Can Experiential Learning Help Students' Learning and Improve Course Satisfaction?

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CONTEXT
Environmental Management Systems (7407ENG) is a postgraduate course taught at Griffith University. The course attracts a large student enrolment from a wide range of engineering and non-engineering programs. Although, the course had been designed and structured to meet industry expectations and develop critical skills; it had traditionally struggled to achieve high course satisfaction score. Through critical analysis of students' feedback and reflection on course delivery practices, four issues were identified: (a) poor student engagement; (b) ill equipment with assumed knowledge; (c) course structure and (d) assessment, feedback and feedforward loops. Therefore, it was necessary to redesign the course to address these issues.

PURPOSE
What impact will experiential learning have on students' course satisfaction score and learning?

APPROACH
The course was redesigned to be more student focused using experiential learning approach which included careful design of authentic assessment. Student experience was measured using quantitative and qualitative feedback on the university run student experience survey (SEC). The results from two years post implementation of new approach were compared to the results from the year prior to implementation.

RESULTS
The results showed that the new approach had significantly improved students' satisfaction in the course. The new approach also showed that students were more engaged in learning.

CONCLUSIONS
The new approach has been successful in improving students' learning and achievement of learning outcomes as well as improving students' satisfaction in the course. The approach may be applied in other courses with similar cognitive level.

KEYWORDS
Experiential learning, student focus, student engagement, authentic assessment.

Introduction

Achieving course learning outcomes is central to teaching and learning at higher education. Students who pass a course (subject) are expected to have sound knowledge of the content taught; but more importantly, they have met the 'learning objectives' of the course. Problem solving is the most distinguishing skill of the engineering profession (Downey, 2005). As such, problem solving and critical thinking are key learning outcomes of engineering curriculum. Proper alignment of content, learning activities and assessment with the course learning outcomes is important to facilitate effective learning (FitzPatrick, Hawboldt, Doyle, and Genge, 2015). However, 'learner-centeredness' was reported to be the greatest measure of students developing critical thinking skills (Holt, Young, Keetch, Larsen, and Mollner, 2015). At the same time, students' satisfaction measurement instruments, such as the Student Evaluation of Course (SEC) and Student Evaluation of Teaching (SET), are increasingly being used by universities as measures of effective learning and teaching (Oon, Spencer, and Kam, 2016). To achieve both student satisfaction while at the same time fulfilling the course objectives requires delicate balance. Experiential learning theory (Kolb, 1984) provides a platform which allow students to learn through experience and apply knowledge of conceptual understanding to real-world problems with the instructor acting as a facilitator of learning (Faculty Innovation Center, 2015). This paper describes how the experiential learning theory was used in the delivery of a post-graduate course and its results on both achieving the learning outcome and student satisfaction.

Experiential Learning (ELT)

Experiential learning theory was introduced by Kolb (1984) based on and extending the works of Dewey, Lewin, and Piaget (McCarthy, 2010). According to Kolb (1984) learning is

> *a process whereby knowledge is created through the transformation of experience. Kknowledge results from the combination of grasping and transforming experience*.

In its most basic form, ELT refers to the idea of constructing knowledge and meanings through real-life experiences and that individual people learn different concepts differently based on their social interactions (Yardley, Teunissen, and Dornan, 2012). Kolb (1984) presented this as a four stage cyclic model comprised of two modes of grasping experience- concrete experience (CE) and abstract conceptualization (AC); and two modes of transforming experience- reflective observation (RO) and active experimentation (AE) (Sternberg and Zhang, 2014). Although, the learner may enter the process at any point, the stages must be followed in sequence (Healey and Jenkins, 2000).

In the ELT model, learning is treated as a process (Kolb and Kolb, 2005). As such, the learner makes a choice on how to grasp an experience and transform it into knowledge. In the concrete experience, the learner relies on his/her senses (apprehension) to grasp the experience. This can be through work placement, laboratory experiments or field visits. On the other hand, new experience may be acquired through abstract conceptualization (comprehension) through analysis and systematic planning (Healey and Jenkins, 2000; Sternberg and Zhang, 2014). Similarly, different learners may transform their experience to knowledge through active experimentation (extension) by applying learnt skills to new situations or testing new ideas; others may reflect on what happened and relate it to past experiences (intention) to formulate conceptual understandings of ideas. Thus giving rise to the notion of Kolb's learning styles inventory (Healey and Jenkins, 2000; Sternberg and Zhang, 2014).

The learner must go through all four stages of the learning circle for the learning process to be complete. However, many learners focus on two or three stages; thus developing a preference to a certain learning style (Healey and Jenkins, 2000). Kolb developed an inventory of learning styles, or commonly named as the learning style inventory (LSI) (Kolb, 1981). According to Kolb (1984), a student who grasped experience through apprehension

and transformed it through intention is described as divergent learner; a student who grasps an experience through apprehension and transform it through extension is an accommodative learner. On the other hand, a student who grasped an experience through comprehension and transformed it through intention is said to be an assimilative learner; while the student who transformed the experience through extension is said to be a convergent learner (Baker, Robinson, and Kolb, 2012). The LSI was later extended by Abbey, Hunt, and Weiser (1985) to eight distinct styles depending on which stages of the ELT model the learner most utilise. According to Abbey, Hunt, and Weiser (1985) those who utilise 3 stages of the learning circle are referred to as Easterners, Westerners, Southerners and Northerners depending on which semi-circle the stages of learning form. There are also those who mainly utilise two stages, those are referred to as Northeasterners, Northwesterners, Southeasterners and Southwesterners (Abbey, Hunt, and Weiser ,1985). Finally, there are those who are in the balancing centre and are referred to as "Balancing" who integrate all of the four stages (Mainemelis, Boyatzis, and Kolb, 2002). Figure 1 shows an illustrative summary of Kolb's 1984 experiential learning model including Abbey, Hunt, and Weiser (1985) expansions of learning styles (LSI).

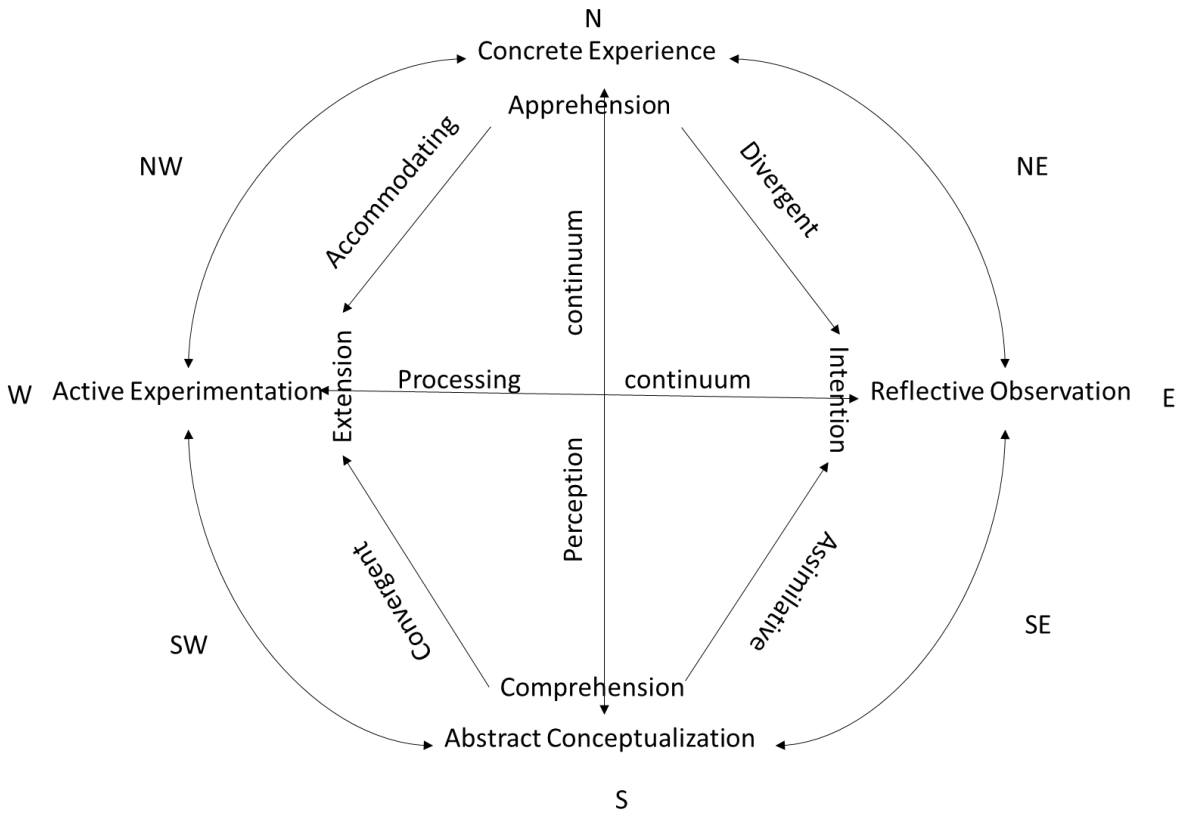

Figure 1. Learning cycle according to Kolb's (1984) Experiential Learning Theory

Regardless of the learning style which a student may adopt, ELT emphasises the active role of students in the learning process. Understanding the learning style of individual learners help the teacher to cater and provide activities that best suits and engages the student. Furthermore, to achieve effective learning, the learner must go through all stages of the ELT model. This paper describes how ELT was used in the design and delivery of a postgraduate course at School of Engineering at Griffith University and what effect did the ELT design have on students level of satisfaction in the course and achievement of the course learning outcomes.

Methods

The course 7407ENG was used as a case study in this paper. The course was thoroughly redesigned in 2014 to closely align the delivery of the course with the teacher's teaching philosophy which is based on "Learning by doing". Data were collected using the students' evaluation of courses (SEC) survey. The surveys from before the implementation of the new design (2013) and post implementation of the design (2014 and 2015) were analysed. Statistical testing (t-test) of the results were used to compare the effect of the redesign on students' responses to key indicators: overall satisfaction with the course; feedback and engagement in learning. Table 1 shows a summary of the three cohorts.

Table 1. Summary of the 2013, 2014 and 2015 surveys

Year	Enrolment	SEC response rate (%)
2013	37	54.1
2014	55	58.2
2015	61	52.5

Course background

The course has been offered at Griffith University to postgraduate students in Engineering and Environment schools. It has enrolment of between 50 and 70 students. Students have varied backgrounds regarding their exposure and skills; ranging from limited training in environmental engineering concepts to wide experience and exposure in the industry. The class is also highly diverse in terms of students' cultural backgrounds; international students make up the majority of the class (>60%).

Prior to 2014 the class was taught as a series of lectures and workshops with the assessment consisting of a group assignment and an end of semester exam. However, students' evaluation of the course indicated that while the majority of students were generally satisfied with the course, there were issues that needed to be addressed; for example assessment and assumed knowledge. Further analysis of students' academic backgrounds revealed that a significant number of students had limited exposure or training in environmental engineering concepts that are necessary for them to be able to complete some of the assessment tasks. As a results the quality of student assessment submission had a very wide spread with some obviously unable to demonstrate competency in some of the learning outcomes resulting in failure of the course. To address these issues, a complete overhaul of the course curriculum design was undertaken. The new design espoused the teaching philosophy 'learning by doing', thus focusing on experiential learning theory model.

Curriculum redesign

The main issues identified in the analysis of the course delivery were:

1- Student engagement

2- Assumed knowledge

3- Course organisation

4- Assessment, feedback and feedforward

Therefore the course was redesigned to address the identified issues with specific focus on increasing students' engagement. The following is a brief description of the redesigned course.

Assumed knowledge

As the course was delivered at postgraduate level, it was assumed that students had good understanding of environmental engineering concepts. However, due to the diverse nature of students enrolling in the class, students' knowledge varied widely. Therefore, to address this issue an easy to read textbook was adopted to provide students with the basic understanding of concepts important for each of the topics discussed in the course. The textbook was supplemented by a series of assigned journal articles to keep students updated with the latest developments in each topic. The journal articles were changed every year to suit the theme of the experience provided to students.

Course delivery

The course departed from the traditional mode of lectures/workshops to adopt a new structure based on (semi) flipped classes. Thus providing a platform for active learning. The course delivery revolves around an integrated 3 assessment items, each of which feeds into the other.

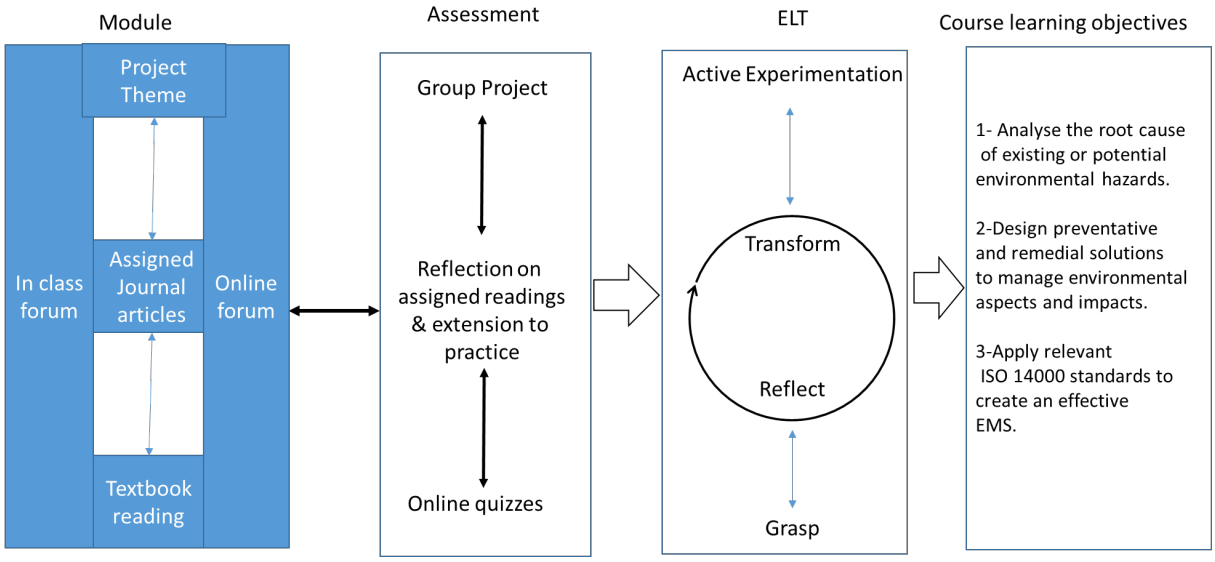

Figure 2. Schematic model of the curriculum design for 7407ENG.

Assessment, feedback and feedforward

As shown in Figure 2, the assessments are integrated and tightly connected to the course content and the course learning objectives. Online mini quizzes are no risk modular formative exercises which allow students to gauge their progress at regular intervals. They provide instant feedback to students and direct them to how they can improve their level of understanding. Each quiz draws questions at random from a reasonably large database, thus allowing students to experience new set of problems each time they try and cover wider area of the content.

Students, as a group, select a semester long group project based on the project theme introduced at the start of the semester. The project is designed to provide two important components in the ELT cycle, the experience and the active experimentation stages.

Central to the assessment, and in fact learning process, are the reflective writing exercise. In these exercises, students are explicitly asked to read two journal articles (assigned reading) and reflect on them with emphasis on how can the student apply or extend the knowledge to her group project. The articles are selected by the course convenor and released to students

on fortnightly cycle. Each article is selected on the basis that it has direct connection to the project theme and at the same time the module of study that corresponds to their release. Students submit their work fortnightly and receive rapid feedback on the submitted work and suggestion on how to improve the next submission.

Results and discussion

The new design has shown improved student satisfaction in the course evaluation as well as better achievement of course learning objectives as judged by the quality of the submissions. Figure 3 shows the response of students to three important parameters on the student evaluation of courses survey, before and after the implementation of the new design.

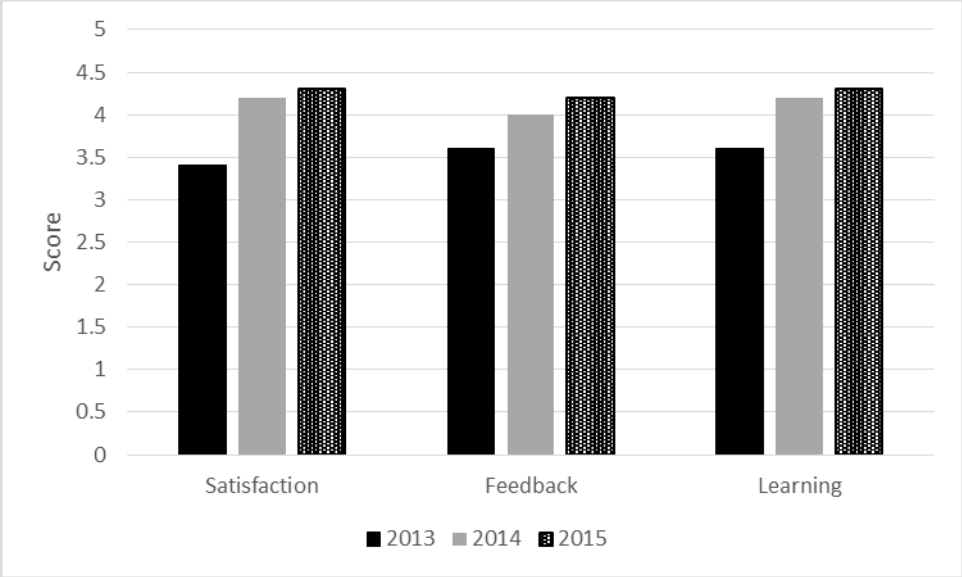

Figure 3. Average scores of three measured parameters on the student evaluation of courses survey for 7407ENG.

As shown in Figure 3, Students response to *"Overall I am satisfied with the quality of this course.",* labelled in the graph as 'satisfaction', increased from an average score of 3.4 in 2013 (before) to 4.2 and 4.3 in 2014 and 2015 (post), respectively. Interestingly, other indicators had also increased proportionately. Students' response to *"I received helpful feedback on my assessment work."*, labelled as feedback, increased from 3.6 in 2013 to 4.0 and 4.2 in 2014 and 2015, respectively. Similarly, students' response to *"This course engaged me in learning.",* labelled as 'Learning', also increased from 3.6 in 2013 to 4.2 and 4.3 in 2014 and 2015, respectively. An interesting observation is that post the implementation of the new design, a perfect correlation (albeit limited dataset) between students' perception of their learning and their satisfaction with the course.

Statistical testing (t-tests) were conducted to determine if the changes in students' responses to the measured parameters were statistically significant at $\alpha=0.05$. The t-test indicated that there was significant difference between the before and after implementation satisfaction scores ($P=0.0007$); thus strongly suggesting that the new course design has improved students' satisfaction in the course. Similarly, students' engagement in learning and feedback scores were significantly higher with P values of 0.002 and 0.024, respectively. The t-tests strongly suggested that the new design was effective in improving students' satisfaction and engagement in learning. This is further supported by students' comments in the open responses section. Several students specifically pointed out that being engaged in a real-life project helped them in forming concrete understanding of the concepts taught in class. Furthermore, many of the students pointed out the role of the reflective writing

exercises and class students' discussions as being instrumental to their learning. In all cases, students' engagement in the learning process was a key in improving the learning outcomes (Baker et al., 2012).

Using the project as a vehicle to engage students and tie up the content together provided the needed element of experimentation. At the same time, making an explicit requirement that students should reflect on their reading and pose the question of 'now what?' or 'how does this help me' by linking the theory (readings) to practice (project) helped students understand the connections between different elements in the course but also allowed them to extend the experience they grasped to new knowledge through application to new scenarios (Faculty Innovation Center, 2015).

The approach was also tested on another postgraduate course at the same institution and has proven to be successful. Therefore, it is recommend that the design be adopted in other courses. However, designing courses using ELT is challenging. Although, ELT emphasises the role of the learner, the teacher plays an equally important role as s/he must provide authentic experiences that will engage the learner in reflective manner and stimulate the learner intellectually, physically, socially or emotionally. This places extra demand on the teacher's time for careful planning of running the course. It also means that the course is under constant development to keep it authentic and relevant. A key to the process is allowing the students to learn from the experience and construct new meanings; this however, requires that timely feedback should be provided to allow the learner to reflect on the experience (the Reflective observation stage of the ELT) and move on to formulate appropriate conceptual abstracts from the experience. This should engage the students in both single loop and double loop learning. In the single loop learning, the focus is on solving immediate problems while the double loop learning engages the learner in deeper learning that involves critical questioning (Akella, 2010).

Conclusions

Experiential learning theory (ELT) is a comprehensive learning theory that treats learning as a process rather than an outcome. It emphasises the role of authentic experience in learning. The learner grasps knowledge either through concrete experience or abstract conceptualisation and then transforms it either through reflective observation or active experimentation. For effective learning, the learner must go through all stages in sequence. In this paper, the application of ELT to design a postgraduate engineering course at Griffith University was presented. The results showed that the design was effective in improving students' learning and satisfaction in the course. The author also argued that implementing ELT courses is challenging particularity because of the increased demand on teachers' time.

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