Enabling Reflective Practice for 2nd Year EBEE Students

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Abstract: We have undertaken an action research project to enable 2nd year Bachelor of Engineering in Electrical and Electronic Engineering (EBEE) students with the type of skills and practices they would need to obtain maximum benefit from the Problem Based Learning (PBL) experience. Reflection is a difficult process and students need to be trained to reflect purposefully. Students also often bring negative preconceptions about the particular academic discipline. It is important to spend time at the start of a course to ask students to describe and evaluate their perceptions of the course. This kind of dialogue can promote what we call reflection-for-learning, and also gave us the baseline for our action research project. The second stage of our project was to deliver workshops and other training sessions to the students. The third stage was to then re-assess the students' knowledge and application of reflective practices.

In this paper we will present the qualitative and quantitative feedback from the project.

Introduction

Victoria University (VU) in Melbourne, Australia is continuously reviewing its undergraduate programs to ensure that in addition to the expected technical expertise, its graduates are equipped with the skills required by employers and the community. As part of this initiative the undergraduate engineering programs at VU adopted Problem Based Learning (PBL) for first year students in 2006, with an annual phased roll out of PBL into the later years of each program. Problems are the very heart of the PBL paradigm, and reflection is critical to PBL. Today's engineering graduates are expected to be equipped with the competencies that they require for working at an increasingly demanding workplace (EA, 2007). Students are, however, usually ill-prepared for the type of reflection necessary to participate in the PBL process. The capacity to reflect purposefully, therefore, needs to be fostered or coached. Reflection is, however, a difficult process and not all students feel comfortable enough to engage in the process of reflection.

In their first year Electrical Engineering (EBEE) students had to write two reflective reports, but the main concentration was on facilitating their assimilation of the general structure of the PBL paradigm, as most had been through a more traditional, teacher centred, learning paradigm at school where they had been given specific instruction of almost every detail of their learning requirements. The reflective reports from first year were largely used to assess their transition from traditional learning to PBL and to assess their development without training. First year students were asked to write "a reflective report" during their first week in the course. They were asked to write a second reflective report in week 10, and given some guidance on what to include. The brief outline of the topics to be included in a reflective report which was given to first year students is shown in Table 1.

Most did not even approach covering all of these topics and certainly did not extend their reflection beyond the bare minimum of what was suggested. The unassisted development shown was limited and thus spawned this action research project. Approximately 30 second year EBEE students undertook this problem during semester 1 of 2008. The reflection and reflective writing theme was spread across the entire semester. The basic aim of this case study was to work with this group of students to

evaluate their pre-training reflective capabilities, deliver training sessions and then re-evaluate their post-training capabilities in order to determine the efficacy of the training sessions. In order to establish a pre-training baseline for their reflective capabilities and also to allow the students to take ownership of the problem by performing "Reflection **For** Action" in order to document their expectations for later comparison and analysis, students were required to write a reflective report detailing their background, experience and expectations prior to the commencement of the problem.

Item #	Reflective Report Topics Given to First Year Students
1	How are you adjusting to life as a student in Electrical Engineering at Victoria University?
2	What are you enjoying/finding a challenge about PBL?
3	How are you coping with non PBL units of study and integrating them with this PBL unit?
4	What have you learned from PBL about working in a team, problem identification, solution formulation, problem solving and time management?
5	How do your experiences compare with your expectations of the course that you outlined in week one?
6	What did you learn about the advantages and disadvantages of writing a group report?
7	In what ways does this written exercise differ from writing a technical report?
8	What have you learned about different styles of writing?
9	What did you learn about your writing skills?
10	What did you learn about your skills in other forms of communication?

Table 1: List of Reflective Report Topics Given to First Year Students

Reflective reports are very often seen by students as being little more than a chronological list of events. Students need to go beyond this short sighted view in order to gain maximum benefit. We analysed the students' reflective reports looking for evidence that they were looking beyond this simplistic view of reflection. Table 2 contains a list of the possible topics which may be included when writing reflective reports and journals and has been adapted from Moon (1999). This formed the base of what we looked for in the student reports.

Pre-Training Reflective Reports

Pre-Training Quantitative Analysis

This group of 2ⁿᵈ year EBEE students was asked to write a reflective report in the first week of semester 1, 2008. They had the background of already having written reflective articles based on the list of topics shown in Table 1. The student reports were analysed to look for evidence of an appreciation of the topics which may be included in reflective reports. This data was collated across the students in the subject (alternatively called a unit), and is shown in Table 2.

Topic	Topics Included When Writing Reflective Reports	Pre	Post
1	To record experiences	100	100
2	To deepen the quality of learning in the form of critical thinking	13	25
3	To enable the learner to understand and be able to describe their own learning process	88	100
4	To facilitate learning from experience	50	88
5	To increase personal involvement in learning and personal ownership of learning	50	63
6	To enhance problem-solving skills	38	50
7	To encourage the development of reflective practice	0	25
8	To explore the self, personal constructs of meaning and understand one's view of the world and to enhance the personal valuing of the self towards self-empowerment	0	88
9	As a means to foster deep learning rather than "quick fix" or surface learning by taking more thorough account of a situation or situations	0	88
10	To foster reflective and creative interactions in a group	100	100

Table 2: Percentage of Students Including each Topic in their Pre and Post Training Reports

It can be seen from Table 2 that all students appreciated the concepts of a chronological record (topic 1) and group interactions (topic 10). Beyond these two, the only topic which seems to have been understood by more than half of the students related to being able to understand their own learning experiences (topic 3). It can also be seen from Table 2 that none of the students exhibited any evidence of understanding that topics 7, 8 and 9 were potentially important aspects of reflective reports.

Pre-Training Qualitative Analysis

In addition to obtaining evidence of the number of students who included insights into the use of reflection for aspects beyond the obvious, we also looked for qualitative evidence of the depth of insight being displayed. This evidence is presented here in the form of a number of quotes from various student reports.

> *"Whilst PBL has proven to be highly beneficial in many areas, there were also several flaws to this unit. Working as a team was extremely difficult to deal with at times. There were several instances where conflict arose.."*

> *"I easily understand when I read the theory behind the idea..."*

> *"PBL requires you to work in a team and be active while non-PBL subjects oblige you to listen."*

These quotes show that the students recognise the differences between PBL and traditional teaching, but seem to think that the theory rather than its contextual application is the key to understanding a particular subject. They also recognised that problems can occur in teamwork, but were ill equipped to resolve the conflicts.

Outline of the Training Workshops

Brief Content of Training Workshops

The starting point of the workshops was to present the students with the following as a possible definition of reflection, from Moon (1999, 2002):

> *"Reflection is a form of mental processing – like a form of thinking – that we use to fulfil a purpose or to achieve some expected outcome. It is applied to relatively complicated or unstructured ideas for which there is not an obvious solution and is largely based on the further processing of knowledge and understanding and possibly emotions that we already possess."*

The students were then introduced to the concept of experiential learning integrated with reflection as developed by King (2002) in his discussion on developing student skills in reflective writing. He attempted to plot the three levels of reflection on the cycle of experiential learning as shown in Figure 1. He admits that the simplicity of the model exposes it to criticism. Reflection-in-action is seen to be included within Concrete Experience (CE) representing the reflection which expresses our use of tacit knowledge. While it may give rise to immediate experimentation, reflection-in-action is very much here and now and is least likely to be referred to in reflective writing. Reflection-on-action is the first stage of making meaning of an experience. Such reflection can occur in both the Reflective Observation (RO) stage and in Abstract Conceptualisation (AC) where usable concepts or hypotheses are generated. Reflection-for-action, to plan what they intend to do, maps naturally onto the Active Experimentation (AE) stage of Kolb's cycle where the implications of concepts are tested. However it may also occur during the forming of hypotheses in the AC stage.

In addition the students were given a workshop on Team Dynamics and introduced to the concepts of Belbin's Self Perception Inventory for Team Role Assessment. Students had to identify themselves as a:- Shaper (S), Plant (P), Monitor evaluator (ME), Completer finisher (CF), Implementer (I), Resource investigator (RI), Coordinator (C), or Team worker (TW). They then looked at their characteristics, their features and weaknesses and the interactions appropriate to each of these.
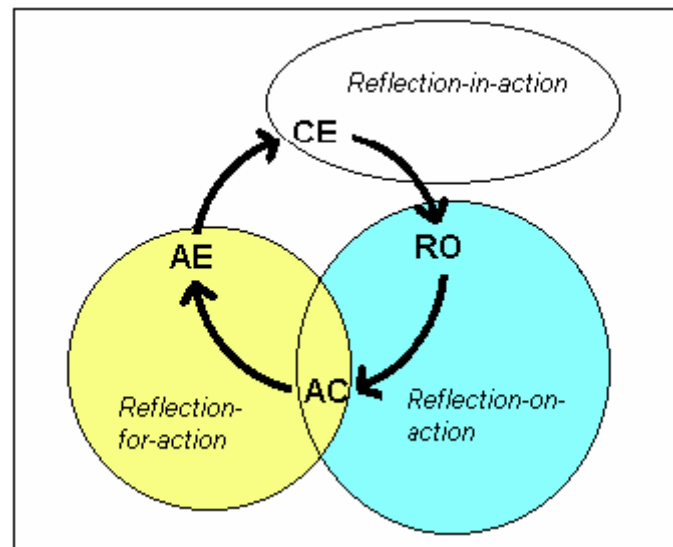
Figure 1: Assigning the Types of Reflection to the Cycle of Experiential Learning

Another workshop on Personality in the Workplace, based on the Meyers Briggs Type Indicator (MBTI) testing was delivered to the students. Students had to determine whether they were:- Extrovert (E) or Intorvert (I), Sensing (S) or iNtuitive (N), Thinking (T) or Feeling (F) and Judging (J) or Perceiving(P). They looked at the typical characteristics of a person with their character type, and the interactions such a person may have with individuals of other character types.

The Benefits of Reflective Reports and Journals

Students were introduced to the benefits to be gained from writing reflective reports, without being told prescriptively about what they should include. After all, writing reflective reports is a dynamic component in the whole learning process, and we want the students to be able to adapt and include aspects which are important in any given context. The use of reports and journals as a means for reflection in educational settings is becoming more common (Moon, 1999). Journals are usually written material based on reflection and are produced over a period of time rather than in a single session, whereas reports are usually written as a singular entity. We encourage students to maintain a (private) project logbook and include reflections within this logbook.

The main learning potential of journals comes when students can revisit what they have been recording. This can help to address what Kolmos and Kofoed (2003) call as the problem of in-process reflection loops diminishing to nothing. Revisiting the journal allows students to see the connection between apparently unconnected areas, which leads them to a deeper meaning for the material of learning. It can also be a great meta-cognitive tool as journal provides students a record of their progression in the learning process. Frantz, Siddiqui and Simcock (Frantz, 2008) map the standard three phases of reflection from an **action** form into a **learning** environment as follows:-

Reflection FOR Action, Reflection IN Action and Reflection ON Action - become respectively

Reflection FOR Learning, Reflection IN Learning and Reflection ON learning.

The point where one makes a journal entry then may be seen as not only an "IN-learning reflection" but it also has the characteristic of being a continuous "ON-Learning reflection" because it allows the person to move back and reflect on what he or she has done so far, and reflect in the light of any new learning which may have occurred. Thus writing journals, for later distillation into an assessable report, becomes part of a continuous cycle of learning where students monitor themselves in a systematic manner (Morrison, 1996).

Post Training reflective Reports

Post-Training Quantitative Analysis

Students were asked to write a second reflective report in week 10, after they had undertaken the training workshops outlined above. The workshops were not prescriptive, and the students were not given the list of topics (shown in Table 2) which may be included in reflective reports, and which we were looking for. The student reports were again analysed, the data was collated and is also shown in Table 2. The data for the Pre and Post training reports was graphed and is shown in Figure 2. It can be seen that there is some improvement in topics 2 to 6, but more importantly many students were starting to use reflection as an aid to learning and personal evaluation, as can be seen in the results for topics 7, 8 and 9.
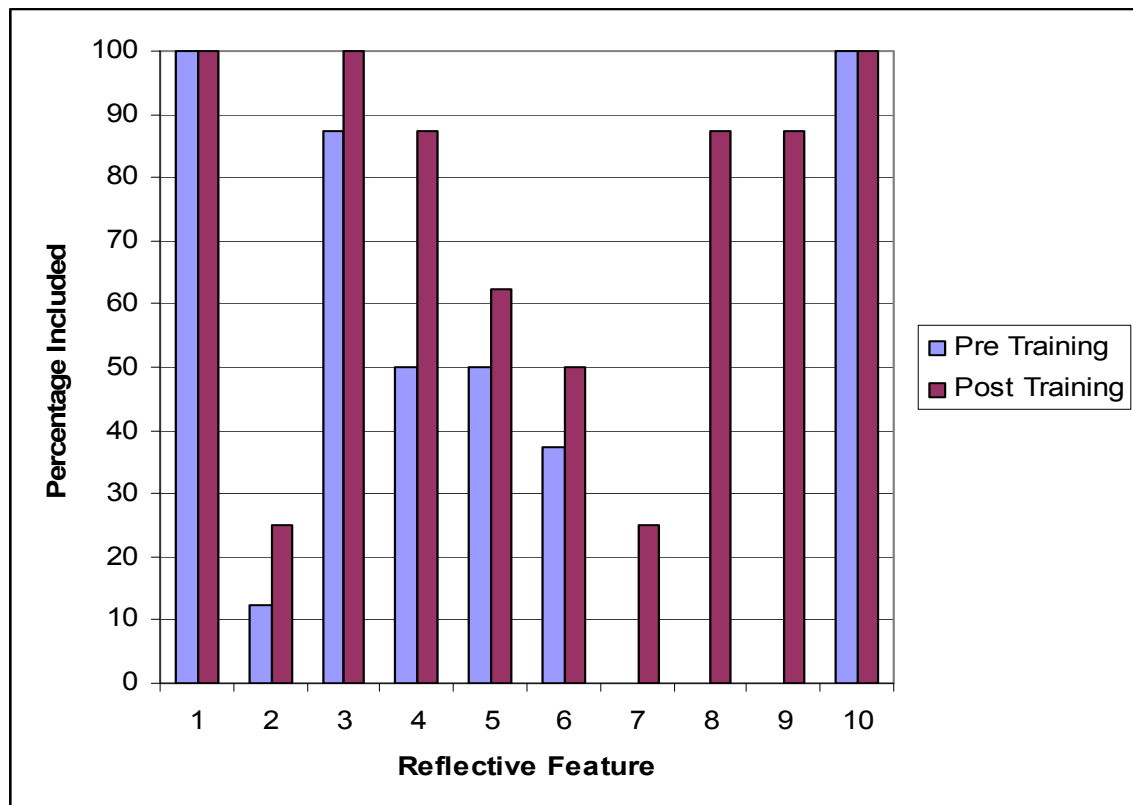
Figure 2: Results of Pre and Post training Report Analysis

Post-Training Qualitative Analysis.

As with the pre-training reports, the post-training reports were analysed for evidence of the depth of insight being displayed. This evidence is presented here in the form of a number of quotes from various student reports.

> *"The workshops have improved my knowledge regarding team dynamics, which has been reflected in the successful functioning of the team, in particular communication between team members. In the previous year conflict arose and was challenging to deal with, however the workshops have also been informative in detailing how to deal with conflict situations."*

> *"By determining each team member's personality, I was able to evaluate how I would best approach and deal with persons of different characteristics. Not only was I able to improve the way I interacted with others, but this helped me to use my strengths to benefit others."*

> *This helped me to ensure that I listened more to others and was more encouraging. This information taught me to adjust my personality and not expect everyone else to adjust to mine."*

It can be seen from these quotes that students are beginning to show insight into how their own personality and characteristics could influence their interactions with team mates.

Conclusions

Reflective report writing is not a skill that many students acquire independently, and so we decided not to use a classical control strategy in this action research project because we thought that no students should miss out on the potential for learning that would accrue from the training. It can be seen from the results obtained that they can, indeed, acquire the skills with suitable training and support. Students can be trained not only to include a broad range of reflective topics, but also to develop in depth analysis techniques which will assist them through the lifelong learning experiences they will encounter well into the future. The value of the reflective report as a learning tool has been shown to be something which students can appreciate. Reflection is one of the seminal skills which students should be able to demonstrate to prospective employers to show that they are "job-ready" and not just "job-seeking".

This whole exercise seems to have been appreciated by the students. The following quote from a student portfolio is an unsolicited testimonial to the value of reflective report writing:-

> *"My lifelong learning skills are also evident in my individual reflective pieces. My reflective pieces are a collation of the skills I have continued to develop and also state the challenges that I faced. I have accepted constructive criticism from individual reflective piece draft to produce a final copy, showing that I am continuing to learn and develop writing skills. The reflective workshop aided me in continuing to improve my skills to write a reflective piece."*

The inclusion of reflective report writing to the toolset of the students may require additional effort in the initial stages, but once it has become standard practice the benefits should outweigh this initial overhead. There will also be an additional initial effort by staff to implement such a scheme across all years of the EBEE course. The self-regulating, self-educating nature of the skills developed may well repay this initial effort in terms of creating more independent students who will require less future "supervision"

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