A Reflexive Course for Masters Students to Understand and Plan Their Own Continuing Professional Development

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Abstract
Continuing Professional Development (CPD) is seen as a vital part of a professional engineer’s career, by professional engineering institutions as well as individual engineers. Factors such as ever-changing workforce requirements and rapid technological change have resulted in engineers no longer being able to rely just on the skills they learnt at university or can pick up on the job; they must undergo a structured professional development with clear objectives to develop further professional knowledge, values and skills. This paper presents a course developed for students undertaking a Master of Engineering or Master of Project Management at the University of Queensland. This course was specifically designed to help students plan their continuing professional development, while developing professional skills such as communication, ethical reasoning, critical judgement and the need for sustainable development. The course utilised a work integrated learning pedagogy applied within a formal learning environment, and followed the competency based chartered membership program of Engineers Australia, the peak professional body of engineers in Australia.

The course was developed and analysed using an action learning approach. The main research question was “Can extra teaching and learning activities be developed that will simulate workplace learning?” The students continually assessed and reflected upon their current competencies, skills and abilities, and planned for the future attainment of specific competencies which they identified as important to their future careers. Various evaluation methods, including surveys before and after the course, were used to evaluate the action learning intervention. It was found that the assessment developed for the course was one of the most important factors, not only in driving student learning, as is widely accepted, but also in changing the students’ understandings and acceptance of the need for continuous professional development. The students also felt that the knowledge, values and skills they developed would be beneficial for their future careers, as they were developed within the context of their own professional development, rather than just getting through the course.

Introduction
Professional development is a major part of all practicing engineers’ working lives. It is vital to be up to date with best practice, learning new techniques and knowledge, developing new skills and furthering their understanding of their responsibilities as engineers. What engineers learn at university in their undergraduate program will not give them all the knowledge, values and skills they require to be practicing engineers in the future. Over the past ten years it has been recognised instead that universities need to develop students as lifelong learners, who continue their professional development not just for the first few years out of university, but for the rest of their working lives[3]. While part of this continuing professional
development will take place within formal learning environments, such as postgraduate courses or training programs, most of the learning that engineers undergo occurs within the workplace, as work-integrated learning\textsuperscript{[2-5]}, based on the concept of action learning\textsuperscript{[6-8]}. This work-integrated learning approach has also been demonstrated\textsuperscript{[9]} to provide more favourable learning outcomes compared to traditional classroom approaches to learning. The question that was at the focus of this research then was can a work-integrated learning approach be applied within a formal educational setting? What is the essence of work-integrated learning, and how can it be applied to a university course as part of an engineer’s continuing professional development?

The other aspect of continuing professional development is that the ‘students’ have changed from child or teenage learners to become adult learners. As Knowles points out\textsuperscript{[9]}, adult learners need to assimilate new information with what they already know, their life experiences, rather than just accepting the new. Any formal continuing professional development designed for adult learners, must take into account of the differences in learning styles between adults and the usual cohort of undergraduate students. How then does this impact the use of work-integrated learning as the predominant pedagogy within a professional development course?

This paper presents a course that was developed in part to answer these questions. The course MECH7110 – ‘Professional Practice’, was a postgraduate level course for students undertaking a coursework masters program in either engineering or project management, as part of their formal continuing professional development. The course was based around developing the students’ reflexive abilities as engineers\textsuperscript{[10]}, in order to facilitate a deep approach to learning\textsuperscript{[11]}. It was initially set up for external students to obtain formal credit for work-integrated learning they were experiencing already while in the workplace through a structured reflection process. This was soon changed as primarily internal students enrolled in the course, presenting a unique opportunity to investigate the basis behind work-integrated learning, and whether or not its ‘essence’ can be applied effectively within a formal setting. It is important to note that this was not to mimic work-place learning, but rather to simulate some of the same experiences to achieve the same learning outcomes in the internal and external students.

The course as designed went further, to look at the process of becoming a professional engineer, based on the Chartered Professional Engineer program\textsuperscript{[12]} of Engineers Australia, the major professional accreditation body of engineers in Australia. The course was developed to help the students evaluate their knowledge, values and skills they had developed so far in their careers, to look forward and identify the career paths they wished to pursue in the future, and start to develop the sorts of professional skills they will require to get there. These included teamwork, professional communication, ethics and professionalism, social and environmental responsibilities, sustainability and engineering judgement. The entire focus of the course was on the students and the development of their professional plans and skills, rather than teaching them specific knowledge.

The study undertaken used an action research approach, with the intervention involving comparing the work integrated learning experiences of the external students with the simulated experiences of the internal students, using the same learning objectives and assessment. This was not only to help in the running and organisation of the course, but also as the study focused on simulating workplace experiences, the learning objectives and
assessments needed to be the same to ensure an accurate result. The question for the study was then:

“Can extra teaching and learning activities be developed that will simulate workplace learning?”

This paper presents the findings from the action research, and discusses the implications for both the continuing professional development of practicing engineers, and how better to educate students for their future careers and professional development, with reference to adult learning principles.

Work Integrated Learning
Work integrated learning, refers to learning that students encounter when they are in a workplace situation, rather than in traditional, on-campus classrooms\(^2\). Work-integrated learning programs are\(^3\):

- **work-based**, where the learning is in context with the student spending an appropriate period of time in the work environment,
- **structured**, with formal (academic and employer) supervision and assessment
- **productive**, where the student does 'real work' that has economic value or definable benefit to the employer. It is NOT simply work experience, although this may be a by-product of such programmes, and
- **relevant** to the student's area of study. The work should have clear linkages with/add to the knowledge/skill base of the qualification/education programme.

Workplace learning also helps prepare the students for lifelong learning\(^2\). Lifelong learning has been recognised as something that is essential to a professional engineer’s career, as the knowledge and skills they learn at university are not enough to allow them to practice as a professional throughout their careers\(^13\). Most lifelong learning engineers undergo is while they are in the workplace, not only learning from what they do everyday, but using gaps they identify in their own skills when working on new projects to inform further formal learning. It is important then when simulating workplace learning, that the students constantly evaluate their strengths and weaknesses as they go about their tasks, reflect, and learn from them.

In particular, one of the strengths of work-integrated learning is that it provides context for learning, providing examples of where to apply theory and develop practical skills. More than this, the experiences are real life and authentic, rather than made up tasks created solely as learning activities. This authenticity is a vital part of work integrated learning, and is part of the ‘essence’ of work-integrated learning\(^3,4\).

Another important aspect of work integrated learning is that it not only develops students’ technical skills, but ‘key interactive attributes’\(^4\), such as teamwork, leadership and communication. In order to function and interact in a workplace environment, students develop these skills specifically during tasks undertaken within that environment. They do not write reports or give presentations for the sake of learning good communication, they write reports and give presentations for clients, suppliers or their work mates as part of their working life. Thus another part of the ‘essence’ of work-integrated learning is developing authentic interactive attributes.
Reeve[5] conducted a survey of employers participating in work-integrated learning programs of the best practices that made work-integrated learning work for the students. He found the most important aspects of work-integrated learning are:

1. Students are included in group meetings and given the opportunity to report on their work.
2. Students are invited to in-house lectures or lectures given by visiting experts.
3. Students have full access to company recreational facilities.
4. Students are assigned a mentor chosen from full-time staff.
5. Students have access to project work as a break from their regular or routine work.
6. Students are required to give an oral presentation on their work at the end of their work term.

The aspects of most relevant to the design of the study were 1, 4 and 5. A vital part of work integrated learning is that the students relate to their fellow workmates as peers, encouraging regular communication. This is part of the essence of work integrated learning, slightly different to those discussed above, as it focuses on being included as a fellow employee rather than as a student, as well as having to report on the work they are doing.

Having a mentor is another major part of work-integrated learning, as it is with professional development generally. A mentor is important as they not only act to guide the activities and the learning of the students, but also as a peer and fellow workmate, who is as much a part of the learning journey as the students.

Students having access to other work is another vital part of work integrated learning, as it is in those situations that the students learn what it is like to work on typical engineering projects, rather than specific projects created for the students. Here, the essence is for the students to experience real projects that their placement company is working on as another engineer, not a student.

It also develops the students’ future career prospects, as they not only have more work experience, but also a greater awareness of workplace culture, as well as useful contacts for their future careers. The essence then is to understand what it is like to be in a workplace, what is expected, and what sorts on knowledge, values and skills employers are after.

Bringing this all together, the essence of work integrated learning is thus:

1. Real life context
2. Developing authentic interactive attributes
3. Reflecting on strengths and weaknesses
4. Appreciation of lifelong learning
5. Interaction with a group of peers
6. Having a mentor
7. Real outside projects
8. Awareness of what employers are after
Adult Learning
As mentioned above, adults have different needs and styles as learners, compared to traditional university students. Knowles\textsuperscript{[9]} found that adult learners:

- **Are autonomous and self-directed**
  They need to be free to direct their own learning, working in areas and on topics that interest them, and must be shown how the course will help them reach their goals.
- **Have life experiences to draw upon**
  They need to be able to connect what they are learning with their previous experiences, as well as drawing on those life experiences to help inform what and why they are learning.
- **Are goal oriented**
  They are usually enrolled in a course with a goal in mind, and need to be made aware how the course will help them attain their goal. This can be partially accomplished using course objectives.
- **Are relevancy oriented**
  They must see a reason for learning something, what they are learning must be relevant to their current or future work, rather than being generic. Letting them choose their own project topics is again one way to meet this need.
- **Are practical**
  They focus on the aspects of the course that are most useful for them in their work, and are not usually interested in knowledge for its own sake.
- **Need to be shown respect**
  While all students need to be treated with respect, adult learners should be treated as equals with useful life experiences and should be able to voice their opinions freely in class.

How does this then align with work-integrated learning? Adult learners are autonomous and self-directed; where as work integrated learning works best when there is a mentor guiding the student. Alignment can be reached by allowing students to choose topics and projects that interest them, but providing guidance when needed or asked. The life experiences of adult learners work in helping the students understand what employers are after, and in reflecting on their strengths and weaknesses, thus reinforcing the work-integrated learning experiences. The goal oriented nature of adult learners can help develop an appreciation of the need for life long learning, as anywhere the students want to go in their careers will require further learning. Adult learners’ need for relevance and practical knowledge and skills is met by the real life context of work-integrated learning, and their need for respect and to be treated as equals enables the development of authentic interactive attributes and the interaction with a group of peers. Thus the essence of work-integrated learning correlates very well with adult learning pedagogy.
Overview of MECH7110: Professional Practice

The educational intervention was aimed at giving the internal students enrolled in MECH7110 the opportunity to develop their professional knowledge, values and skills in tasks that simulated workplace experiences. This was not only to help the internal students with their professional development, but to investigate pedagogies behind professional development; those of work-integrated learning and adult learning.

The aim of the course was:
... to help you with your development toward becoming a competent professional engineer by developing life long learning skills that are essential to professional engineers in today's society.

The learning objectives developed for the course were the same for both the internal and external students, and by the end of the course the students should be able to:

1. **Critical Analysis:** Critically analyse and evaluate the tensions that can occur in meeting the social, cultural, and environmental responsibilities of engineers in practice.
2. **Engineering Communication:** Communicate in a professional manner, both in class discussions and written assignments.
3. **Engineering Judgement:** Make engineering judgements in complex situations involving ethical and other professional considerations.
4. **Professional Development Program:** Plan a professional development program as an engineer by assessing your strengths, weaknesses and possible future career paths.
5. **Reflexivity:** Demonstrate a reflexive approach to your role as a professional.
6. **Systems Thinking:** Apply systems thinking to problem / opportunity identification and formulation involving diverse stakeholder groups.
7. **The Engineering Profession:** Critically discuss the development of the engineering profession in historical terms, and assess the challenges facing the profession in the future.

These learning objectives were based on both Biggs SOLO taxonomy\(^{[14]}\) and Bloom’s taxonomy of educational objectives\(^{[15]}\). The assessment that was developed tried to assess the required levels of understanding of each of the learning objectives. For instance, learning objective 5 required students to demonstrate a reflexive\(^{[10]}\) approach to their role as a professional, so this was included in all the assessment pieces to reinforce the ‘demonstrate’ level of understanding.

A different topic was covered each week, presented in table 1, that represent some professional issues that are important for professional engineers and thus their continuing professional development.
The assessment for the course was:

Individual assignments (100%)
- Professional Needs Analysis (15%)
- Literature Review (25%)
- Reflexive Portfolio (60%), made up of
  - 4 Professional Development Logs (submit 6) (30%)
  - Professional Abilities Inventory (30%)

To help students develop themselves as professionals and to mirror workplace activities, the assessment was made as authentic as possible. Authentic assessment is a “form of assessment in which students are asked to perform real-world tasks that demonstrate meaningful application of essential knowledge and skills”[16]. As this course was about the student’s professional development, the assessment was designed to align with what they may be expected to do in their professional lives as engineers.

It was important that the students developed the professional skills in this course through a student focused learning program. As Ramsden points out, “when we talk about a student understanding something, what we are really saying is that he or she is capable of relating to a concept or topic in the way that an expert in that subject does”[11], in this case a professional engineer. As learning consists of changes in student understandings it is important that they were given the opportunity through their learning experiences to challenge these understandings. This was attempted in this course through the thorough engagement of all students with all of the learning activities and assessment pieces, which were designed so that the students were active and in control of their own learning.

The professional needs analysis required the students to identify a future career path they wished to move along, and identify the knowledge values and skills they required to follow that path. They then planed for the attainment of these identified skills, finishing with a definite plan for their professional development over their next few years as a professional. They were also required to reflect on what they had learnt and what they feel they could have done better, reinforcing reflection as a vital professional skill.

The literature review required the students to investigate a current challenge to the engineering profession that interested them and explain why, with reference to their future career path identified in the first piece of assessment. They reviewed three journal articles.
about the chosen challenge and critically analysed the views the authors presented, and discussed what they believe should happen in the future to meet this challenge. The students finally reflected again on what they had learnt and what they could have improved upon.

The reflexive portfolio\cite{10} was made up of two parts, professional development logs and a professional abilities inventory. The professional development logs were fortnightly critical reflections on significant learning events that the external students encountered in their workplace. The internal students reflected on the in-class activities and readings that were developed as part of the intervention. This piece of assessment was ongoing throughout the semester and was the main instrument to develop the students as reflexive professionals.

The professional abilities inventory required the students to self evaluate the personal and professional skills they had developed both prior to the course and during the course. They then conducted a self evaluation using a case study that tested a number of professional skills, including systems thinking, social and environmental responsibilities and engineering judgement.

**Methodology: Design of Action Learning Intervention**

The action learning model used is based on social constructivist models of learning, where students are active in their learning within a group setting and where they develop their knowledge and skills through practice\cite{11,14}. This approach is a student-centred one, where the students are in control of their own learning experiences, and reflect on what they are learning. Thus the approach that was taken focused on the student’s understanding their own professional development, coming to terms with various professional issues and developing themselves as learners. The model that was developed consisted of one large action learning cycle throughout the semester, and twelve smaller cycles during the semester, based on the model proposed by Bunning\cite{17}.

The implementation consisted of thirteen class workshops, and thus twelve smaller action learning cycles. At each class, all of the students reviewed and discussed the set of two to three journal articles. Internal students then undertook the workshop for that week that usually consisted of a case study that dealt with the issues raised in the class discussion. The students then reflected on what they learnt in their professional development logs and their other various assignments.

The effectiveness of any intervention is dependent upon its evaluation, as without a valid and reliable evaluation, accurate conclusions about the intervention could not be made. In order to evaluate this action learning intervention, a number of different methods of evaluation were used. This was to increase the validity of the results obtained, which is an important part of any evaluation of teaching\cite{18}. This validity was achieved in this intervention through the process of triangulation, in this case five different sources of data were used\cite{19}:

- an introductory survey to establish a baseline;
- the quality of the assessment pieces, comparing the internal and external students’ works;
- in class discussion and observation, to evaluate what and how the discussions centred on the weekly professional topic;
- one on one discussions with internal and external students to gather their perceptions; and
- an exit questionnaire to see how the students’ perceptions had changed from the beginning of the course.
The evaluation methods were chosen to enable to accurate evaluation of the impact of the intervention, and consisted evaluations to constantly monitor and adapt the intervention to unforeseen circumstances, and to determine the overall impact of the intervention. The evaluation methods were also chosen to provide primarily qualitative data, which can produce rich, deep information\cite{20}. As the class size is relatively small, quantitative data is not going to provide as useful information, but is still used in methods such as questionnaires.

**Action Research Intervention**

There were a total of six internal students and two external students enrolled in the course. The same aims, learning objectives and assessment plan were used for both the internal and external students. The major course development was the extra teaching and learning activities for the internal students with extra teaching and learning activities to simulate workplace experiences, with the external students could participate as originally planned in the workplace.

The extra teaching and learning activities were made up of three parts; a “journal club”, a set of weekly workshops, and the authenticity of the assessment tasks. The journal club consisted of a set of journal articles to read and exercises to complete each week. The students were also encouraged to keep a reflexive journal about what they were learning both within and outside the course. While this was not directly examined, all of the assessment tasks were designed to feed from the students’ reflexive journals. While the journal club was aimed at both types of students, the weekly workshops were developed explicitly for the internal students, to provide extra learning activities for them to participate in. While not part of the initial plan, the authenticity of the assessment pieces was soon included in the intervention, as assessment is not only a driver of student learning, but simulates a lot of workplace activities in itself.

**Journal Club**

Each week, all of the students were involved in a journal club that involved the students reading two to four journal articles before class, with the internal students discussing the issues raised in the articles in relation to their professional development in class. While this part of intervention was used by all students as a framework for their learning, it was especially necessary for the internal students as many of the issues covered were new to them. The journal articles presented different viewpoints of the same topic each week, requiring the students to not only read what the articles were saying, but to critically analyse them to create a single picture in their mind of the issue. The journal articles chosen were all relevant to the students’ professional development, and tried to engage the students with the literature as a professional engineer would. It also provided a real life context for their learning, as well as trying to develop within the students an appreciation for and understanding of lifelong learning.

The in class discussions of the journal articles was also an important part of the internal students’ experiences, as they discussed the professional issues each week like peers in a workplace, rather than students. This helped the students develop authentic interactive attributes. The discussions were facilitated by both the tutor in the course coordinator, who both steered the conversation towards how these professional issues impacted each of the students, and what they would do as results, rather than just accepting them at face value. In this way the tutor and the course coordinator act as mentors, to help further simulate workplace learning. This context based discussion was a vital part of stimulating workplace learning environments.
In-class Workshops
The extra teaching and learning activities the internal students undertook consisted of a series of workshops, based upon the weekly topic. Most of the workshops included real life case studies, which actively engaged the students in considering the different issues each week. Each case study had a situation and context, a problem that needed to be solved and a possible solution. The students had to consider the problem in relation to what they had learnt in the journal club and other external readings, and critically analyse the solution proposed. They then had to recommend their own solution, be it the same or different to the one proposed, and justify their decision. This process engaged the students with the material in an active way, which Felder & Brent\cite{21} have shown encourages learning within students much more than a teacher centred way. This was also to align with the essence of work integrated learning, where the students are working on real life projects, rather than studying knowledge and content.

The workshops were also aimed at encouraging a deep approach to learning, which is more about understanding the material rather than memorising facts. As both Ramsden\cite{11} and Biggs\cite{14} identify, encouraging students to take a deep approach to learning is vital for a true understanding to be reached. The students were further encouraged to take this approach as the assessment pieces were looking for a deep understanding of the material.

Finally, the workshops provided interaction with a group of peers each week, discussing professional issues. This also helped the students to develop authentic interactive attributes, including inter-personal skills as well as spoken communication. The workshops also gave the students a greater awareness of what employers are after in terms of knowledge, values and skills, based on discussions with the course coordinator, the tutor, and the more experienced students.

Authenticity of Assessment Tasks
The final part of the intervention focused on the assessment being as authentic as possible\cite{16}, to mirror the sorts of tasks students would be expected to undertake in the workplace. This was to further add real life context to the students’ activities and assessment, rather than having typical exams to test knowledge. This was found to be one of the major parts of work-integrated learning. The assessment was aimed at helping the students plan their own professional development. It presented the students an opportunity to develop their career plans and thoughts, and have their progress critically assessed, not to judge if they were right or wrong, but to act as a guide for their professional development.

The professional needs analysis required the students to plan their future professional development, based on the chartered membership program of Engineers Australia\cite{12}, in order to become a professional engineer. The chartered membership program is part of the push by the institution for continual professional development, aiding the individual engineers, the public and employers, and the profession generally. This assignment required the students to review their current career plans, their strengths and weaknesses in their skills, and plan for the attainment of competencies from the chartered membership program. They were also required to reflect on what they had learnt throughout the assignment.

The literature review required the students to engage with the literature, focusing on a particular challenge to the engineering profession that interests them. They were required to review and critically analyse three journal papers, and reflect on what they thought needed to
happen in the future to address this challenge. Again they were also required to reflect on what they had learnt. It was designed to be authentic as it mirrors what is expected of professionals, to keep up with the current literature of their field as part of their continuing professional development and life long learning. They were also required to submit their assignment in the form of a conference paper, to further add to the real life context.

The professional abilities inventory was designed to prepare them for the future, by reflecting on and evaluating their current personal and professional abilities. These identified abilities are then able to help the students go for jobs and assess their future professional development. They were first required to provide examples of how they have developed a series of personal and professional attributes, including

- Teamwork
- Ethics
- Communication
- Critical Judgement
- Professionalism
- Lifelong learning
- Systems thinking
- Global awareness
- Social responsibility
- Environmental responsibility

They then conducted a self evaluation of their professional attributes using a case study. The case study consisted of designing a systems solution to a particular problem that contained many social, environmental and economic issues; improving the efficiency of Mexican subsistence farming. They were retained by Oxfam International as a professional engineer to develop a systems solution, that contained not only a technical solution, the design of a plough, but other system elements, such as education, government support and community consultation. They were required to submit their solution as a white paper to Oxfam International, further making the assessment piece as authentic as possible.

Finally, the professional development logs required the students to reflect on the past fortnight and what they had learnt. They had to select one significant learning event and conduct a structured reflection upon it, using the SAID approach (Situation – Affect – Interpretation – Decision)\textsuperscript{[22]}. This reflexive approach has been shown to be the main way professionals act and learn in practice\textsuperscript{[23, 24]}.

Besides providing real life experiences, the question must be asked what it was about the assessment that is specifically related to the intervention. What is different in the way the internal and external students went about the assessment pieces, and what was it that required simulated workplace learning? Both the professional needs analysis and the literature review could have been undertaken by both internal and external students in the same way. The professional skills inventory likewise was an assessment piece that both types of students could undertake, but the internal students drew on what they had learnt through the extra learning activities. The professional development logs were really where there was a change. The external students were expected to draw upon their workplace experiences to reflect on in their logs. The internal students reflected on what they had learnt in the extra learning activities, the journal club readings and the weekly workshops, to complete the logs.
Results of Intervention
The intervention that this paper presents asked the question, “can extra teaching and learning activities be developed that will simulate workplace learning?” It was found that yes, indeed teaching and learning activities can be developed that simulate workplace learning experiences. These included interactive workshops, a journal club and authentic assessment tasks. Five different methods were used to evaluate the intervention in order to verify the results. It was found that the results from all methods used pointed to the success of the intervention, and that the teaching and learning methods developed resulted in learning that simulated workplace learning. These are discussed below.

Introductory Survey
The first issue that is identified was that the overall level of experience was much higher than originally expected and planned for, especially from the internal students. Half the internal students had limited engineering experience, but the other half had quite extensive experience in various projects in the fields of engineering and project management. This resulted in more interesting discussions within the workshops, as the experienced students could refer to their previous workplace experiences, while the inexperienced students learnt more about what the workplace is like and what employers are looking for.

Generally the students thought the course involved reflection on their careers, their responsibilities, professional ethics, life long learning and training for the workplace. One interesting comment came from an external student, who thought that it was to “think more of the soft side or ‘care bear’ side of being a professional, rather than just technical/maths/science” which is a common conception among engineering students (and coincidentally some academics)\[25\]. This conception, though, does not mirror those of the engineering industry or the profession\[26, 27\], who regard such skills as communication, teamwork and professionalism as some of the most important skills engineers need to possess. This course was refined then in light of these comments to continually show the students that most of the issues covered were important to practicing engineers, and that they should not be treated in less esteem than the ‘hard’ technical skills.

The students all believed that the course would help them become professionals, and better equip them to handle challenges in the future. This was encouraging, because it meant that they were open to learning about these issues.

Quality of the assessment pieces
Generally, the results of the quality of the assessment pieces indicated that the internal students developed the same sorts of skills and values as the external students. For the professional development logs, this was based upon both what they reflected on and the depth of the reflected experiences. This assessment piece held the largest difference between the internal and external student experiences to draw upon, as while the other assessment pieces could be performed by both internal and external students to the same level, to a certain extent regardless of whether they were presently in a workplace situation. The professional development logs drew directly on the students’ experiences during the course. Thus this assessment piece is the main indicator of the success of the intervention. The results indicated that if the students applied themselves, by participating in the teaching and learning activities designed to simulate workplace learning experiences, then they performed just as well as external students in a workplace.
The professional needs analysis assessment piece was based around the students planning their future careers, the focus of the intervention evaluation was thus on how authentic the assessment was, and how well the students embraced both analysing their own strengths and weaknesses and planning for the future attainment of competencies. To this end, the work of the internal students that performed well paralleled the work of the external students. Both groups reflected on their chosen career, analysed their current skill base and planed for their future professional development. This indicated that the internal students were at least, not disadvantaged by not being in a workplace environment while evaluating and planning their future career paths.

The literature review assignment not only required the students to engage with the literature, but follow a particular writing format; that of a conference paper. All of the students were able to engage with the literature, and in fact two internal students performed better than the external students at the literature review and its associated critical analysis. Reflection was a larger part of this assignment, and this was the only place the external students did better than the internal students. Even so, the quality of the insight and analysis was comparable for both internal and external students.

Finally for the professional abilities inventory, the quality of all the students’ responses was very similar, and did not produce much discernable difference between internal and external students.

In class discussion and observation
Overall the workshops worked in the way that was originally planed, providing a place to expose the internal students to the different professional issues each week and discuss them with their peers. They also allowed them to develop professional skills through hands on activities. Thus, the workshops have integrated many of the essential parts of work integrated learning.

One-on-one discussions
While no formal one-on-one interviews were conducted, some informal discussions were conducted with a few students on this level. One major discussion was with one of the external students, to discuss some of the assessment pieces and generally how they were finding the course. They indicated they wanted a ‘bit more’ feedback from the assessment pieces to help their future responses, but other than that they were happy how the course was progressing. They were also particularly happy how well aligned the course was with their own professional development and attaining chartered membership of Engineers Australia.

During another conversation, an internal student related that where he was from students were not required to write reports for any course to complete their Bachelor of Engineering; all courses were assessed using only exams. The course coordinator and tutor discussed how this would affect both his work and the work the others from his country, and thus affect the reliability of the interventions results. As a result of the discussion, more help on basic report writing was offered to both him and other students in his position. It should be mentioned that their final results were not as affected by this as originally thought, and as the intervention evaluation looked at the quality of what was meant in the assessment pieces, rather than communication skills, the results were not affected.

Generally the internal students did not feel that they were at a disadvantage for not being in a workplace. Rather, many felt that they gained more from the discussions with other students.
about their experiences, and liked the extra help they could receive from the course coordinator and tutor. This was especially the case for some of the English second language, or ESL, students in the class. They also felt that the course was preparing them for their future careers in a workplace, which is a major part of the essence of work integrated learning.

Exit questionnaire
The exit questionnaire required the students to reflect on how their ideas of professional development changed, what else they would have liked included in the course, how they thought their enrolment status affected their learning, how they thought their previous workplace experience helped or hindered them in the course, how they felt both the workshops, journal readings and the assessment helped as learning experiences, and generally how they found the course.

It was found that the students’ understandings of professional development expanded, to include issues of sustainability, environmental and social responsibilities and personal development. They wanted included in the course in future:

- Professional development in wider areas, not just engineering (Internal)
- More of a description of what the assignments required (External)
- More detailed feedback about assignments (External)
- More time for assignments, and less overall (External)
- More computer based skills (Internal)

The external student complained about the workload, as his external status affected the amount of time he could devote to the course (although the actual hours spent should have been the same as the internal students). The internal students all felt that they benefited from their enrolment status, as they were able to discuss issues with their peers and obtain help when needed. Some students felt that their previous experience helped, but most could not see how it related, as it was not in the area of engineering.

The internal students all felt the workshops, journal readings and assessment pieces were vital to their learning, and did mirror what they either thought or knew workplace experiences were like. They felt they helped improve their communication skills, both written and verbal, as well as helping them to think about their own learning and future as engineers.

Discussion
This paper presents the evaluation of an educational intervention that was performed on a postgraduate level engineering course on professional development. It was found that extra teaching and learning activities can be developed that simulate workplace experiences, and that the learning of internal students undertaking the teaching and learning activities was comparable to that of external students in an engineering workplace. What does this mean both for teaching and learning at universities, particularly in post-graduate level courses, and for the formal continuing professional development of professional engineers?

The major issues for teaching and learning, especially within engineering build on those already identified about the benefits of work integrated learning to both student development and attainment of graduate attributes, as well as their future career prospects. It also shows that many of the benefits of work integrated learning can be incorporated into internally offered courses. However given the close parallels of work-integrated learning and adult learning, it could be argued that this will be more effective if introduced into courses at a
post-graduate level, which are usually made up of adult learners. It is vital for the success of any course with adult learners that they are to a certain extent in control of what they are learning and what they focus on. This was found to be the case in this study, where the students enjoyed and benefited from being able to choose topics for the assessment pieces that interested them. In a formal educational setting

It should also be mentioned that since this study focused on professional issues, rather than technical ‘hard’ topics, the success of work integrated learning may not directly translate into the teaching of more technical topics. While some aspects of work integrated learning, such as having a real life context can and should be used, assessing personal and professional strengths and weaknesses can not easily be applied. Thus, for teaching courses that focus on aspects of professional development, incorporating the principles of work-integrated learning can result in more favourable learning outcomes for the students involved compared with traditional university teaching.

More broadly for the continuing professional development of engineers, it demonstrates that ‘formal’ professional development does not need to be abstract from the workplace. Rather, a structured development program, in particular through a university program, can result in effective learning outcomes.

Conclusions

The principles of work integrated learning can be applied successfully to a university based course through the use of extra teaching and learning activities. The ‘essence’ of workplace learning parallels that of adult learning, providing a useful pedagogy for the professional development of adult professional engineers. The course presented in this paper is focused solely on the student’s professional development, developing professional abilities and leaving the students with a definite plan of action for their future career path.

References


**Bibliographical Information**

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