeholders, including CIRM Directors' responses

Joe Baker,
Chief Scientific
Adviser, DPI&F

- Change name to Integrated Resource Management to ensure inclusivity and relevance to CIRM partner interest
- Further internal Departmental discussion.
- Internship could provide opportunity for a range of experiences, which may be outside the specific area, to bring new dimension and insights back into the field, to improve employability.

Carol-joy
Patrick,
Manager, Industrial
Affiliates Program
Griffith University
(Executive
Director, Australian
Collaborative
Education Network;
Chair, Griffith
University's
"Engaging Students
in Work Placements"
working party)

- IAP places final year students from all engineering, science, environmental and information technology disciplines in industry placements. Work placement in environmental science currently optional, will become compulsory in 2008.
- Universities must have academic control of accredited work placement courses to abide by Commonwealth funding requirements, and to validate academic credit given to placement.
- ACEN has won a \$300,000 Carrick Institute grant to scope work integrated learning in Australia.
- Students who submit their IAP project for industry and professional association awards virtually always win the award, and the IAP has won over a dozen such state and national awards.
- National association to facilitate dialogue between industry and universities. Working towards a national portal – one-stop web site for universities, employers and students.
- ACEN provides opportunity for a loud and unified voice to communicate to government and industry.

Peter Petersen,
DAFF, Capacity
Building in NRM

- Significant interest in the WIL concept at the federal level
- Scope for NRM graduate areas is high (better than agriculture)
- Capacity to develop capacity building projects (funding available)
- Major interest in capacity building at a national level.

Liz Billing,
Sharon
Bellingham,
NRW HR Services,
Workforce Capability

- Currently offer 3 programs: Graduate program (recent, 18 months to 2 years post graduation); Scholarship program (from 2nd year, gain work experience in spare time, committed to NRW after graduation); Indigenous cadetships (work with specific programs within universities)
- Promote through careers fairs, visiting lectures to uni classes etc.
- Individual business units initiate and pay for program.

<p>Geoff Thomas, Chair, Education & Training group, AIAST</p>	<ul style="list-style-type: none"> • Number one priority for AIAST. On-the-job training essential in most professions and trades, should also be for sciences • Concerned at disconnect between universities and employers and agribusiness. (universities not seen as "employer-friendly" places) • National workshop held in March (will send information, papers on AIAST web site for members) • A Council of Deans of Agriculture exists, would like similar for NRM • Industry is willing to come forward with greater input into university courses • Professional accreditation and registration a positive step.
<p>Office of the Queensland Chief Scientist</p>	<ul style="list-style-type: none"> • Supports strategic concepts that impact on whole-of-government • Has limited capacity to support individual programs.
<p>Brad Scholz, Team Leader, Innovation Skills Fund, Department of State Development</p>	<ul style="list-style-type: none"> • Smart State University Internship program has funded scholarships for internships in 6 Queensland universities (Bond, Griffith, UQ, QUT, CQU and USC). Project to be reviewed within 12 months • Priority areas include science and technology • May be possible to lobby government for extension of program for further development
<p>Rowena Crouch, dairy farmer and tertiary student work placement host</p>	<ul style="list-style-type: none"> • For small businesses capacity is limited • Quarantine and biosecurity issues are significant • The cost of liability insurance is onerous • Students without basic skills can often not contribute significantly • Time to teach basic skills is extremely limited in small concerns • These skills may include driver's licence, etc.
<p>Cameron Archer, Principal, Tocal College, Director, Tocal Agricultural Centre</p>	<ul style="list-style-type: none"> • Changing face of agricultural research from field studies to laboratory work • Research at a national and international level • Private sector more heavily involved e.g. Monsanto etc. • Government experimental stations have a changing role in service delivery • Council of Deans for Agriculture recently formed to have direct links to government through DEST etc. • Promotion of agriculture through education round table called by Minister, Hon Peter McGauran MP • Tocal involved in process for accreditation of agricultural scientists.

Mick Hay,
Director, Rimfire
Resources

- Rimfire Resources is a specialist recruitment company that caters to the agriculture and agribusiness area
 - Runs four Grad-link programs across Australia
 - Aims to bridge the gap between degree completion and employment
 - Industry pays to participate based on quality of potential recruits.
 - Students are screened for suitability prior to invitation to participate
 - Pay Rimfire Ambassadors – final year students – to promote event to peers
 - Cater for about 300 students per year
 - Program highly targeted to match students to employers
 - In 2006 25-30% of students obtained employment from this process
 - Interested in extending activities into NRM and environmental sciences
 - Has industry links and practical experience to facilitate student/industry projects (e.g. Virbac employed veterinary science students to undertake extensive research project)
 - Industry must articulate needs and potential more clearly to attract students.
-

CIRM Directors' responses to discussion questions

1. Universities

Institution	Question
	<i>Question 1: What specific programs exist within your organisation – what capacity may be unique?</i>
Queensland University of Technology – Faculty of Science	<p>There are specific student placement units in the professional courses (pharmacy, medical radiations technology and medical science) where students are placed in professional/clinical settings and work with practising professionals. Also in B Biotech Innov (LS50) students participate in a major collaborative project with industry. Maths also have a WIL unit MAB640 industry project.</p> <p>Another aspect is the field excursions that are an integral part of several of our discipline areas in SC01 – e.g. geoscience and environmental science and ecology areas. These are putting the knowledge and skills students have gained into real-world situations in the same way that a graduate would do in practice – hence they are WIL.</p>
Queensland University of Technology – Faculty of Built Environment and Engineering	<p>The programs vary widely across the institution. The architecture, nursing and teacher education programs have been operating for decades, others are relative newcomers. The university has allocated \$900K over three years to develop real world learning at QUT; this project will embrace WIL and will develop good practice to adopt across the institution. BEE is leading this project with Business and we have a reasonable handle on what's being done. We could direct you to this information if it would be helpful.</p>
James Cook University	<p>Bachelor of Environmental Science 3 year course, Bachelor of Applied Science 4 year course. Work placement for credit between 3rd and 4th year. Approx. 0.25 semester.</p> <p>Competitive access – privilege, not a right.</p>
University of the Sunshine Coast	<p>Workplace learning course part of integrated catchment management and environmental management strategies.</p> <p>Has strong links to SEQ and Burnett Mary Catchment groups.</p> <p>Large proportion of mature age students.</p>
University of Queensland	<ul style="list-style-type: none"> • Integrated our activities at Gatton and St Lucia • Improving our marketing to place more emphasis on career opportunities rather than courses and programs • Improving articulation with the Australian agricultural colleges • Developing linkages with TAFE colleges and schools to develop better relations and optimise the use of facilities at Gatton • Offer vocational education and training within our courses • Incorporated a one-semester industrial placement within the agricultural and food science degrees • Engage actively with industry to understand their needs and improve the relevance of our courses • Developing research facilities at Gatton (e.g. Centre for Advanced Animal Science with DPI&F)

<i>Question 2: What is done well?</i>	
Queensland University of Technology – Faculty of Science	The professional/clinical placements mentioned above work really well – feedback from both students and their field mentors.
Queensland University of Technology – Faculty of Engineering and Built Environment	All kinds of courses embrace this in different ways. The architecture discipline has a well-worn path with its practitioner partners and it all runs rather seamlessly and seems to be an advantage to these students. Students of PR in business conduct a final-year project with an industry partner and thus gain real-world experience through a capstone unit.
James Cook University	Very good example of tripartite agreement with university, students and employers
<i>Question 3: What are the significant challenges? If programs have failed, please outline reasons.</i>	
Queensland University of Technology – Faculty of Science	Science has an industrial internship program (SCB100) which is a full year paid placement. It is/was accessed by about 10-12 students each year with a very positive outcome, however there were no credit points attached to it. Hence we are forced to discontinue the program due to changes to DEST and QUT policy – viz. there must be CP value associated and we cannot afford to sacrifice a large number of CPs in the course. However in the new SC01 we are intending to incorporate the opportunity for a 12CP unit (SCB500) which will be an industry project.
Queensland University of Technology – Faculty of Engineering and Built Environment	There are significant resourcing challenges. Expectations are usually high for WIL and it's nigh on impossible to guarantee 'good' work experience for all.
James Cook University	Some students do not meet the expectations of the Employers. Competition for work places, especially from southern universities wanting access to the Reef and Wet tropics. Students may be offered jobs then fail to complete their degrees in a timely manner.
<i>Question 4: If you are considering change, why?</i>	
Queensland University of Technology – Faculty of Engineering and Built Environment	We are beginning to embrace WIL as a normal part of the curriculum. We have made it into units of study and have constructed it such that the workplace is considered a laboratory or field for student investigation. For detail on this conception see Savage (2005) at < http://www.palgrave-journals.com/udi/journal/v10/n1/pdf/9000130a.pdf >
James Cook University	Many students prefer not to do 4-year course.

	<i>Question 5: How important is your program to graduate employability?</i>
Queensland University of Technology – Faculty of Science	For the professional courses it is a requirement. For the generic SC01 it would be beneficial but not essential.
Queensland University of Technology – Faculty of Engineering and Built Environment	This is difficult to judge. Everyone tells us it's important and it has been a hallmark of QUT's courses but who knows. There's not a lot of empirical evidence around this.
	<i>Question 6: What priority does it have within your faculty's policies?</i>
Queensland University of Technology – Faculty of Science	A very high priority
Queensland University of Technology – Faculty of Engineering and Built Environment	In BEE this is a high priority. We have appointed a member of academic staff (A/Prof Jill Franz) as WIL Director. Jill is allocated 20% workload to develop, with Assistant Dean Teaching and Learning, this stream in this curriculum.
James Cook University	Priority depends on employment demand. An integral part of engineering. Question 7: Have you tried anything (that you consider to be) novel, new and/or different?
Queensland University of Technology – Faculty of Science	We are going to trial the new 12 CP unit mentioned in 3 above.
Queensland University of Technology – Faculty of Engineering and Built Environment	See paper above, this conception of WIL is different to the usual conception of 'work experience' ... In many disciplines it's regarded as important that students learn particular skills through their work experience. We regard 'being there' as the important thing. Question 8: What you would consider to be essential prerequisites and parameters for you to undertake a work integrated learning (WIL) program?
Queensland University of Technology – Faculty of Science	Essential pre-requisites: for the student to undertake WIL, they need to receive the proper preparation prior to undertaking a professional placement/field trip/industry project. They also need the relevant and appropriate monitoring and mentoring during the WIL component and also relevant de-briefing / assessment/feedback after the WIL.
Queensland University of Technology – Faculty of Engineering and Built Environment	Support of leadership, understanding of work/life/study nexus, a conception of WIL as 'normal' in the curriculum
James Cook University	Work placement for credit Formal agreement across the group
Central Queensland University	Financial incentive for implementation

2. Agencies

Institution	Question
	<i>Question 1: What specific programs exist within your organisation – what capacity may be unique?</i>
Old Natural Resources and Water	<p>From my own research experience we have benefited significantly from the Weeds CRC Summer Studentship Program, with students showing a high level of interest in participating – each year we have had a lot of interest and have had to run a selection program.</p> <p>Our student from last year is still with us, working as a volunteer after her 10 week program ended, but now hired as a casual Scientific Officer and soon to undertake a research project with us as part of a special topic subject at Griffith University.</p> <p>All the students we have had to date have submitted their research reports, with many gaining authorship on a scientific publication that their research project has contributed to. For both us and the student this is an excellent outcome.</p> <p>Chris Preston from the Weeds CRC/University of Adelaide has coordinated the program and can outline how it works (a proposal is submitted by the interested hosting organisation; if successful they get the green light to offer a studentship; students must undertake a research project from beginning to end during their 10-week period; they must be supervised by a CRC research scientist and they must write a report; they receive a stipend of \$3K during this time).</p> <p>We found that it was best that the CRC provide the funds directly to the research institution that the student is studying at, as our Department would have taken a large proportion of the funds as set-up costs and required that tax be taken out. The universities are able to provide the funds as a tax free scholarship and are usually set up well to facilitate this.</p> <p>The students must have completed at least 2 years of their degree, but not yet have graduated – this seems to be a good stage as they have some knowledge and capability and are very keen to gain experience. The only issue is timing, summer break covers the Christmas break and there is usually an inconvenient couple of weeks of little activity due to our requirement to shut the research station from Christmas to New Year – this constrains a 10-12 week project. This is one reason why such studentships may not work as well in Australia as summer research internships which are widely available in the US, where there is a 3-month period of uninterrupted research time. The university does not award any credit for the experience.</p>

<i>Question 2: What is done well?</i>	
Natural Resources and Water	<ul style="list-style-type: none"> • Clearly articulated objectives regarding what the student is trying achieve and clarity around what the employer can provide in terms of support and expectations. • A clear understanding of what could be the less attractive aspects of the job, so there are no surprises - e.g. fieldwork with spiders/snakes, monotonous lab work associated with sample processing, an expectation that the work is written up/data is analysed. • An interview process seems to assist both parties. • A safe experience - i.e. WH&S is considered a priority - often dealing with young and inexperienced adults who may be required to operate machinery, work remotely etc. • Budget-neutral and minimal administrative burden associated with the experience. Although having said that, where we experience a significant skills shortage we are actively recruiting casual experimentalists/scientists as PO1 or PO2s who are full-time students. For example we have been hiring several 1d/week undergraduate chemistry students recommended through collaborative networks by their supervisors to enable a larger pool of capability to be developed. Many of these we lose once they graduate, but we have them for at least a year and they become capable casuals quite quickly and value the additional experience they gain - so it is a win:win situation. However, they gain no university credit for their experience.
<i>What are the significant challenges? If programs have failed, please outline reasons.</i>	
Natural Resources and Water	<p>Unsure - have had no experience in this area. I am aware of some state government scholarships offered by the Department that require the officer to be bonded to the Department for a period of 1 or more years. The fact that the students have no control over where they are placed has created some problems and legal issues for the students, particularly when they really don't want to be sent to work in Roma, for example.</p>

Appendix 4: Survey tools

Survey tools were developed to attempt to elicit a wide-ranging and scaled response. Specific surveys were tailored for each stakeholder sector.

Detailed survey statements for each sector

Universities

I think the existing course adequately equips students for employment
Work placement or internship would improve the present course
Sufficient work placement opportunities are already included in these courses
I would like to see work placement included as an accredited subject in resource science courses
The current course already includes an internship
An internship should be an added year to the present course
Work placement should be compulsory
An internship should be compulsory
Any such programs should be arranged by the university for the students
Employers are currently adequately equipped to assess program results
Work placements should occur during the summer break
Work placements should provide paid positions to students
Internships should provide paid positions to students
I would be willing and able to advise and monitor work placements and internships
I would be willing and able to train employers to adopt work placement and internship programs
I would be willing and able to work with individual supervisors/mentors to develop such programs
I think employers should pay the university for students' placement opportunities
I think the university should pay employers for students' placement opportunities
I would be willing to work with employers to establish acceptable criteria and standards for student assessment
Universities should manage the funding arrangements for work placements and internships
An external organisation should coordinate and manage the business elements of the program
The students should find their own placements
I think there should be an authority to set and monitor acceptable industry standards for resource sciences
I think the course of study should be completed over four years (present length 3 years)
I think students are prepared and capable to undertake professional work placements in their final year

Employers

I think the graduates we employ are adequately trained for employment

Work placement or internship would improve the work readiness of new graduates

I would like to support a work placement as an accredited subject in a natural resource management (NRM)/environmental science course

An internship should be an added year to the present course

Work placements should be compulsory within an NRM/environmental science degree

A short internship should be compulsory

Any such programs should be arranged by the university

Employers are equipped to assess program results

Work placements would suit me best during the summer break (November – February)

Work placements should provide paid positions

Internships should provide paid positions

I think my organisation would likely be willing to consider paying students to support these programs:

- a) work placements
- b) internships

I would be willing to mentor work placements and internships

There are people in our organisation who would be capable and willing to mentor and assess undergraduates

I would be willing to undertake training to adopt work placement and internship programs

I would be willing to work with individual academic advisors to develop such programs

I think employers should pay the university for students' placements

I think the university should pay employers for students' placements

I would be willing to work with universities to establish acceptable criteria and standards for student assessment

I think the university should manage the funding arrangements for work placements and internships

I think an external organisation should coordinate and manage the business elements of the program

I think the universities should do more to provide access to internship programs

Employers should retain intellectual property rights for paid work done by students

The student should retain intellectual property for unpaid work

I think there should be an authority to set and monitor acceptable industry standards for NRM and environmental sciences

I think the course of study should be completed over four years (present length 3 years)

Other staff in my organisation would welcome the opportunity to work with undergraduate students

Students

I feel my course of study equips(ed) me for employment
Work placement or internship would improve the course
I would (have) like(d) to do a work placement as an accredited subject
An internship should be an added year to the present course
I am/have already undertaken a work placement as part of my undergraduate course
Work placement should be compulsory
An internship should be compulsory
Any such programs should be arranged by the university
Students should arrange their own work placements
I think employers are equipped to assess program results
Work placements should occur during the summer break (3rd semester)
Work placements should provide paid positions
Internships should provide paid positions
I would take on the project even if I didn't get paid if it was in the summer break
I would take on the project even if I didn't get paid if it was during term time
I think employers should pay the university for students' placement opportunities
I think the university should pay employers for students' placement opportunities
I think my course of study should extend over four years (present length 3 years)
I would be willing to find a suitable employer for work placement or internship
I think there should be an authority to set and monitor acceptable industry standards for professional scientists
I think it is my responsibility to increase my "on the job" learning capabilities
I think it is the university's responsibility to increase my "on the job" learning capabilities
I think it is the responsibility of potential employers to increase my "on the job" learning capabilities

Appendix 5: Three existing work placement and internship models

Model 1: “Teaching model”³³

Undergraduate students include in their final year of a basic degree course a compulsory expanded experience during which students plan, implement and evaluate a program under the supervision of their cooperating mentor. In addition, an internship may be undertaken, which is closely aligned with induction into the profession. The purpose is to offer high levels of independence wherein students can develop more fully their “professional” identity, taking full responsibility for a project, while still in a supported environment and without the extreme pressures of a full-time work load.

The **professional experiences** of the program will be sufficient to enable all students to develop the required knowledge, skills and attributes, and to provide adequate opportunities for students to demonstrate attainment of these against the standards. This is compulsory.

For the purposes of this model, the term “**internship**” means professional experience which occurs after successfully completing the required minimum of academic studies and experience. **The internship is additional and optional to the basic course of study.**

Characteristics of Model 1 internships:

- Provides professional experience after the final stages of an undergraduate program.
- Collegial support is provided to the student by a mentor.
- Offers high levels of independence and opportunities for further growth and development of professional identity.
- Mentors retain responsibility for the oversight and management of their programs.
- The program planned and implemented by the student is normally limited to a half workload.
- The institution attests to each student's fitness to undertake an internship with the support of a mentor.
- Each student will work in specified area(s) only.
- Suitable arrangements have been made by the host management and the institution adviser for supporting and mentoring the work of each student.
- The student is not remunerated for the work performed.

Model 2: “Medicine model”³⁴

Because of the critical nature of medical practice, supervised work experience is essential in the development of fully qualified and competent practitioners. The process involved is therefore extensive and exhaustive. The requirements of both State Medical Board registration and the Commonwealth Medicare System impose conditions more rigorous than is likely to be required of integrated resource sciences. However, the concept of registration merits consideration as do other elements of the medical program.

Characteristics of Model 2 internships:

- All undergraduate courses are accredited by a central authority.
- While degree courses differ, they must all meet a range of criteria and learning outcomes determined and published by the authority.
- On completion of the primary degree, graduates enter the workforce as interns for twelve months.
- It is only upon the satisfactory completion of the intern year that the graduates receive full registration with the relevant authority.

33 <www.btr.qld.edu.au/internships/mf_report.htm>

34 <www.som.uq.edu.au/som/future_students/mbbs/prof_reg.htm>

- The intern year involves a series of work rotations to specific departments or work divisions to expose the graduate to a range of work situations and environments as part of the initial on-the-job, apprenticeship-style training process.
- Most graduates spend at least one more year after their internship working in the host organisation to gain more experience.
- Interns are paid an award salary.

Model 3: “Engineering model”³⁵

There are many similarities in the prospective effective outcomes between engineering and integrated resource sciences. The various opportunities for professional placements merit consideration for this area. Although the following model is based on information from the University of Queensland's School of Engineering, the processes are similar across the discipline in other tertiary institutions.

Characteristics of Model 3 internships:

- Students undertake **60 days of compulsory industrial practice**, at least 30 days of which should be carried out assisting, or under the immediate direction of, a professional supervisor.
- The other 30 days of relevant experience may be any work, including work of a manual or technical nature, carried out in a relevant environment.
- Students must source this work experience themselves.
- Students undertake a final year project equivalent in value to two standard courses.

In addition, students may choose a work-based learning program which enables final-year students to **spend six months in industry while still gaining full academic credit**. Placements provide students with an authentic experience of professional work and give companies the opportunity to observe the student's performance as a potential employee.

How it works:

- Students are selected to work in industry, government agencies or research organisations from December to June.
- They undertake vacation work and then during semester complete a project proposed by the placement organisation that integrates predetermined elements.
- Placement organisations pay a fee to participate in the scheme and students **receive a scholarship as compensation**.
- Students gain academic credit for the placement semester by aligning the tasks they perform with the learning objectives of several university courses.
- The project accounts for the bulk of the credit while the professional knowledge and skills they gain count towards a professional development course.
- Students apply for a place on the scheme.
- They are selected on the basis of their academic record and an interview.
- The scheme suits those who are looking to be challenged and those who prefer to learn in context.
- The student must be highly motivated, an independent learner, be hard-working, have good communications skills and most of all have a sense of adventure.

Industry partners can offer projects through the **CEED (Co-operative Education for Enterprise Development)**³⁶ Program, a joint venture between Corporation Technologies Pty Ltd and universities.

³⁵ <www.eng.uq.edu.au/default.asp?pageid=123>

³⁶ <<http://www.corptech.com.au/aboutCeed.asp>>

Professional Engineering Placement Semester (PEPS)

The Professional Engineering Placement Semester (PEPS) work-based learning program enables final-year engineering students to spend six months in industry while gaining full academic credit. Selected students undertake vacation work, then during semester complete either a major investigation, research project or a significant design task.

The Industrial Affiliates Program (IAP) Griffith University³⁷

The application of the basic engineering model across disciplines is demonstrated in the Griffith University Industrial Affiliates Program. The general structure is as follows:

- Students in science, environmental, information technology or engineering degrees work either half-time or full-time for the first semester of their final year in an industry partner's workplace on a project for which they gain full academic credit. For engineering students, the project forms the basis of the honours program for honours-eligible students.
- The course is compulsory for engineering students and an elective for other students.
- The structure of the IAP has been developed to ensure that all students, regardless of previous academic record, succeed on placement. Students who submit their IAP project for industry and professional association awards virtually always win the award, and the IAP has won over a dozen such state and national awards.
- Griffith University provides a variety of mechanisms to ensure students can succeed in their work placements, including providing a variety of workshops to enhance students' learning while on placement.
- Industry pays a small sponsorship (\$1,100 for half-time placement or \$2,200 for full-time placement) and payment between the organisation and the student is optional.

³⁷ More details can be found at <www.griffith.edu.au/industrial-affiliates-program>.

Appendix 6: Industry accreditation

The integrated resource sciences are represented by several professional organisations. Several of these organisations have considered professional accreditation as a means of validating their activities. Some have implemented a certification scheme. Two groups pursuing this path are the Environmental Institute of Australia and New Zealand and the Australian Institute for Agricultural Science and Technology. However, their approaches vary in several respects.

Australian Institute for Agricultural Science and Technology

In October 2006 the Australian Institute of Agricultural Science and Technology (AIASST)³⁸ launched the AgCredited national accreditation program for professionals working in agriculture and natural resource management.

AgCredited is based on national industry standards aligned to the national Vocational Education and Training (VET) framework.

To become accredited as an advisor or consultant, candidates need to meet specified national core and specialist competencies. Those who are successful in obtaining accreditation will be entitled to use the AgCredited logo, which will become a symbol for superior professional advice and practice³⁹.

AgCredited replaces CPAg providing an accreditation program based on national industry standards with the rigour of formal assessment providing greater assurance to those seeking professional advice in agriculture, horticulture and natural resource management.

Environmental Institute of Australia and New Zealand

The Environmental Institute of Australia and New Zealand⁴⁰ took the lead role to start the certification scheme for environmental practitioners at its 2002 Conference in Brisbane. The Certified Environmental Practitioner - CEnvP scheme was officially launched in November 2004. The EIANZ initiative in developing the CEnvP Scheme was supported by the Australian Government Department of the Environment and Heritage.

Qualification for the CEnvP requires:

- (1) an environment-related degree
- (2) five years of relevant environmental experience over the past ten years
- (3) three referees prepared to vouch for your skills, performance and professional conduct
- (4) a signed statement of ethical conduct
- (5) commitment to a minimum over two years of 50 hours of continued professional development
- (6) additional supporting evidence of claim including at least two referee reports⁴¹.

Neither of these two organisations includes the consideration of work placements or internships as a process towards accreditation in their requirements. However, both are based on a demonstration of applicable skills and experience in the appropriate field.

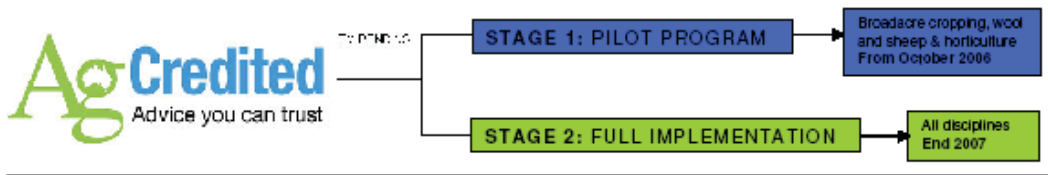
38 <<http://www.aiast.com.au/#>>

39 <<http://www.tocal.com/agcredited/index.html>>

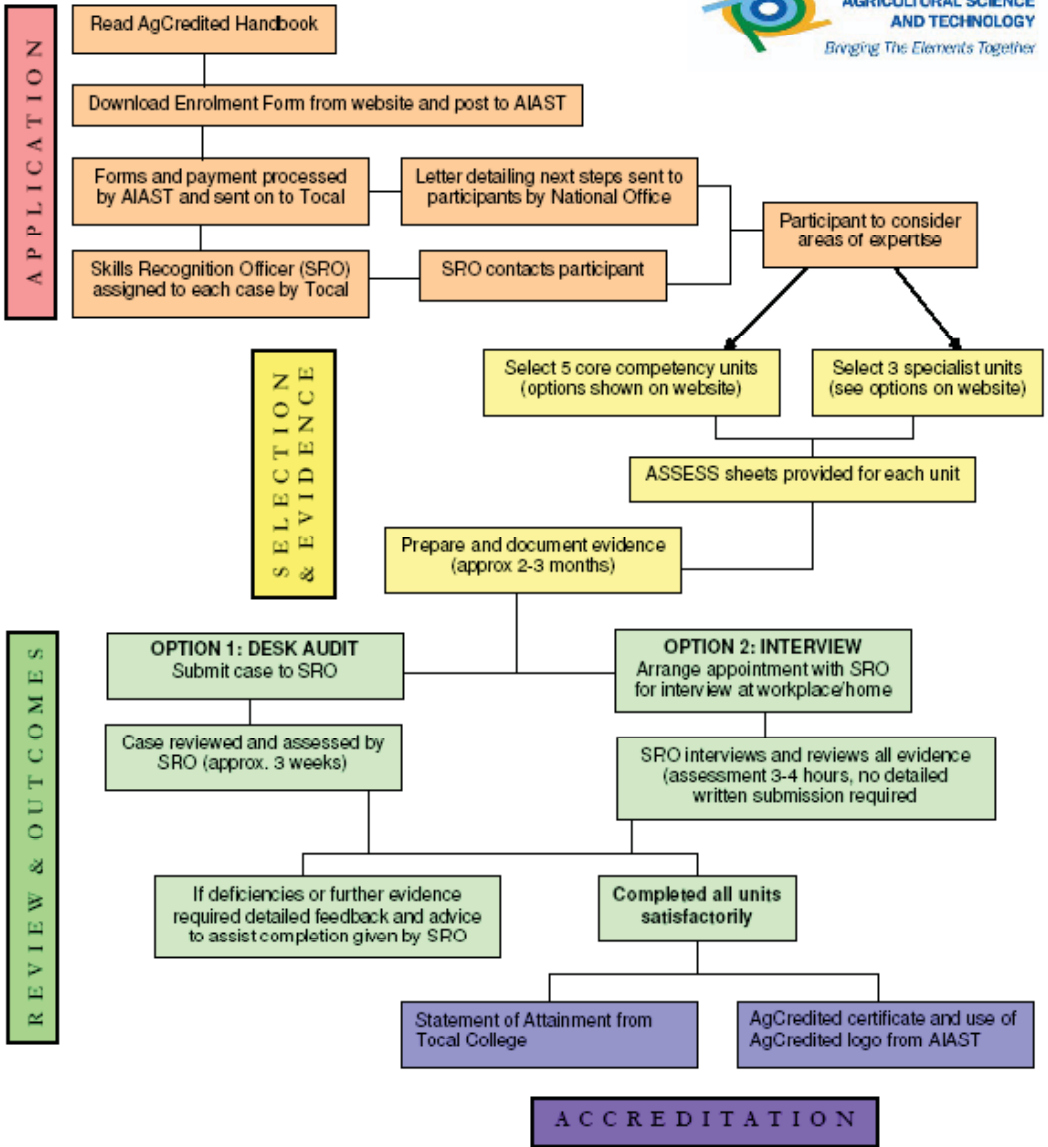
40 <<http://202.53.5.47/index.cfm?objectid=82DD64DD-65BF-EBC1-2E61EE75714EE41C>>

41 <<http://www.cenvp.org/process.php>>

Model for AgCredited accreditation for agriculture professionals⁴²



How it works



42 <<http://www.tocal.com/agcredited/howworks.pdf>>

Appendix 7: Undergraduate work placement programs within CIRM partners⁴³

1. University partners

University	Examples and website
Central Queensland University	<p>The Central Queensland University Student Internship Program is an extension of the university's work integrated learning philosophy in the Engineering Co-Op program, <http://facultysite.cqu.edu.au/view.do?site=37></p> <p>WIL is not compulsory for CQU students.</p> <p>CQU has designed a scholarship program which has criteria specific to WIL.</p>
Griffith University	<p>Work integrated learning (WIL) is a key element of the Griffith signature experience of Engaging Community and is a core goal of the university's Strategic Plan 2006-2010 which aims to build WIL components into at least 70% of all degree programs by 2010, <http://www3.griffith.edu.au/01/ocp/home.php?id=501></p> <p>Environmental Management placement In the fourth year of the Environmental Management degree, the 10 credit point course in environmental project management includes a placement component.</p> <p>Planning practicum The planning practicum is undertaken in the final year of the Bachelor of Environmental Planning, the Bachelor of Environmental Planning/Bachelor of Science and the Bachelor of Laws/Bachelor of Environmental Planning and includes a coordinated professional work placement.</p> <p>Griffith Industrial Affiliates Program (IAP)⁴⁴ IAP is a work integrated learning program that has been designed to integrate students into the workplace through the completion of an industry-based project. It is designed to benefit both the student and the industry partner. Work placement programs are available in all science, environmental science, engineering and information technology programs.</p>

⁴³ Responses from CIRM Directors are included in Appendix 3.

⁴⁴ See also appendices 3 and 5

University	Examples and website
James Cook University	<p>A number of courses at James Cook University incorporate work placements and field experience, < http://www.jcu.edu.au/fse/></p> <p><i>Bachelor of Environmental Science</i> The program includes many subjects that have field and practical components that enable students to get out into the diverse natural environments of north and far north Queensland.</p> <p><i>Bachelor of Applied Science (Aquaculture)</i> The courses in aquaculture have an emphasis on fieldwork and practical skills and getting students out of the classroom. Links with peak research bodies mean students and teaching staff gain valuable practical and research experience. Additionally, links with commercial aquaculture operations ensure the courses keep up to date with industry requirements.</p> <p><i>Bachelor of Applied Science</i> These students undertake an aquaculture farm placement during their fourth year.</p>
Queensland University of Technology	<p>Authentic and real-world experiences are an integral component of curriculum at QUT and reflect the university's commitment to engaged teaching and learning. Work integrated learning is essential to providing real-world experiences, <http://www.mopp.qut.edu.au/C/C_06_01.jsp></p> <p>All undergraduate courses are expected to provide the opportunity for students to undertake various forms of work integrated learning during their course at least as an elective.</p> <p>Any instances of student work experience in industry, where the faculty does not provide for learning performance to be supported, are not covered by this policy and are not eligible for course credit.</p>
University of Queensland Some of the existing programs offered by science faculties within the university are listed here	<p><i>Faculty of Natural Resources, Agriculture and Veterinary Science</i> Industrial placement projects, < http://www.uq.edu.au/nravs/></p> <p>Centre for Rural and Regional Innovation – Queensland (CRRI-Q) CRRI-Q is a collaborative venture between the Department of Primary Industries and Fisheries, the University of Queensland and CSIRO, <http://www.crriq.edu.au/></p> <p><i>Institute of Molecular Biosciences (IMB)</i> Each semester the Institute for Molecular Biosciences offers highly motivated third-year students the opportunity to gain valuable research experience in their premier bioscience laboratories, <http://www.imb.uq.edu.au/></p> <p><i>ARC Centre of Excellence for Integrative Legume Research (CILR)</i> During an undergraduate program, students have the opportunity to conduct research; first, in structured practicals associated with specific courses, and then as semester-long research projects within high-intensity research labs. Such assessable activity counts towards a degree, <http://www.legumecentre.cilr.uq.edu.au/></p>

University	Examples and website
University of the Sunshine Coast	Within the suite of science degrees, all students have access to workplace learning courses that range from a single course up to a full semester placement (four courses). An internship course is an elective course that is usually undertaken in first or second semester of the third year, < http://www.usc.edu.au/Students/Handbook/Courses/Science/researchinternship.htm >

2. Agency partners⁴⁵

CIRM partner	Program
Natural Resources and Water	<p>Scholarship program</p> <p>A scholarship holder will receive:</p> <ul style="list-style-type: none"> • a study and living allowance per semester of full-time study • up to 8 weeks paid vacation employment each year • mentoring and support through the studies and on the job. <p>On completion of their study, graduates will join the department with full-time employment for a minimum period equal to time of supported study</p>
Primary Industries and Fisheries	<p>Each year, around March and October, DPI&F's Graduate Recruitment Program offers a number of placements across a range of disciplines.</p> <p>This program has similar features to the NRW graduate program.</p>
Environmental Protection Agency	<p>The EPA offers Indigenous Cadetships for university study and traineeships for high school students.</p> <p>Traineeships are offered by in various locations across Queensland.</p>
CSIRO	<p>CSIRO offers a number of vacation scholarships for tertiary students to develop their skills and knowledge in a research environment pertinent to their studies.</p> <p>Scholarships are intended primarily for third year students who intend to undertake an honours degree.</p>

⁴⁵ Agency websites:

Natural Resources and Water: <http://www.nrw.qld.gov.au/about/employment/graduate_program.html>

Primary Industries and Fisheries: <http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/31_6503_ENA_HTML.htm>

Environmental Protection Agency: <http://www.epa.qld.gov.au/about_the_epa/careers_and_vacancies/training_and_professional_development/>

CSIRO: <<http://www.csiro.au/org/VacationScholarships.html>>

Appendix 8: Excerpt from: A National Internship Scheme - discussion paper⁴⁶

3. Budget cost and public benefits

Any innovative concept that seeks to result in improvements in work readiness for Australian graduates will have immediate costs in establishment and in ongoing administration, but the potential benefits from embracing change and positioning Australian universities and industry in a more competitive way are worth pursuing.

The following "ballpark" calculations are put forward solely to illustrate the potential cost of such a scheme associated with options 1-4.⁴⁷

- If there were 80 internship officers working centrally as coordinators in industry, community associations and universities, this would cost \$12 m annually in direct and on-costs. There are indirect and associated support and flow-on-costs that might also need to be taken into consideration.⁴⁸
- If each university additionally created a sub Dean role in each individual faculty or school with liaison responsibilities, and offered higher duties payment for such administration and for liaison on curriculum and placement wherever appropriate, there is merit in having a reimbursement mechanism in place whereby government would fund that additional cost annually. This might be estimated to be on average ten such positions at each university at \$10,000 per sub-Dean per annum, plus support costs, giving a total annual cost of \$5.7 m.⁴⁹
- A 10% wage subsidy to employers for interns under the scheme would cost some \$105 m annually. Again, an administrative cost component would be incurred.⁵⁰

The benefits of such a scheme are in the context of:

- *Benefit to government budget*
Reduced direct income support costs to the Commonwealth under existing support arrangements such as Austudy. This could be conservatively estimated as of the order of \$213 m based on 30% of current support recipients;⁵¹
- *Benefit to industry*
Reduced skill shortages and enhanced productivity assessed at a 15% improvement or margin in commencing graduate earnings for ex-interns, representing approximately \$330 m annually per cohort for the first year post-graduation; and perhaps a 7.5% margin in second year post-graduation equalling \$165 m, or \$495 m per intern cohort conservatively assuming convergence thereafter to common wages for all graduates.⁵²

46 Universities Australia (2007) A national internship scheme <<http://www.universitiesaustralia.edu.au/documents/publications/discussion/A-National-Internship-Scheme.pdf>>.

47 The costings are suggestive only. The resources and skills for authoritative costings are to be found in the central agencies of government.

48 Forty industry appointments and 40 university appointments at \$100 k annual personnel cost plus 50% on-costs. Variants of such schemes could include higher funding per officer but competitive application for the same or a smaller pool, or attachment of Commonwealth liaison officers from departments such as DEWR or DEST who would spend one-third of their time each at universities, at industry attachments and in government. This latter approach is the present model used for DIAC officers assisting industry to bring in migrants to fill skill shortages. The same approach also should apply at least for Australian residents.

49 Ten sub-deans for each of 38 universities at \$10 k direct cost and \$5 k support cost each is \$5.7 m per annum. This is a conservative estimate as it represents only a small salary loading for additional duties.

50 Assuming an annual part-time wage of \$15 k applied to half of the average 140 000 students eligible in any one year during their degree for a single year internship.

51 Based on 144,000 Youth Allowance and Austudy recipients in higher education, who on conservative estimates currently receive a minimum full rate of \$190 per fortnight. Costs could be reduced or controlled by funding under the scheme for new internships only, so that windfall gains or cost-shifting does not occur for existing funded schemes.

52 Graduate Careers Australia - starting salary \$40 k with 110 000 completions, half with internships. Higher Education Funding Council for England (HEFCE) research finds that "relevant work experience during the degree program had a highly positive influence on employability" (G. Mason et al., How much does higher education enhance the employability of graduates?, London, HEFCE, August 2003), <http://www.hefce.ac.uk/Pubs/rdreports/2003/rd13_03/>.

