Graduating Students' Perceptions of Learning Design in an Undergraduate Engineering Course

Kali P. Nepal
Deakin University, Melbourne, Australia
Corresponding Author's Email: knepal@deakin.edu.au

Structured Abstract

BACKGROUND
Undergraduate Civil Engineering Course at Deakin University, Australia is relatively a new course. It graduated its second main cohort in 2013. Since its beginning in 2012, this study has been running an internal annual Course Experience Surveys targeted at uncovering the graduating students' perceptions on three components of contemporary learning system provided by Deakin University-learning design, learning environment and the human factor. Learning design covers the learning curriculum, learning resources, learning activities and learning supports; learning environment includes physical environment, virtual environment and psychosocial environment; and human factor includes learners, facilitators/teachers and help/support staff and their culture. There is a common agreement among educators in higher education that these three components of learning system should interact and complement each other in order to maximise student learning. This paper covers only learning design aspect of the overall surveys from 2012 and 2013.

PURPOSE
The aim of this study is to analyse the students' perceptions of learning design provided by Deakin University to its undergraduate civil engineering students in 2012 and 2013. This will help track down the progresses in different aspects of learning design and to understand whether the learning design provided by the institution have actually helped students in their learning and met their learning expectations.

DESIGN/METHOD
This study adopts questionnaire approach to collect original data by asking students about their perceptions of learning design provided by the institution. 5-point Likert-scale questionnaire survey (strongly disagree, disagree, neutral, agree, strongly agree) is developed and responses are collected. The responses are then statistically analysed in order to uncover the students' perceptions of learning design provided by the university.

RESULTS
The statistical analysis shows that the graduating students in both 2012 and 2013 did not perceive some important aspects of the learning design of the undergraduate civil engineering program/course as good as they expected. Moreover, in line with the shift in the learning design paradigm from content-centric to more inclusive learning design where soft skills, self-directed learning skills and research skills are incorporated, graduating students clearly perceived these changes. However, respondents' perceptions on some components of learning design got slightly down in 2013 compared with 2012 particularly the 'learning resources', 'learning activities' and 'learning supports'.

CONCLUSIONS
The shift in the learning design paradigm of the undergraduate civil engineering program/course at Deakin University from teacher-centric to student-centric between 2012 and 2013 has not been perceived by students positively as expected. Students have clearly indicated that they prefer improved curriculum, quality learning resources, customised learning activities and additional learning supports in order to successfully implement student-centric learning design.

KEYWORDS
Contemporary learning system, learning design, students' perceptions

Introduction

Civil Engineering Course/Program at Deakin University is relatively new. It graduated about 50 civil engineering students per annum in its first two cohorts in 2012 and 2013. There have been several attempts to modify and enhance the civil engineering learning design during these starting years to achieve its goal: "*The Deakin Civil Engineering Graduate will be a competent and innovative designer, developer and maintainer of the physical infrastructure to sustain current and future generations*". Although other terminologies such as 'educational design', 'instructional design', 'curriculum design' have been frequently used in existing literature, the term 'learning design' in this study covers learning curriculum, learning resources, learning activities and learning supports. As with any new engineering course/program, the Civil Engineering Course at Deakin University comprises a total of 32 units (7 units of basic maths, physics, materials, engineering drawings and computers; 7 units of professional practice that includes 3 units of final year project; 16 units of core civil engineering units and 2 units of higher level electives, preferably from advanced civil engineering topics) spread across the four-year full-time study. Out of 16 core civil engineering units, 6 units are related to mechanics and structures, 5 units are related to water and wastewater engineering and 5 units are related to geotechnical and transportation engineering.

The learning design combined with an appropriate learning environment (physical, virtual and psychosocial) and the human factor (learners, facilitators/teachers and help/support staff) as an interactive learning system is expected to maximise student learning experience. Although the success of overall learning goal depends on all three principal components of contemporary learning system (Figure 1), learning design plays a vital role as it 'guides' learners (and facilitators/teachers) within an learning environment.

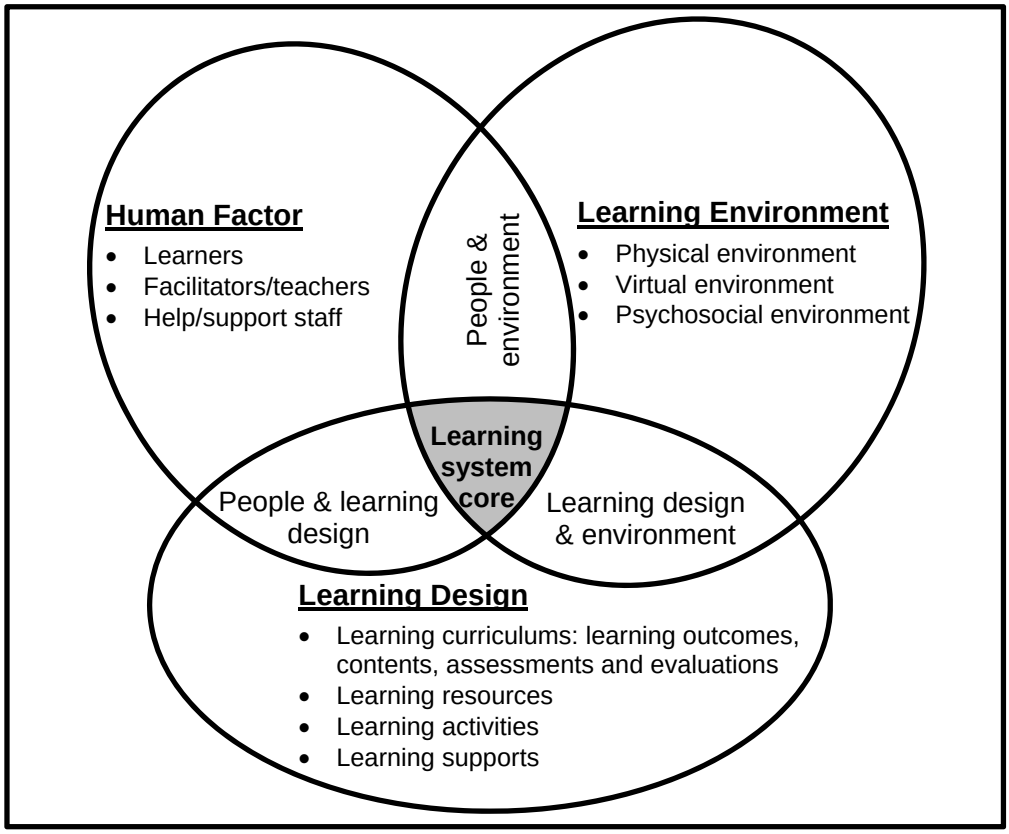

Figure 1: Components of contemporary learning system

The ‘human factor’ acts on its perception and awareness of the learning design and learning environment (Ramsden, 1992). Lucas and Meyer (2005) have identified that the learning approaches adopted by learners vary from unit/subject to unit/subject depending on their perceptions of the learning design and learning environment. This study aims to gain insight into whether the learning design provided by Deakin University to its undergraduate civil engineering students who graduated in 2012 and 2013 supported their learning aspirations. This knowledge will help develop learning design strategies to maximise the learning goal of the program/course.

Learning design has been identified by many researchers and educators as one of the key components of contemporary learning system (Toohey, 1999; Biggs & Tang, 2011; Beethem & Sharpe, 2013; Starkey, 2012; Bowen, 2013). It is the core to the contemporary learning system and to the ultimate learning experience students can have. Cotemporary learning curriculums, types of learning resources suitable for contemporary learning environments and for contemporary learners, types of learning activities facilitators/teachers use in the classroom or online and the type and quality of learning supports the learners receive in the form of interactions and feedback have a huge impact on learners’ learning achievement. However, it is often taken as granted and it tends to be implicit- not formally articulated, apart from at course/program structure and subject/unit curriculum levels. As students are the learners, it is important to understand the interactions between how they approach their learning and how they perceive the university learning design and learning environment. This study aims to uncover these students’ perceptions of learning design of undergraduate civil engineering course at Deakin University.

Research method

As previously discussed, the primary objective of this study is to capture the graduating engineering students’ perceptions of learning design (learning curriculum, learning resources, learning activities and learning supports) in an undergraduate Civil Engineering Course/Program. Literature synthesis confirmed that the questionnaire survey was the most appropriate instrument for eliciting such perceptions. The student learning experience survey questionnaire was designed that included a range of statements that help capture these perceptions through the students’ responses from the first two years (2012 and 2013) of graduating cohorts. During their final trimester of study (just before graduation), graduating students completed a survey questionnaire through an independent research staff who was not part of the teaching team at any times during their studies. Ethical clearance was granted for this research from Deakin University.

This study collected the responses from the first two graduating cohorts of about 50 students who were at their final trimester of studies in 2012 and 2013. In total, 24 questionnaire surveys were completed by the graduating cohort in 2012 representing a response rate of about 50%. Similarly, a total of 14 questionnaire surveys were completed by the graduating cohort in 2013 representing a response rate of about 30% in 2013. The questionnaire survey contained several sections but only four sections of the surveys were of interest for this study, namely learning curriculums (LC), learning resources (LR), learning activities (LA) and learning supports (LS). These sections requested respondents to provide their opinions about statements related to curriculum, learning resources, learning activities and learning supports as either (1) strongly disagree (2) disagree (3) neutral (4) agree or (5) strongly agree. These statements were derived from several studies (Kember & Leung, 1998; Justicia et al., 2008; Biggs, 1987; Nepal & Jenkins, 2011; Nepal & Jenkins, 2013; Nepal, 2013). Unidentifiable background information about the respondents was also collected. These responses were statistically analysed in order to gain insight into the research questions.

Data analysis and results

Data profile

Only a fraction of the respondents were female (12.5% in 2012 and 0% in 2013). The respondent cohort contained 16.67% of international students in 2012 and 21.40% in 2013. 20.83% in 2012 and 28.60% in 2013 of the respondents had other than English as their first language. The majority of students were in their early to mid-twenties in both 2012 and 2013, which is typical for an undergraduate engineering course. More than 70% of the respondents had experience of one year or less in 2012 and 57.10% in 2013. The type of experience included both engineering and non-engineering works as well as part-time and full-time works. Less than 10% of the respondents had more than 3 years of work experience in both 2012 and 2013.

Students perception of learning design

The resulting descriptive statistics (means and standard deviations) of the responses relating to students' perceptions of learning design statements are summarised in Table 1 for both 2012 and 2013.

Table 1: Descriptive statistics of students' perceptions to learning design

Item	Statements	2012 (Mean, SDV)	2013 (Mean, SDV)
LC1	The course developed my comprehensive (theory and practice) understanding of civil engineering discipline	(3.93, 1.068)	(3.86, 1.724)
LC2	There was a sufficient flexibility to choose the units I wanted to study	(3.16, 1.367)	(2.06, 2.359)
LC3	Assignments and examinations of the units were appropriate	(3.74, 1.032)	(3.12, 1.457)
LC4	The course developed my problem-solving and analytical skills	(**4.55**, 0.633)	(**4.60**, 1.105)
LC5	The course improved my soft skills (communication, teamwork and leadership)	(**3.68**, 1.038)	(**3.97**, 1.584)
LC6	As a result of this course, I feel confident about tackling unfamiliar problems	(**3.93**, 1.068)	(**4.84**, 0.804)
LC7	The course prepared me well for employment in civil engineering	(3.54, 0.955)	(3.21, 1.574)
LC8	The course developed my interest in civil engineering field	(4.27, 1.418)	(4.03, 1.791)
LC9	The course met my expectation	(3.76, 1.133)	(3.37, 1.593)
LR1	Learning resources for the units were relevant and up to date	(3.78, 0.988)	(3.21, 1.699)
LR2	The learning materials were clear and concise	(3.40, 1.149)	(3.12, 1.653)
LR3	It was easy to access information technology resources when needed	(4.26, 0.945)	(4.27, 1.310)
LA1	Lectures/tutorials/labs for the units were appropriate & sufficient	(3.78, 1.044)	(3.53, 1.459)
LA2	Teaching approach adopted by teaching staff was relevant to my need	(3.69, 1.124)	(3.04, 1.783)
LA3	Modern teaching and learning tools were incorporated in teaching and learning activities	(4.07, 0.896)	(3.29, 1.416)
LS1	The teaching staff made a real effort to understand difficulties I might be having with my study	(3.60, 1.190)	(2.96, 1.671)
LS2	There was adequate opportunity to consult with teaching staff when needed	(3.93, 1.068)	(3.45, 1.804)
LS3	I received appropriate and constructive feedback from teaching staff	(3.40, 1.198)	(2.88, 1.732)

The mean scores varied from 3.16 to 4.55 and standard deviations from 0.633 to 1.418 in 2012. Mean scores ranged from 2.06 to 4.84 and standard deviations from 0.804 to 2.359 in 2013. Some of these mean scores are fairly low in both 2012 and 2013 indicating that there is a room for further improvements in some aspects of learning design such as 'there was a sufficient flexibility to choose the units I wanted to study', 'the learning materials were clear and concise' and 'I received appropriate and constructive feedback from teaching staff'. The large standard deviations indicate that students' responses to the statements varied widely. It is interesting to see that mean scores of the statements relating to soft engineering skills (communication, teamwork and leadership), essential engineering skills (analytical skills and problem solving skills) and research skills (*LC4-LC6*) have been improved in 2013 compared with in 2012. This can be linked with the recent changes in the learning design at Deakin University, which has recently shifted its focus from content-centric learning design to more inclusive learning design to produce work-ready engineering graduates.

However, respondents' perceptions of all other components of learning design did not improve (in fact, slightly down) in 2013 compared with 2012. Assuming that the other two components of learning system- 'human factors' and 'learning environment'- were similar in 2012 and 2013, the students rated lower in learning resources (*LR*), learning activities (*LA*), learning supports (*LS*) and some aspects of learning curriculums (*LC*) in 2013. There may be a number of reasons for such result. *First*, the students might not be familiar with the new learning design model, i.e., a shift from content-centric learning design to more inclusive learning design where soft engineering skills, self-directed learning skills and research skills are part of the course learning outcomes. *Second*, facilitators/teaching staff might have controlled their resources, activities and supports in order to let students engage in self-directed learning activities and improve their soft engineering and research skills. *Finally*, the students may require better quality learning resources, extra or different types of learning activities and additional learning supports in an inclusive learning design model compared with content-centric learning design model. One or more of these reasons might have made the students perceive that the current learning design did not help to meet their expectations of maximising their learning experiences and preparing themselves well for employment in civil engineering profession.

Conclusion

Undergraduate Civil Engineering Course at Deakin University, Australia is relatively a new course. It graduated its second main cohort in 2013. The aim of this study is to analyse the students' perceptions of learning design- an important component of contemporary learning system- provided by Deakin University to its undergraduate civil engineering students in 2012 and 2013. The statistical analysis shows that the graduating students both in 2012 and 2013 did not perceive some important aspects of the learning design of the undergraduate civil engineering program/course as good as they expected. Moreover, in line with the shift in the learning design paradigm from teacher-centric to student-centric, graduating students clearly perceived these changes. However, the students rated lower in learning resources, learning activities, learning supports and some aspects of learning curriculums in 2013 compared with in 2012. Students have clearly indicated that they prefer improved curriculum, quality learning resources, customised learning activities and additional learning supports in order to successfully implement student-centric learning. This study, however, reports the results from only a small percentage of respondents in small cohorts of students. It is important to have similar studies over the years and this study aims to continue this research in future.

References

Beetham, H., & Sharpe, R. (Eds.) (2013). *Rethinking pedagogy for a digital age: Designing for 21st century learning*. Routledge.

Biggs, J. & Tang, C. (2011). *Teaching for quality learning at university*. McGraw-Hill International.

Biggs, J. (1987). The study process questionnaire (SPQ): Manual. Camberwell, Victoria: Australian Council for Educational Research.

Bowen, W.G. (2013). *Higher education in the digital age*. Princeton University Press.

Justicia F, Pichardo M.C., Cano F., Berbén A.B.G., De la Fuente J. (2008). The revised two-factor study process questionnaire (R-SPQ-2F): Exploratory and confirmatory factor analyses at item level. *European Journal of Psychology of Education*, 23(3), 355–372.

Kember D., Leung D.Y.P. (1998). The dimensionality of approaches to learning: An investigation with confirmatory factor analysis on the structure of the SPQ and LPQ. *British Journal of Educational Psychology*, 68, 395–407.

Lucas, U. & Meyer, J.H.F. (2005). Towards a mapping of the student world: the identification of variation in students' conceptions of and motivations to learn introductory accounting. *The British Accounting Review*, 37, 177-204.

Nepal, K.P. (2013). Comparative evaluation of PBL and traditional lecture-based teaching in undergraduate engineering courses: evidence from controlled learning environment. *International journal of engineering education*, 29(1), 17-22.

Nepal, K.P. and Jenkins, G.A. (2011). Blending project-based learning and traditional lecture-tutorial-based teaching approaches in engineering design courses. Proceedings of the 22nd annual AAEE Conference on Engineering Education 5-7 December 2011, Fremantle, Western Australia, pp. 338-343, Engineers Australia, Fremantle, W. A.

Nepal, K.P. and Jenkins, G.A. (2013). Graduating students' experience of learning approaches and their perceptions of teaching quality in a new undergraduate Civil Engineering course. Proceedings of the 24th 2013 Australasian Association for Engineering Education Conference, pp. 1-9, Griffith School of Engineering, Griffith University, Brisbane, Qld.

Ramsden, P. (1992). *Learning to teach in higher education*. London: Routledge.

Starkey, L. (2012). *Teaching and learning in the digital age*. New York: Routledge.

Toohey, S. (1999). *Designing courses for higher education*: Open University Press.

Copyright statement