

## Chapter 6

# Growing Pains in the Revitalisation of a 2nd Level Engineering and Spatial Science PBL Course

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### **ABSTRACT**

*This chapter is a report on a 3-year study of the effects of curriculum reform on student learning outcomes and experiences in a 2nd level engineering and surveying PBL course which offers on-campus and off-campus modes of study. The investigation was initiated in 2007, producing a list of recommendations that led to structural changes in the subsequent 2008 course offer. Additional student feedback was collected in 2008 to further refine the model, and these student evaluations resulted in modifications to the course model that were implemented in 2009. Data collected and lessons learnt in 2009 were used to fine-tune the course design in 2010. The consequences of these course modifications were that even though curriculum reform has resulted in enhanced student learning, it gave rise to negative student experiences in 2009 and 2010. It can be argued that though the course design implementation process overall has been regarded as successful, academics' attitudes towards PBL, opportunities for training and orientation in PBL, and familiarity with the new course design were evidenced as weaknesses in the delivery of the course. While both facilitators and students focus on the explicit teaching goals, such as technical and engineering aspects, there is less of a focus on the "hidden" curriculum of teamwork skills and group dynamics, and this can compromise the way in which the course is undertaken. Despite introduction to*

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*PBL methodology in a prior course that has a strong focus on team work and group skills, students fail to progress this acquired knowledge and continue to compartmentalize their learning. This scenario also alludes to the dynamics of change management involving large teaching teams, in particular, difficulties relating to academics' willingness to buy-in and adherence to collective decisions.*

## **LITERATURE**

Problem-Based Learning (PBL) surfaced over 30 years ago as a reaction to the problems and shortcomings of conventional educational approaches. Through experience and research in many different educational arenas, it has evolved into what a distinct educational method is aimed at giving the learner effective skills in problem solving, self-directed learning as a life-long habit and team work, all the while, acquiring an integrated body of knowledge from many different topics and disciplines (Barrows, 1988, 2002; Schmidt, 1983). One of the method's strongest attributes is that it is an engaging and motivating way to learn as the learner works with the problems that are challenging and perceived as relevant. According to Schmidt (1983), there are three conditions that facilitate learning: • The role of prior learning; "Learning presupposes earlier knowledge that is used in understanding new information,"

- Similarity between learning and practice situations; "The closer the resemblance between the situation in which something is learned and the situation in which it is applied, the better the performance. This phenomenon is called encoding specificity," • Elaboration of knowledge; "Information is better understood, processed and retrieved if students have the opportunity to elaborate on that information."

Whilst PBL is considered to be a student-centred pedagogy, it is essential that the process is adequately scaffolded for students, particularly those students which have not experienced problem-based learning before. Scaffolded inquiry

and problem-based environments present learners with opportunities to engage in complex tasks that would otherwise be beyond their current abilities (Hmelo-Silver, et al., 2007). Scaffolding makes the learning more tractable for students by changing complex and difficult tasks in ways that make these tasks accessible, manageable, and within students' zone of proximal development. Scaffolding is a key element of cognitive apprenticeship, whereby students become increasingly accomplished problem-solvers given structure and guidance from mentor who scaffold students through coaching, task structuring, and hints, without explicitly giving the final answers. The mentors should be guiding students in the learning process, pushing them to think deeply, and model the kinds of questions that students need to be asking themselves, thus forming a cognitive apprenticeship (Hmelo-Silver, et al., 2007).

This research is based on a description case study. The case study approach is not a data-gathering technique per se. Rather, it is a methodological approach that incorporates a number of data-gathering measures (Berg, 2001, p. 225). The case study method is useful in describing change processes because it provides for investigation of perceived change within its real-life context (Yin, 1984, p. 23). This diverges from modernist reductionism (deductive) and represents a shift from objectivism towards critical subjectivity, and from relativism to relationalism (Sterling, 2004, p. 51). Its purpose is pragmatic because it shares practice: Case studies may provide ideas, suggestions, or imagery that might sensitise outsiders to issues they may have not considered, particularly with regards to the process of behavioural change (Wals, Walker, & Blaze Corcoran, 2004, p. 347). This chapter shares the research outcome and

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