

Graduating students' experience of learning approaches and their perceptions of teaching quality in a new undergraduate Civil Engineering course

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Structured abstract

BACKGROUND

Deakin University graduated its first cohort of Civil Engineering graduates in 2012. In the continually changing professional and university learning and teaching environments of engineering education, it is important to establish the link between learning approaches adopted by the students and their perceptions of the learning environment (particularly the teaching quality) at the university. Literature studies suggest that the learning outcomes can be achieved more efficiently when the students' perceptions of learning environment match with their learning approaches. Although there exists significant amount of literature regarding the Course Experience Surveys, this study is aimed at going into detail by re-designing survey questionnaire and analysing student responses to establish these interactions. Further strategies to improve the university learning environment can be developed taking into account the students' learning approaches at both unit/subject and course/program levels.

PURPOSE

The aim of this study is to analyse the students' approaches to learning and their perceptions of teaching quality at the university. This will help understand whether the learning environment provided by the university have actually helped students in their learning.

DESIGN/METHOD

This study adopts questionnaire survey approach to collect original data by asking students about their perceptions of teaching quality and learning approaches adopted by students. 5-point Likert-type scale questionnaires are developed and responses are collected. The responses are then statistically analysed in order to establish the link between students learning approaches and their perceptions of teaching quality at the university.

RESULTS

Statistical analysis of the survey responses shows that the students' perceptions of teaching quality depend on the type of learning approach adopted by the students. Students who followed a deep learning approach have positively perceived the existing teaching quality whereas those who adopted a surface learning approach have negatively perceived the teaching quality. In other words, existing university teaching quality may have failed to motivate surface learners to change their learning approaches to deep learning or to make surface learning more efficient.

CONCLUSIONS

Even though the majority of civil engineering graduates at Deakin University adopted a deep learning approach and their learning was supported by appropriate teaching approaches at the university, there exist significant proportions of students who could not optimise their learning due to a different learning environment than they expected. It is important for the university to develop strategies either to help surface learners shift to deep learning or provide an individualised learning environment to surface learners to make surface learning more efficient.

KEYWORDS

Learning approaches, teaching quality, engineering education

Introduction

Deakin University graduated its first cohort of Bachelor of Civil Engineering graduates in 2012. As with most engineering programs/courses across the world, 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/transportation engineering. The course curriculum combined with an appropriate learning environment at the university is expected to provide the breadth and depth of civil engineering knowledge required by graduates to practise as 'work-ready' professional engineers. However, these goals heavily depend on the learning approaches adopted by students and their perceptions of teaching quality at the university. This study aims to gain insight into whether the learning approach adopted by civil engineering students at Deakin University is well supported by the teaching quality at the university. This knowledge will help develop teaching strategies to suit students' learning need.

University students' approaches to learning have been widely researched since 1980s (e.g., Marton & Säljö, 1984; Prosser & Trigwell, 1999; Biggs & Tang, 2011). These studies have identified three basic approaches of learning: surface learning approach, deep learning approach and strategic or achieving approach. These students' learning approaches are not fixed characteristics and depend on the students' perceptions and awareness of learning environment at the university (Ramsden, 1992). Lucas and Meyer (2005) have identified that the learning approaches adopted by students vary from unit to unit depending on the student's perception of the teaching and learning environment. Learning environment, in this context, is a broader concept than simply being the physical space in which teaching and learning takes place (Jenkins *et al.*, 2011); the most important one is the teaching approaches adopted by academic staff. University academic staff's approaches to teaching have also been studied in greater detail (e.g., Fenstermacher & Soltis, 1986; Trigwell, Prosser & Taylor, 1994; Biggs & Tang, 2011). Fenstermacher & Soltis (1986) have categorised teaching approaches into 'executive approach', 'therapist approach' and 'liberationist approach'. Trigwell, Prosser & Taylor (1994) grouped the approaches to teaching into five qualitatively different groups ranging from teacher-focused approach (transmitting information and assisting to acquire conceptions) to student-focused approach (acquiring conceptions, developing conceptions and changing/consolidating conceptions). The quality of the student learning outcomes are related to both the nature of learning environment provided and the approaches of learning by students (Biggs *et al.*, 2001).

Good university learning environment should encourage a deep approach (together with an achieving approach) at the expense of a surface approach. The claim that the university students adopt deep, surface and strategic/achieving approaches to learning has had a significant impact upon the development of learning environment at the university. Anecdotal evidence available to authors suggests that most university academic staff prefer their students to take a deep learning approach along with an achieving approach, but the students often take surface approaches whereas most university students blame the university teaching approach as being teacher-and-exam focused that discourages them to adopt deep learning approach. This gap in the understanding may have negative consequences in learning achievements. 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 environment. This study aims to uncover these interactions for Deakin University's new undergraduate Civil Engineering Course.

Research method

As previously discussed, the primary objective of this study is to capture the interactions between students' learning approaches and their perceptions of learning environment (with particular focus on teaching quality) in an undergraduate Civil Engineering Course (Program). Literature synthesis confirmed that the questionnaire survey was the most appropriate instrument for determining such interactions. The Course Experience Survey questionnaire was re-designed to include a range of statements that help capture these interactions through the students' responses. During their final trimester of study (just before graduation), graduating students completed a survey questionnaire distributed by 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 solicited the responses of a cohort of 50 students who were at their final trimester of studies in 2012. In total, 24 questionnaire surveys were completed by the graduating cohort representing a response rate of about 50%. The questionnaire survey contained several sections but only two sections of the surveys were of interest for this study, namely students' learning approaches and their perceptions of teaching quality. These two sections requested respondents to provide their opinions about statements related to their learning approaches and their perceptions of teaching quality 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) including the original Study Process Questionnaire (SPQ) by Biggs (1987). 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%). The respondent cohort contained 16.67% of international students and 20.83% had other than English as their first language. The majority of students were in their early to mid-twenties, which is typical for an undergraduate engineering course. More than 70% of the respondents had experience of one year or less. The type of experience included both engineering and non-engineering works as well as part-time and full-time works. Only 4.17% of the respondents had more than 3 years of work experience.

Students' learning approaches

The resulting descriptive statistics (means and standard deviations) of the responses relating to students' learning approaches are summarised in Table 1.

Table 1 Descriptive statistics of students' responses to learning approaches

Study Process Questionnaire (SPQ) Statements	Mean	Standard Deviation
At times studying gives me a feeling of deep personal satisfaction	3.00	.834
I spend extra time trying to obtain more information about new topics to understand them completely before I am satisfied	3.04	1.022
I come to most classes with questions in mind that I want answering	2.38	1.056
I feel that virtually any topic can be interesting once I get into it	2.83	1.129
I do not find this course very interesting so I keep my work to a minimum	2.33	1.129
I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with the topics	2.25	.944
I see no point in learning materials which is not likely to be in the assignments and exams	2.33	1.007
I find the best way to pass the unit is to try to remember answers to likely questions	2.67	.917
My aim is to pass the course while doing as little work as possible	2.13	1.116

The mean scores varied from 2.13 to 3.04 and standard deviations from 0.834 to 1.129. The large standard deviations indicate that students' responses varied widely. It is interesting to see that mean scores of the statements relating to deep learning are slightly higher than those related to surface learning (refer to the factor analysis in Table 2 regarding these two extracted factors of learning approaches) meaning that majority of students agreed with the statements relating to deep learning except '*I come to most classes with questions in mind that I want answering*'. This may be because contemporary engineering students do not have sufficient time to go through the learning materials in advance no matter what type of learners they are.

Factor analysis technique was used to extract the underlying latent factors (*i.e.*, students' learning approaches) and results are summarised in Table 2. 'Two factors' extracted from the student responses can be described by 'surface learning approach' (factor 1) and 'deep learning approach' (factor 2). It is interesting to observe that the students are clearly divided into two groups: 'surface learners' who are not engaged in learning to details and 'deep learners' who prefer to engage deeply in their learning. One interesting point from this factor analysis is that the students, whether they are surface learners or deep learners, do not want to waste their time to study in detail if it is not necessary to achieve good results (achieving or strategic approach is linked to both deep and surface learning approaches).

Table 2 Factor analysis of student approaches to learning

Study Process Questionnaire (SPQ) Statements	Factors	
	1	2
At times studying gives me a feeling of deep personal satisfaction	-.341	.769
I spend extra time trying to obtain more information about new topics to understand them completely before I am satisfied		.674
I come to most classes with questions in mind that I want answering	-.557	.405
I feel that virtually any topic can be interesting once I get into it	-.598	.436
I do not find this course very interesting so I keep my work to a minimum	.826	
I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with the topics	.667	.423
I see no point in learning materials which is not likely to be in the assignments and exams	.824	
I find the best way to pass the unit is to try to remember answers to likely questions	.600	
My aim is to pass the course while doing as little work as possible	.939	

Students' perceptions of teaching quality

The resulting descriptive statistics (means and standard deviations) of the responses relating to students' perceptions of teaching quality at the university are summarised in Table 3. The mean scores varied from 2.83 to 3.54 and standard deviations from 0.576 to 1.122. Similar to students' responses to learning approaches, the large standard deviations indicate that students' responses varied widely. The mean scores of the students' responses to the quality of teaching are comparatively higher than the scores of the students' responses to learning approaches. This means that more students agreed with the quality of teaching.

Table 3 Descriptive statistics of students' perceptions of teaching quality

Study Process Questionnaire (SPQ) Statements	Mean	Standard Deviation
There were sufficient and adequate number of teaching (academic) staff for the Course	3.38	.576
The study materials were clear and concise	2.96	.999

Teaching approach adopted by teaching staff were relevant to my need	3.21	.977
Modern teaching and learning tools were incorporated in teaching and learning activities	3.54	.779
Teaching staff were well prepared and good at explaining the subject materials	3.04	1.122
I received appropriate and constructive feedback from teaching staff	2.96	1.042
There was adequate consultation environment with teaching staff when needed	3.42	.929
The teaching staff made a real effort to understand difficulties I might be having with my study	3.13	1.035
The teaching staff motivated me to do my best work	2.83	1.090
Overall, I am satisfied with the teaching staff	3.00	.978

Factor analysis technique was used to extract the underlying latent factors (*i.e.*, a reduced number of underlying factors relating to the quality of teaching) and results are summarised in Table 4. 'Two factors' extracted from the student responses regarding the quality of teaching may be described by: 'overall teaching quality' (factor 1) and 'teaching materials, methods and interactions' (factor 2). Students' responded positively to all statements relating to overall teaching quality. However, they responded negatively to some of the statements relating to 'teaching materials, methods and interactions', particularly the quality of study materials and teaching approach adopted. This means that some students (they may well be surface learners) felt that the quality of study materials and teaching approach was not adequate for their learning need. It is important for School of Engineering to review these two important aspects to improve the student's perceptions of teaching quality.

Table 4 Factor analysis of students' responses to teaching quality

Study Process Questionnaire (SPQ) Statements	Factors	
	1	2
There were sufficient and adequate number of teaching (academic) staff for the Course	.621	
The study materials were clear and concise	.821	-.380
Teaching approach adopted by teaching staff were relevant to my need	.807	-.406
Modern teaching and learning tools were incorporated in teaching and learning activities	.667	
Teaching staff were well prepared and good at explaining the subject materials	.871	
I received appropriate and constructive feedback from teaching staff	.813	
There was adequate consultation environment with teaching staff when needed	.495	.778
The teaching staff made a real effort to understand difficulties I might be having with my study	.613	.700
The teaching staff motivated me to do my best work	.855	
Overall, I am satisfied with the teaching staff	.939	

Interactions between students learning and teaching quality

Bivariate correlations between students' learning approaches and their perceptions of teaching quality at the university are summarised in Table 5. Highlighted cells indicate the significant correlations at 0.05 level.

Table 5 Interactions between students' learning approaches and their perceptions of teaching quality

		Correlations										
		Students' Perceptions of Teaching Quality										
		There were sufficient and adequate number of teaching (academic) staff for the Course	The study materials were clear and concise	Teaching approach adopted by teaching staff were relevant to my need	Modern teaching and learning tools were incorporated in teaching and learning activities	Teaching staff were well prepared and good at explaining the subject materials	I received appropriate and constructive feedback from teaching staff	There was adequate consultation environment with teaching staff when needed	The teaching staff made a real effort to understand difficulties I might be having with my study	The teaching staff motivated me to do my best work	Overall, I am satisfied with the teaching staff	
Students' Learning Approaches	Deep Learning Approach	At times studying gives me a feeling of deep personal satisfaction	.181	.313	.427*	.067	.465*	.400	.281	.453*	.383	.480*
		I spend extra time trying to obtain more information about new topics to understand them completely before I am satisfied	.128	.248	.042	-.334	.044	.218	.029	.210	.276	.251
		I come to most classes with questions in mind that I want answering	-.098	.428*	.132	.324	.243	.173	.100	.313	.472*	.253
		I feel that virtually any topic can be interesting once I get into it	.167	.456*	.348	.354	.486*	.253	.235	.353	.577**	.472*
	Shallow learning Approach	I do not find this course very interesting so I keep my work to a minimum	-.134	-.218	-.223	-.115	-.252	-.209	-.180	-.149	-.341	-.236
		I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with the topics	-.340	-.081	.130	-.192	-.010	-.033	-.422*	-.211	-.211	-.141
		I see no point in learning materials which is not likely to be in the assignments and exams	.000	-.331	-.074	-.406*	-.205	-.276	-.341	-.125	-.343	-.265
		I find the best way to pass the unit is to try to remember answers to likely questions	-.082	-.206	-.210	-.284	-.197	-.425*	-.494*	-.367	-.363	-.291
		My aim is to pass the course while doing as little work as possible	-.008	-.190	-.105	-.181	-.247	-.295	-.304	-.165	-.340	-.239

*. Correlation is significant at the 0.05 level (2-tailed).
 **. Correlation is significant at the 0.01 level (2-tailed).

It is clear from these correlation coefficients that surface learners perceived the same learning environment quite differently than the deep learners. Deep learners had positive or no correlations with the statements relating to the quality of teaching whereas surface learners had negative or no correlations. It means that the current quality of teaching helped deep learners to achieve their learning outcomes better than those of surface learners. This may be because surface learners required extra care or individualised teaching approaches. In addition, this may be due to the lack of efficient teaching strategies to motivate surface learners to deep learning.

Conclusion

Deakin University graduated its first cohort of undergraduate Civil Engineering graduates in 2012. This study used Course Experience Survey-type approach to identify the interactions between learning approaches adopted by the students and their perceptions of learning environment (particularly the teaching quality) at the university. Statistical analysis of the survey responses shows that the students' perceptions of learning environment depend on their learning approaches. Deep learners have positively perceived the existing learning environment whereas the surface learners have negatively perceived. In other words, existing quality of teaching may have failed to motivate surface learners to change their learning approaches to deep learning or to make surface learning more efficient. Even though, the majority of civil engineering graduates at Deakin University adopted a deep learning approach (mean scores of the statements relating to deep learning approach received higher scores than the mean scores of the statements relating to the surface learning approach) and their learning was supported by appropriate learning environment at the university (deep learning statements were positively correlated with the statements relating to the quality of teaching), there exist significant proportions of students who could not optimise their learning due to a different learning environment than they expected (surface learning statements were negatively correlated with the statements relating to the quality of teaching). It is important for the university to develop strategies either to help surface learners shift to deep learning or provide an individualised learning environment to make surface learning more effective. Improvement in the quality of learning materials and development of a different teaching approach are identified as two important strategies to be adopted to further improve students' learning. This study, however, reports the results from only small cohort of students in a year. It is important to have similar studies over the years both as students during their final trimester of studies and as engineering professionals at their industry jobs to clearly uncover the perceptions of teaching quality at the university.

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