The Griffith University Environmental Engineering Industry Program

Ms Jane McKenzie and Dr David Bromwich
School of Environmental Engineering
Griffith University

Abstract: *A pilot project-based industry program has been established in the School of Environmental Engineering at Griffith University to primarily enhance the lifelong learning outcomes and also the job prospects of final year students. When appropriately constructed, this type of program has been shown to enhance educational outcomes and bridge the gap between traditional teaching outcomes and the needs of both the student and potential employers, whilst maintaining academic integrity. The program has been modelled on an existing successful program in its School of Microelectronic Engineering, where its success relates to resourcing the management of its program. A special feature of this particular program is the pre and post program evaluation of Generic Skills. The program was researched before its implementation, drawing on existing programs and the educational literature for the development of its structure, documentation, procedures and policies, including feedback and review mechanisms. As environmental engineering is a relatively new profession in Australia, the program has been well received by local organisations and good student placements should be sustainable.*

Introduction

The School of Environmental Engineering at Griffith University is intimately embedded in the Faculty of Environmental Sciences. The Environmental Engineering degree is by its nature transdisciplinary, perhaps more so than in traditional engineering schools, as its roots are in the environmental sciences and associated social sciences rather than a traditional engineering faculty.

The School was granted a Strategic Improvement Grant by the University to introduce a pilot work placement program for fourth year Environmental Engineering students. The grant was offered to:

- Improve quality of enrolling students;
- Improve student retention rates;
- Improve graduate satisfaction;
- Improve graduate employment opportunities; and
- Embed the characteristics of the "Griffith Graduate" (Crebert, 2003).

A work based learning program, the Environmental Engineering Industry Program (EIP), was developed with the aim of meeting these criteria. It was designed as an honours program to be undertaken in a flexible mode of working four days a week with an industry partner, and the remaining day spent at University undertaking a design course and EIP related activities. The pilot program represents 32 credit points (equivalent to four subjects) and is being undertaken in Semester 2, 2003. Following a week of workshops covering basic introductory material, the students undertake a work-based project negotiated between the industry partner and the university.

This paper outlines the rationale for the EIP structure, management and evaluation.

Background

Throughout this paper, the terms cooperative education, work-based learning, work placements and placements are interchangeable and all are related to the concept of students undertaking a project with organisations whilst gaining academic credit.

The Griffith University Environmental Engineering Industry Program was conceived in response to a clearly perceived need for the development of skills in environmental engineering graduates which would meet the needs of their potential employers and develop lifelong learning skills. Crebert and Bates *et al* (2002) found that numerous reports requested by government and employers have been critical of the *"lack of work-readiness of many of today's graduates"*. They linked an *"increasing emphasis on the inclusion of work placements in undergraduate degree programs"* to this need.

The Federally (DETYA) funded National Review of Engineering Education (IEA, 1996) recognised the effectiveness of Co-op engineering programs and stated:

> Students from Australia's limited number of cooperative programs are in high demand. Industry strongly favours providing experience in semester-length blocks.

Griffith University researchers have also undertaken extensive investigation into the merits of work placements. The Griffith Graduate Project (Crebert, 2003) commenced in 1999 and represented a University-wide approach to raising awareness of and embedding generic skills and abilities in the curriculum to improve student learning and graduates' employment outcomes. Reports completed as part of this Griffith Graduate Project explored the relationship between undergraduate programs that include components of work placement and those which did not. This was achieved by surveying the perceptions of graduates and employers in relation to generic skills development in these particular learning contexts. Evidence from this project indicates "work placements are valuable in the development of students' generic skills and abilities". (Crebert, Cragnolini *et al,* 2003)

EIP structure and development

The EIP was researched before its implementation, drawing on existing engineering programs and the educational literature relating to workplace based learning for the development of its structure, documentation, procedures and policies, including feedback and review mechanisms.

Some programs from Australian universities were examined and a literature review was conducted to explore approaches used in the United States, Canada and New Zealand. Cooperative education in Canada is viewed as *"an educational model rather than a job placement strategy"* (CAFCE, 2000). Continuous learning is promoted through the integration of classroom and applied work-based learning, in which employers and educators share the responsibility for preparing students to tackle change. The Canadian model is *"learner-centred"*, where the onus of responsibility is on the students to direct their own learning and make useful contributions to the workplace. A similar model has been adopted for the EIP. From the outset students were told that ultimately "the buck stops with them".

Table 1: Some co-op Engineering programs at other Australian universities

Institution	Degree	Program
Griffith University	Bachelor of Microelectronic Engineering	Industrial Affiliates Program
The University of Queensland	Bachelor of Engineering (all disciplines)	Undergraduate Site Learning Program
Queensland University of Technology	Bachelor of Electrical and Computer Engineering	Industry Cooperative Program
Central Queensland University	Bachelor of Engineering (Co-op)	Project based learning
Swinburne University	School of Biophysical Sciences and Electrical Engineering	Industry Based Learning
Murdoch University	Bachelor of Engineering	Structured Workplace Learning
Edith Cowan University	Bachelor of Engineering	Work Based University Learning

The structure and model chosen was that of Griffith's School of Microelectronic Engineering. Their Industrial Affiliates Program (IAP) had been operating successfully for the past 11 years. Not only did the IAP contribute to that School's development, it also was successful in attracting high calibre students. One of us (DB) has been involved with the IAP for four years as an "industry partner", supervising fourth year microelectronics engineering students. This has provided an insight into the success of the structure and operational outcomes of the program, including how it had helped grow the School of Microelectronic Engineering and produce significant links with industry.

Phase 1 of EIP involved development and initial implementation of the program. To date this has involved:

- Examination of styles of work-integrated learning;
- Preparation of course submission;
- Invitation and a selection of students to participate in pilot;
- Marketing the program to potential industry partners;
- Development of performance indicators;
- Appointment of first cohort of students to industry placements; and
- Implementation of the new course.

Features of the EIP program

In its initial year, the EIP is one of three, fourth year Bachelor of Environmental Engineering strands, with the strands being:

- Thesis;
- EIP; and
- Non-thesis (electives).

There is still significant support for the existing Thesis program as it offers a year-long opportunity to perform research that links to seasons, like rainfall, or the opportunity to work directly with an academic. The three stands will continue again in 2004. Phase II may see a move towards only one strand being available, the EIP, but with the academic filling the role of an industry partner for Thesis students.

The EIP is a significant change to the existing Thesis and Non-thesis options in the fourth year Environmental Engineering degree (Table 2), but it also differs from the existing Microelectronics Engineering IAP at Griffith University.

The essence of the program involves students being placed with an industry partner to complete a project addressing a real workplace problem. It is a project-based learning experience for the students and utilises a number of different assessment methods including a project plan, workbook and a written project thesis that represents half of the academic assessment. Whilst responsibility for the projects ultimately rests with the student, learning is guided and supported by the employer and the university. The EIP, like its sister IAP program in Microelectronic Engineering, has been structured for maximum flexibility and students can participate in the EIP in a variety of ways from placement with an EIP external industry partner to one entirely within the School. The latter will be necessary when an academic requires direct ties with the student on a research project or when a student may be unsuitable for an industry placement.

Table 2: Comparison of EIP with other similar Griffith programs

	Environmental Engineering			Micro - electronic Engineering
	EIP	**Thesis**	**Non-thesis**	**IAP**
Semester load	32 CP + Environmental Engineering Design (8 CP)	16 CP + 2 Electives @ 8 CP	4 Electives @ 8CP	40 CP
Eligibility for Honours	✓	✓	✗	✓
Course manual	✓	✗	✗	✓
Introductory workshops	✓	✗	✗	✓
Assessment of generic skills	✓	✗	✗	✗
Structured management	✓	✗	✗	✓
Business plan	✓	✗	✗	✗
Milestone reports	Non-graded	✗	✗	Graded
Status reports	✓	✗	✗	✓
Career episode reports	✓	✗	✗	✗*
Project presentations	✓	Invited to participate	✗	✓
Able to take electives that semester	✗	✓	✓✓	✗
Academic staff research seminars	✗	✓	✗	✗

* The opportunity to participate in the Career Episode Report process was only made available from the Institution of Engineers in late May 2003. This did not provide sufficient time to officially include this as part of the School of Microelectronic Engineering's Industrial Affiliates Program. The intention is to include this in future years of the IAP.

Prior to the industry placement, students attend a week of workshops covering topics such as ethics, expectations, common software packages, time management and communication skills, to name a few. Ideas from The University of Queensland (UQ, 2001) and the IAP were adopted when developing these workshops.

Embedding the characteristics of the "Griffith Graduate"

The EIP has been designed to incorporate the recommendations of the Griffith Graduate Project (Crebert, 2003) which described work placement programs. The following features from the project have been included:

- Integration of the work placement in the undergraduate program (e.g. credit points are allocated to work placement courses)
- Allocation of a staff member to take responsibility for coordinating the program between the School and industry
- Acceptance of a fair degree of responsibility by students for negotiating and managing the placement process, as part of their professional development
- Provision of both an academic and workplace supervisor for the student on placement; and
- Formal assessment of the student's learning outcomes from work placement by the University.

EIP Program Management

The success of any program depends on "*the administrative structure of the program and the position of the coordinator within it*" (Coll & Eames, 2000). In considering the resourcing of the EIP program, the School of Environmental Engineering took guidance from the relevant literature and the IAP.

Three role models for the placement coordinator identified by Coll and Eames (2000) include a simple administrative role; a centralised unit of coordinators whose role is still substantially administrative in nature; and a model in which coordinators hold joint positions as placement coordinators and teaching faculty within their specialty areas. The major advantage of the final model, noted by Coll and Eames (2000), was that coordinators have the "*ability to get to know students better through classroom interaction, leading to a better understanding of the employers' business and to enhanced matching of student and employer*".

While the role within the EIP is predominantly administrative, it resembles the final model identified by Coll and Eames (2000), with the EIP Manager conducting many of the workshops at the beginning of the placement, in a similar way to the IAP. To enhance the matching of student and industry partner, the EIP Manager undertakes one-on-one interviews with students and liaises heavily with academic teaching staff to determine the most appropriate projects and placements for students. This was made relatively easy by the small manageable number of students in 2003.

The School of Environmental Engineering recognised the need to source specific skills for managing the EIP. These specific skills differ from traditional teaching skills and management of the program does not require a technical understanding of the projects. The focus is on managing the process rather than dealing with the technical issues that arise. To address this most effectively the School recruited a manager with extensive administrative, marketing and business management experience.

It also recognised the need to limit demands on teaching staff participating in the program. It remains to be investigated whether this has been achieved. There is some evidence that the reporting structure of the EIP is increasing academic workloads by forcing academics to address problems raised by students in their status and milestone reports. While this increased workload is of concern, it is mitigated by the more effective

relationship with students. In contrast, the traditional thesis presently has no formal reporting structure and students with problems may quietly sink.

EIP business plan

The EIP was structured to move towards sustainability. To help achieve this goal a business plan was developed, that will be reviewed annually. Specifically, the business plan focused on:

- Determining the level of service to be offered (Coll & Chapman, 2000);
- Objectives and mission of the program;
- Management of the program;
- Market analysis including needs, trends, growth forecasts;
- Strategy and implementation strategy including value propositions, competitive advantages, marketing strategy and milestones;
- Management summary; and
- Financial plan including performance indicators.

The learning benefits were clearly stated in the business plan, fitting with suggestions by Cates and Jones (1999) on selection of an appropriate academic model and aligning the program with the goals of the university. The EIP educational objectives are also strongly aligned with the ideals of the "Griffith Graduate" (Crebert, 2003).

Academic integrity of EIP

The concept of academic integrity within the framework of the EIP has been taken to be education with a solid theoretical framework and open to scrutiny. With the EIP, the day-to-day direction of the student is under the control of the industry partner supervisor however overall direction of the program is provided by the university via the negotiated project topic, milestones, feedback and ultimately with the marking of their work and grading the student.

There are threats to academic integrity of a program such as the EIP (Sovilla, 1998), particularly if excessive emphasis is placed on marketing of increased students numbers, student retention and job prospects rather than an improved educational impact. Without an increased educational benefit, a program is a gimmick.

An additional risk to academic integrity, identified by Boud and Solomon (2001), is that "*academics involved in work-based learning no longer have the sole right to decide what is to be learned or how it is to be learnt. The accountability is no longer self-referential but extends into the boundaries of the workplace*."

To take this into consideration, together with the need to ensure academic validity of the project thesis topics offered by the industry partners, the EIP office negotiated and liaised with the industry partners and academic staff to ensure this was addressed. It was recognised that this was an important factor in gaining academic support for the program and the ensuing changes that were required. Despite these efforts, feedback has indicated a feeling of "lack of ownership" on the part of some of the School's academics. This may be due in part to the shift from the thesis topic being defined by the academic to one being primarily defined by the industry partner. In the future, academics will become more involved in formulating the projects with the industry partner to increase ownership of the project.

EIP Program review and assessment

Eames (1999) identified that many studies have attempted to apply quantitative survey techniques and educational achievement instruments. These studies have tended to concentrate on measuring changes in academic performance as an indicator of educational benefit, rather than the actual learning experiences that can occur during work placements. However, Eames (1999) in reviewing the work of Coll (1988), indicated that there is increasing recognition that *qualitative* methods may reveal a depth of information about students' experiences in work placements. This view has also been taken with the EIP and a number of qualitative approaches have been included to learn about the students' experiences.

Evaluation tools

A series of evaluation tools have been used to assess both the students' and the program's effectiveness. These include:

1. <u>Self assessment of generic capabilities</u> – this was conducted at beginning of the programme and was used to determine the student's level of basic generic skills (Lizzio, 2001)
2. <u>Pre-placement questionnaire</u> – a quantitative and qualitative tool to investigate the students' appreciation of the issues involved; to determine how well prepared they felt; and to ascertain what generic skills they wish to develop during the course of the programme. This was conducted after the initial week of workshops
3. <u>Mid-placement questionnaire</u> – this quantitative questionnaire was conducted in week nine to assess the success of the placement and to provide immediate feedback to the program to assist with planning for 2004. It was also intended to give early feedback on the extent to which the students' placements facilitated development of generic skills.
4. <u>Self re-assessment of generic capabilities</u> – this will be conducted at the end of programme and is designed to assess the changes in competency with various generic skills, developed during the placement.
5. <u>Focus groups</u> – Interviews/forums will be conducted with key players to evaluate the programme:

   - Six months following graduation, student participants will be interviewed to evaluate the impact of the placement on their generic skill development and their perception of the overall success of the programme. The format of this will be similar to that undertaken for Griffith Graduates Stage 5 (Crebert, Cragnolini *et al*, 2003) in order to provide some comparison.
   - Separate focus groups for university staff and EIP students will be held at the end of the placements in late November 2003.
   - Other focus groups will be held with industry partners to cover:
     - EIP administration;
     - Their expectations and tangible deliverables; and
     - Assessment.

     The industry partners' questionnaire used in the focus groups will be based on surveys used previously by the School of Microelectronic Engineering and on the framework provided by Coll and Chapman (2000). Knowledge of employers' needs is crucial for the success of cooperative education (Hurd & Hendy, 1997; Coll & Chapman, 2000).

Performance indicators

As the EIP pilot program was funded by a Griffith University Strategic Improvement Grant, accountability was an important part of the work being undertaken. To address the issue of accountability a number of performance indicators were developed. There were:

A. A significant improvement in generic skills (Crebert, Bates *et al,* 2002; Crebert, Cragnolini *et al*, 2003)
B. A significant increase in student enrolments (Sovilla, 1998)
C. Increased student retention, particularly after first year (Vivekananda, Ramsay *et al*, 2003)
D. Decreased median time for graduates finding employment (Edwards and Jancauskas, 1999)
E. Significant increase in research partnerships with host organisations (Boud & Solomon, 2001)

Each of these performance indicators will be addressed in more detail.

A.   Significant improvement in generic skills

Whilst generic skill development has been discussed in various reports written as part of the Griffith Graduate Project (Crebert, Bates *et al*, 2002), they were not overtly measured or assessed. To quantify changes in generic skills in the EIP, Lizzio's "Self Assessment of Generic Skills" (Lizzio, 2001) was used.

Potential EIP students were introduced to the concept of the EIP providing them with an opportunity to improve their generic skills and the importance of these from the outset. This was stressed in the initial correspondence to the students offering them an opportunity to participate in the pilot:

> …As you know these days it is not enough to graduate with a high GPA. Employers are wanting new recruits who are able to function quickly in the workplace, be able to communicate well with clients and solve problems. In other words they want graduates to have developed a number of generic skills and become lifelong learners….

The Institution of Engineers has implemented a Professional Development Program (IEA, 2003). The 2003 EIP students will be the first students in Australia to participate in their programme and they will be able to use their industry experience to gain up to five elements of the "competencies" for this Professional Development Program. It is anticipated this will accelerate their progress towards chartered status with the Institution, the peak industry body for engineers.

B.   A significant increase in student enrolments

A return to maximum enrolment numbers in the Environmental Engineering degree and the length of time it takes to achieve this will be measured. A timeframe of at least three years for any change is expected if the EIP is not actively marketed. However, the success of some other programs is encouraging. The first engineering co-op program at the University of Cincinnati in 1906 had 27 students and 400 prospective students enquired about the program the following year (Sovilla, 1998). The University of Waikato BSc Technology program enrolments rose from 10 to 200 between 1974 and 1995 with the introduction of an industry placement program (Coll & Eames, 2000). Failures also exist. In the United States, the number of programs has dropped after an initial period of vigorous federal funding (Sovilla, 1998). Further discussion of reasons for this is outside the scope of this paper.

C.   Increased student retention, particularly after first year

Increased student retention particularly after first year is sought as one of the outcomes of the EIP. Poor student retention deceases the reputation of the institution, reduces the pool of potential higher degree students, makes recruiting more difficult and is expensive, particularly for overseas students (Vivekananda, Ramsay *et al*, 2003)

Whilst measurement of changes in retention rates in the degree program will take a number of years and would be difficult to directly attribute to the EIP, some activities are planned to make the EIP better known to first year students. These include current EIP students speaking to first year students prior to the exam period about their experiences, and inviting first, second and third year students to attend the EIP Expo in November 2003.

D.   Decreased median time for graduates finding employment

Students will be surveyed six months after graduating. The survey instrument will be similar to that used by the Griffith Graduate Program (Crebert,, 2003). It should be restated that while the potential for better job prospects exists, it should not overshadow the academic integrity of the program.

E.   Significant increase in research partnerships with host organisations

Boud and Solomon (2001) found that partnerships increased, and interviews with the industry partners has indicted a high level of interest in strengthening relationships with the university. This interest will be developed and monitored.

Results

Pre and post self assessment of generic skills

A survey "Self Assessment of Generic Capabilities" developed by Griffith University (Lizzio, 2001) was used assess the level of skills before the EIP placements began and will be repeated at the end of the EIP to determine change. The survey aligns with ideals of Griffith University's Griffith Graduate (Crebert, 2003) and the experience of Lizzio (2001) and should ensure a minimum level of validated assessment. This should make direct comparison with other groups in the future possible.

This survey was also sent to traditional thesis students at the beginning of the EIP. The response from the six EIP students was 100% but only one thesis student replied, despite follow-ups. It will not possible this year to compare the development of Generic Skills in the two groups, but the lack of interest of the thesis students may be a matter of concern as the importance of generic skills for their career progression needs to be emphasised (Crebert, Cragnolini *et al,* 2003)

With any self-assessment there is a potential to introduce bias. This has been minimised by making the teaching environment supportive and cooperative rather than competitive. Further experience and research in questionnaire formulation and usage should further reduce the element of bias. Though the initial class was only six, strong trends should still be evident.

The averaged results of the quantitative pre-placement survey results for self assessment of generic skills are given in Figure 1, with the skills ranked in descending order of assessed competence. The differences are unlikely to be significant, but some trends may be emerging.
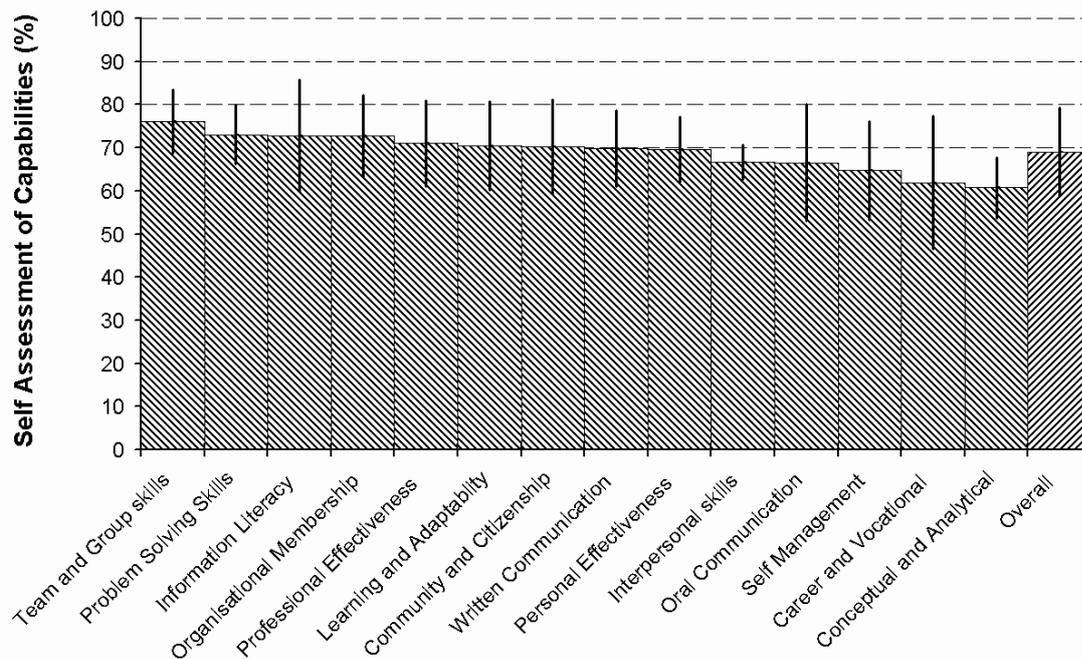
Figure 1: Pre-placement questionnaire results. Bars indicate 1 SD (n=6).

It was not surprising that the students considered their team/group skills well developed as they commonly work in groups for assignments. This has been noted in other classes (DB) where the environmental engineering students work more co-operatively (to cope with their workloads) than environmental science students, but to a lesser extent than behavioural science students.

Problem solving skills and conceptual skills were at different ends of Figure 1 and this may indicate the type of problems commonly solved by students do not require abstract thinking.

Generally, skills that should develop with maturity, such as interpersonal skills and self-management, ranked lower than ones gained directly from coursework. It will be of interest to see whether the lower ranked skills pick up more after the EIP placement.

Mid-placement questionnaire

A mid-placement questionnaire was conducted to determine the extent to which placement was allowing students to develop generic skills.

The degree to which they had opportunities to develop skills depended to some extent on the placement, with this being less effective if the students were left alone to work with limited contact with other staff. Opportunities to present reports at a number of levels of complexity were assessed as limited. This was due to students not having started the main write-up of their reports at the time of the questionnaire. The opportunity to design and conduct experiments was missed by some students as their work used standardised monitoring methods or the monitoring phase of their work not having commenced at the time of the interview.

One student was given counselling following the mid-placement questionnaire as the student had concerns regarding the progress of their project and needed to realign the objectives of their work to ensure the high level of learning they had experienced would be reflected in their report.

<u>Workplace visits</u>

An issue that has arisen as a result of interviews with industry partners and students at the workplace, is a need for the students to be better orientated by the workplace at the beginning of their placement so that they can better construct a detailed plan of their project. Options are being investigated for implementation in 2004.

Conclusions

The existence of the School of Microelectronic Engineering's Industrial Affiliates Program (IAP) and their willingness to share experiences and course documentation has permitted the rapid development of the EIP, but tailored to environmental engineering students.

The inclusion of measurable performance indicators will permit an objective assessment of the program's success, but for some of the indicators such as student enrolments, there will be a lag time of several years. Immediate indicators such as an increase in generic skills should be available later in 2003. Positively, the EIP appears to be offering students the opportunity to develop generic skills to the extent they expected.

The pre and post generic skills testing should make students more aware of the generic skills they possess and which ones they wish to improve.

Subjectively, there has been an increase in the confidence of the students, but this is hard to quantify. Camaraderie has developed amongst the students, due in part to the group being the first cohort of EIP students and working as a team to present the EIP Expo in mid-November 2003. The on-site interviews indicate an increased ability to self manage and some increase in networking skills.

Areas that are being addressed are the tension between Thesis and EIP students and some residual apprehension with academics due to a feeling of lack of ownership their student's placement. Some of the structural elements such as milestone reports will be included in the Thesis program, but whether the EIP becomes the management structure for all fourth year environmental engineering students remains to be resolved.

The large effort in planning and use of advice from the School of Microelectronics Engineering and Griffith Institute of Higher Education have contributed to the success of the program to date. As the EIP develops, it is hoped the information flow will reverse.

The School of Environmental Engineering anticipates the EIP will enhance the lifelong skills and job prospects of final year students. This will benefit prospective employers as one of the aims of the program is to develop high calibre graduates with the necessary attributes, skills and competencies expected in a graduate environmental engineer.

References

Boud, D. and N. Solomon (2001). Future Directions for Work-based Learning: Reconfiguring Higher Education. in <u>Work Based Learning</u>. D. Boud and N. Solomon. Buckingham, The Society for Research into Higher Education**: 215-227.**

CAFCE (2000). Canadian Association for Co-operative Education's Co-operative Education Manual, A Guide to Planning and Implementing Co-operative Education Programs in Post-Secondary Institutions. Toronto, Canadian Association for Co-operative Education**:** 53. URL: http://www.cafce.ca/e/documents/Co-op%20Manual.pdf

Cates, C. and P. Jones (1999). <u>Learning Outcomes and the Educational Value of Cooperative Education</u>. WACE/CEA International Conference on Cooperative Education.

Coll, R. K. (1988). <u>International Cooperative Education Placements: Benefits and Barriers</u>. Proceedings of the Third Asia-Pacific Conference on Cooperative Education, Hong Kong, World Association for Cooperative Education.

Coll, R. K. and R. Chapman (2000). "Evaluating service quality for cooperative education programs." <u>Asia Pacific Journal of Cooperative Education</u> **1**(2): 1-12.

Coll, R. K. and C. Eames (2000). "The Role of the Placement Coordinator: An Alternative Model." <u>Asia-Pacific Journal of Cooperative Education</u> **1**(1): 9-14.

Crebert, G. (2003). The Griffith Graduate. Brisbane, Griffith University. URL: http://www.gu.edu.au/centre/gihe/griffith_graduate/home.html

Crebert, G., M. Bates, et al. (2002). The Griffith Graduate Project (Stage 4) Final Report. Nathan, Brisbane, Griffith University**:** 1-24. URL: http://www.gu.edu.au/centre/gihe/griffith_graduate/GG4report.pdf

Crebert, G., V. Cragnolini, et al. (2003). The Griffith Graduate Project (Stage 5) Final Report June 2003. Nathan, Brisbane, Griffith University**:** 1-24. URL: http://www.gu.edu.au/centre/gihe/griffith_graduate/gg5_report.pdf

Eames, C. (1999). <u>Learning in the Workplace Through Cooperative Education Placements: A Longitudinal Study</u>. WACE/CEA International Conference on Cooperative Education.

Edwards, R. and E. Jancauskas (1999). <u>Does Co-op Really Make a Difference? Career Development Opportunities of Co-op and No-Co-op Engineering Graduates</u>. WACE/CEA International Conference on Cooperative Education.

Hurd, J. and M. Hendy (1997). "What we know about coop employers' perceptions of coop education: A synthesis of research in the US & Canada." <u>Journal of Cooperative Education</u> **32**(2): 55-62.

IEA (1996). The National Review of Engineering Education; Changing the Culture: Engineering Education into the Future. Barton, ACT, The Institution of Engineers, Australia**:** 112. URL: http://www.engaust.com.au/epub.html

IEA (2003). Your Career in Engineering. A Guide for Students enrolled in Engineers Australia Accredited or Recognised Engineering Courses, The Institution of Engineers Australia**:** 1-8.

Lizzio, A. (2001). Self Assessment of Generic Capabilities, Griffith University. URL: http://www.gu.edu.au/centre/gihe/griffith_graduate/sagc.pdf

Sovilla, E. S. (1998). "Co-op's 90-year odyssey." <u>ASEE Prism [H.W. Wilson - Educ]</u> **7**: 18. UQ (2001). Value added career start, The University of Queensland. URL: http://www.vacs.uq.edu.au/index.html

Vivekananda, K., S. Ramsay, et al. (2003). Griffith University Student Retention Project Final Report February 2003. URL: http://www.gu.edu.au/tandl/secure/retention.pdf