Learning as a Practitioner Does

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Dr Jocelyn Armarego is a Senior Lecturer in the School of IT, Murdoch University. She worked for 10 years in industry as a Requirements Engineer before becoming an academic. Teaching in schools of Computing and Engineering has led her to develop an interest in women in non-traditional areas and to actively pursue strategies for supporting females studying in these areas.

There is a gap between what students learn in their formal education, and the skills sought by industry. This gap has been identified in many disciplines and, in software development, is confirmed by studies of practitioners and academic research. These show that while discipline knowledge is covered well, nontechnical skills are usually addressed at a more abstract level and often in association with ethics, management or social concern. Yet practitioner studies indicate they place great importance on these skills – they require personable professionals who integrate into the organisational structure. Industry also looks for graduates who, rather than cope specifically with today's perceived problems, have models, skills and analytical techniques that allow them to learn, evaluate and apply appropriate emerging technologies in a collaborative environment (see, for example Lee (2004); Macauley & Mylopoulos (1995)).

I wanted to identify what generic and soft skills IT practitioners considered important, and explore how learning models could address them within a tertiary curriculum. Rather than encompassing the broader IT domain (where Software Engineering (SE), Computer Science (CS) and Information Systems (IS) are identified as the more visible disciplines), I decided to focus on Requirements Engineering (RE) (sometimes called system/software analysis), acknowledged as one of the most problematic of the activities undertaken in developing and implementing IT systems. Studies show that the root cause of many of the problems with systems in general can be traced back to RE issues. Examining perceptions of competence in RE could go some way towards addressing these issues more generically.

A preliminary investigation isolated characteristics of the RE discipline on the one hand (identified as complex, cognitive, opportunistic, creative, emergent) and of learning on the other. This suggested that the elements highlighted as either

- *practitioner* needs (eg generic intellectual abilities and skills such as initiative, ability to deal with complexity and ill-structure and organisational (self, task and information) skills or
- *domain* needs of formal education (eg a focus on flexibility, productive thinking and creativity enhancing activities, and effort spent on higher (metacognitive) learning skills, including abstraction and reflection)

could be best addressed through less traditional approaches to learning.

From 1995 to 2005 Murdoch University Engineering (MUE) provided a suite of programmes in Software Engineering. From 2002 students enrolled in the first of the core SE units (addressing RE) participated in an Action Research study that looked at how learning models addressed specific elements drawn from the practitioner studies, and also how they aligned with the students' models of learning and approaches to study. Later work looked at developing an alignment between the practitioners' needs, the curriculum and the students' learning characteristics.

The three cycles of the study (2002, 2003 and 2005) investigated the Cognitive Apprenticeship model (Collins, Brown, & Newman, 1989), a *CreativePBL* model (Armarego, 2005) and finally Studio Learning, which focusses on Schön's (1987) reflecting-in-action. He argued that reflection is central to the ability to act effectively in the unique, ambiguous, or divergent situations that become central to professional practice.

References

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Analysis of student perception of these learning environments showed that success was, to some extent, determined by its alignment to the students' learning approaches:

- students participating in the Cognitive Apprenticeship implementation (2002) were comfortable with the model – as *Assimilators* and *Convergers* (typical of engineering) in the main, they expected the teacher to function as a coach. However, they were less comfortable in the *fading* phase of the model
- the *CreativePBL* model implemented in 2003 tried to address this and focused on strategies to enhance deep learning. However analysis of the data collected showed that as a cohort they perceived that they had learnt neither more nor less from this approach – it depended on their individual approach to study. So that *Meaning*-oriented students were more likely to see their learning environment in positive terms

The School name has changed several times over the period of the study while Reproduction orientation was associated with the view that the learning environment was difficult.

However, the major issue identified was the fact that PBL is process-oriented, implying process is of greater importance then the product. This raised issues of several types: IT students are very product oriented – they see the artefact (generally the software they develop) as the primary goal of the activities they undertake. Being made to focus on process to (in their perception) the detriment of the product was very frustrating; the dependence on process also had some detrimental effect on the creativity-enhancing environment that had been developed -in theory students were required to follow process stages in sequence, even if the *aha*! factor suggested otherwise. Ultimately PBL was in conflict with the ultimate aim of the intervention – to model professionals in practice.
By 2005 the decision had been made in MUE to migrate all discipline teaching to years 3 and 4 of the BE, and that learning would be based on an adaptation of the environment developed in the SE programme. The benefit to this research was all students were required to undertake an orientation Design Week to facilitate a common understanding of Design Studios and the PBL process. Within the Studio Learning model applied in the SE programme, it was therefore possible to de-emphasise the process and focus to a greater extent on reflection as a strategy to enhance deeper learning. Most students perceived this learning environment favourably (though, as a caveat, they exhibited learning approaches that aligned most closely with the learning model). As one student noted

> *I have noticed that the design studios require a lot more work from me than if I was working alone. For example I have to spend more time working on problems because of the extra overhead of working in a team (meetings and social interaction). There is also the need to do extra research to gain information that is normally just handed out in a lecture. However I don't mind putting in the extra effort because I feel the extra effort is worth it because I feel more confident that I do know the material (not an impostor) and can apply it to future situations.*

An indication of employer satisfaction is provided by graduate career prospects. While empirical evidence was not feasible – there were too few SE graduates to provide statistically significant results, the anecdotal evidence is encouraging. Where one (20%) 2004 graduate Software Engineer was employed by a global software development organisation, of the 2005 cohort 50% (six graduates) are now employed there, as are both 2006 graduates (100%).

The progression to Studio Learning has been a journey both the students and I undertook to empower graduates to be industry-ready IT professionals. For the student, the collaborative nature of the learning environment that has evolved transcends the classroom, fostering self-directed learning and reflective practice that integrates class and work experience. Future research will examine the validity of this perception. ❖