'Lessons Learned' by engineering students on placement

It is generally acknowledged that students have the opportunity to gain far more than technical knowledge on placement or even the chance to experience contextual application of their skills. Students also leave placements with enhanced professional skills. The difficulty for an educator is often to get students to recognise them. However, if students themselves are not brought to an awareness of their own progress and abilities, and then a real opportunity is lost for them to benefit fully from the placement experience. If co-op is only a vehicle for experience to gain information about the work place and to link technical knowledge with the work place application, then its effectiveness is not fully developed. (Van Gyn 1996)

The School of Engineering at the University of Queensland offers a Professional Placement Scholarship to students in their fourth year, for which students obtain full academic credit. As part of the academic element, students undertake a two unit professional development course. This course is sits alongside the six unit engineering research project that is also completed whilst the students are on placement. The combined eight units represent a full semester load.

Through the professional development course, the students are asked to identify critical learning events in terms of professional development. At the end of the placement the students are asked to review their learning and to deliver a presentation on their 'Lessons Learned'. They are asked to focus on three or four key areas of their professional development that they feel would be most beneficial to share with their peers. This assessed task is set in addition to an assessed presentation delivered on the outcomes of their research project, this giving parity to the two areas of placement experience.

This paper looks at how the students are taken along the reflective journey that culminates in their presentations.

Professional Engineering Placement Scholarship

Engineering students at the University of Queensland are offered the opportunity to undertake an engineering internship during their first semester of fourth year. The program is small offering placements to between 10 and 20 students each year.

The program is called the Professional Engineering Placement Scholarship (PEPS), and can be described as an approach that enables students to develop and demonstrate engineering technical skills as well as graduate attributes whilst on placement. Ideally the program duration is six months, comprising one semester of vacation work and one semester of PEPS. However, in practice the initial vacation work lasts anything from a full semester to a couple of weeks.

Students are selected via university and company interviews, and are chosen by their motivation, enthusiasm and potential to cope with independent learning and external courses, rather than on good academic performance. However, all students are generally averaging a GPA of 4.5 and above.

The PEPS program is fully accredited as students enrol on two external courses, which are assessed during the PEPS semester: one a research project, and one a professional development course.

Research Project

The 6-unit research project course requires students to use their technical skills. Companies are asked to provide a project that will stretch the students, to motivate and be useful to the company. One strength of the program is the complexity and depth of these projects. Students are often completing projects that are vital to the business of the companies, and at a level to be expected of a junior graduate engineer. Students gain technical skills and experience beyond that of their peers in the lecture room.

Professional Development Course

The second course that students undertake is a two unit professional development course, and is this aspect of the programme that creates a unique learning experience for the engineering students. Students are introduced to reflective thinking, which in almost all cases is a new and unfamiliar practice. Through her review of education literature Van Gyn (1996) finds that reflective practice is regarded as a learned skill and is most effectively introduced in conjunction with an experiential component of a curriculum. As a learned skill, necessary for its development are deliberate practice with this activity, adequate feedback and the opportunity for the transfer of the skill to a 'real' environment.

How we diagnose and construct our experience, take action, and monitor our behaviour while simultaneously achieving our goals is crucial to understanding and enhancing effectiveness. If we learn to behave differently and to make these new behaviours stick, we will begin to create a new world. (Argyris & Schon 1974).

The course seeks to encourage students to recognise the importance of professional skills and check the development of those skills through the placement in preparation for eventual preparation for professional status.

The course has six elements:

- Professional Development Log
- Critical analysis of Professional Abilities
- Presentation of Professional Abilities
- Work-integrated Learning: A critical Analysis
- Workplace performance
- Lessons Learned

1. **Professional Development Log**

   Central to the professional development course is the Professional Development Log or PDL in which students use reflective thinking to analyse the learning incidents that have occurred each week.

The professional development log is kept by each student and submitted electronically each week. Students are asked to identify critical learning events that have happened in terms of professional development. They are asked to consider those 'Ah Ha!' moments when things have clicked into place. They then analyse the most significant of these events using a standard analysis template. Feedback to the student is critical, and so the logs are assessed by an academic and feedback given to the student within 48 hours. This allows students time to review the comments made by the marker before completing the next log.

Analysis of learning incidents

Students are asked to analyse their learning incident in a very structured way by working though the incident in four stages on a standard template.

a.   **Situation:** What actually happened?

b.   **Affect:** What was its impact on <u>you</u> personally?

c.   **Interpretation:** What did you learn from the experience?

d.   **Decision:** What did you decide to do so as to become a better engineer?

Situation

In this stage, students are asked to simply state the facts of the incident without interpretation. Students are asked to be concise, but to write as much as they feel they need to. Incidents will vary in complexity and depth.

Example:' I received a task handover for a departing colleague, but didn't look at it. This was because, as per normal, I felt rushed and like I didn't have time. When I finally got around to looking at the task handover plan, I had several questions for the departed colleague. However, I couldn't talk to him as he was on holiday. Hence, the required tasks were much more difficult and time consuming.'

Affect

In this stage, students have to set out the personal affect the situation had on them. Students initially find this phase very difficult in terms of analysing their feelings.

When students can find or demonstrate a link between successive log entries, it enhances the reflection that is taking place, and reinforces the value of the exercise.

Example: 'I felt frustrated because I knew that a few simple answers would clear up my questions. I realised that I should have looked at the task list at the time, and so I was annoyed with myself.'

Interpretation

This phase is usually easier for students once they have worked through the first two. Students are asked to explain in what ways the new learning either confirms or

contradicts their prior knowledge, theories, or understandings about the practice of engineering, in particular the knowledge they have gained at university.

Example: 'I learnt that even if things are hectic, it is necessary to determine if it would be more efficient to have a quick look at certain tasks/documents in order to save time later.'

Decision

This phase is usually the one that struggle with the most. Students are asked to describe how the learning that has taken place will become part of their regular professional arsenal and be routinely applied in a wider range of circumstances, not just those similar to the particular event. In order to be effective, decisions must be specific, realistic, and ideally with some time frame indicated. Decisions such as 'I will do better next time' are not helpful to the individual and shows that the student has not really thought through how the incident will affect their professional life in the future.

Example: 'It's not practical to look at everything as soon as you receive it. However, I resolved to scan my email every morning, even during busy times. When I see something that is important, I will make a conscious decision to either leave it, or have a quick look and follow it up.'

2. **Critical Analysis of Professional Abilities**

Half-way through semester, students are asked to prepare an inventory of their professional abilities/skills by drawing on their weekly activity log and professional development log as resources. In a structure format, they are given twelve headings, each a demonstrable skill; problem identification/formulation, innovative analysis/problem solving, leadership, negotiation, influencing others (written or oral communication), systems thinking, effective teamwork, time and self-management, range of interests (balanced lifestyle), initiative and accountability, adaptability/resilience, lifelong learning.

Students are to demonstrate these professional abilities/skills by drawing on their experiences, primarily from their experiences on the PEPS but also drawing on other experiences. Students record this information in the Professional Abilities Inventory.

3. **Presentation of Professional Abilities**

The next task asks students to present their professional abilities in the format that they will all be asked to in the real world, via a job application. Students are asked to take the information recorded in the inventory and to complete applications for two engineering positions. In the applications, students are required to demonstrate transferable skills from the Professional Abilities Inventory.

It is hoped that this task will put the reflective thinking into context for the students as well as improving their job search skills.

4. **Work-integrated Learning: A Critical Analysis**

   Students are asked to prepare a critical review of the literature on some aspect of work integrated learning that relates to their experience in the placement. The paper must relate their learning experiences in the workplace to the literature and critically compare the theory and the practice. The paper must be approximately 2000 words long.

5. **Workplace Performance**

   The company based mentor completes an assessment of student performance during the semester in four areas; technical knowledge, problem-solving skills, teamwork, negotiation and influence. The mentor is asked to rate the student according to a set of criteria.

6. **Lessons Learned**

   This is the final task that students are asked to complete. They are asked to make a ten minute presentation o the main 'lessons learned' about being a professional engineer based on the experience in the placement semester.

'Lessons Learned' presentations

Since these presentations are arranged in conjunction with their technical presentations, they are advised to consider a format that is different to the technical presentations and bear in mind the subject matter and their audience, their peers. The presentation styles, although all PowerPoint, are varied and imaginative and can be very revealing as to their insights about the world of world.

Comments on Communication

There are different levels of people working in an organisation.

You will often get more help if they understand why you are doing something, but they won't want all the details.

Learn how to approach the different levels ie operators, technicians, professionals.

Don't expect everyone to have time for you when you want it, but be polite and assertive, set times for contact or meetings.

Be clear about what you want/need. Don't be afraid to give reminders, people forget

Learn to get on with and work with people you would be unlikely to socialise with because of age or interests

Comments on Protocols /procedures

Make sure you find these out and follow them. People respond better if you do

It is very important to record what you do.

Comments on Projects/problems

Finding answers is easier than establishing the question in the first place.

The company is only interested in the answer and you being able to justify it. They are not interested in how you arrived at the answer. Make sure you know your facts.

Get your calculations right – no one is going to check them or 'mark' them.

Money is the important thing when it comes down to it, and will drive the take-up or not of any solutions/recommendations.

Don't look for perfection. Work towards 'good enough' design or answers, this is not the same as shoddy work. Time is also money, and companies cannot always afford to spend a lot of time on one small problem.

Comments on Time management

Things always take longer than you expect.

You may have worked out how you are going to do something and resources needed, and then someone higher in the organisation takes priority.

Learn to outsource things you can't do yourself.

Allow yourself to ask for help, it is ok to do this.

Work to your own priorities not someone else's ie learn to say no to people who say 'can you just do this for me'.

Comments on Career Choice

Confirmation of my career choice.

Affirmation of ability of be an engineer and to take my place in industry.

Comments on Safety

Being on site is dangerous. Safety isn't just talk. Following correct procedures is important.

Conclusion

At the end of the course it is hoped that students have a better insight into their own professional skills and that they can use this new knowledge in their own career development. Reflection and reflective practice are crucial features in developing the effectiveness of WIL (Coll & Eames 2004). For a WIL placement to be more than just an experience, a chance to learn or enhance technical skills, students must be able to take something more away with them, something that cannot be developed at university.

To clarify the process, students are first helped to identify their strengths and weaknesses through recording learning incidents in their Professional Developments Logs.

Students are then guided through relating their learning incidents to employability skills through the Professional Abilities Inventory.

Students use this knowledge to present their shills to employers in the format that will be required, that is, a job application. They also present their findings to their peers using a PowerPoint presentation.

All the presentation methods used in the course, that is written communication and oral presentation, are the ones that students will need in their professional engineering careers.

At the end of the course, students have gained a better understanding of themselves as professionals, and they are able to match their skills to employers' requirements and be much more effective in their job search.

References

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