Full Paper

Introduction

Civil Engineering Course/Program at Deakin University is relatively new. It graduated about 45-55 civil engineering students per annum in its first three cohorts in 2012-2014. The Course comprises a total of 32 units/subjects (eight units of basic maths, physics, materials, engineering drawings and computers; six units of professional practice that includes three units of final year project; 16 units of core civil engineering units and two 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, six units are related to mechanics and structures, five units are related to water and wastewater engineering and five units are related to geotechnical and transportation engineering. There have been several attempts to modify and enhance the civil engineering curriculum and improve the quality of teaching during these starting years with the hope of managing students' learning approaches and their learning expectation.

Good university curriculum and teaching should encourage a deep approach (together with an achieving approach) at the expense of a surface approach. Anecdotal evidence 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 learning approach whereas most university students perceive the university curriculum and teaching quality being teacher-and-exam focused that discourages them to adopt deep learning approach. Moreover, how students perceive curriculum and teaching quality is more important than what teachers perceive similar to what students learn is more important than what teachers teach. Literature studies suggest that the learning outcomes can be achieved more efficiently when the students' perception of curriculum and teaching quality are closely aligned with their learning approaches. Hence, it is important to understand the relationships between how the students approach their learning and how they perceive the program/course curriculum and the quality of teaching. This study aims at capturing the relationships between students' learning approaches and their perception of curriculum and teaching quality.

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 but depend on the students' perception and awareness of learning environment at the university (Ramsden, 1992). The students' learning approaches are not static but can be influenced by both the curriculum and teaching quality they are exposed to. Lucas and Meyer (2005) have identified that the learning approaches adopted by students vary from subject/unit to subject/unit depending on the students' perception of the teaching and learning environment.

Curriculum includes learning outcomes, learning contents, learning resources, learning activities or tasks and learning supports (Nepal, 2014). Quality of teaching covers both the quality and approach used by teaching staff (pedagogical vs andragogical as discussed in Knowles, 1984) while implementing the components of curriculum. University academic staff's approaches to teaching have also been studied in greater detail (e.g, Fox, 1983; Fenstermacher & Soltis, 1986; Trigwell, Prosser & Taylor, 1994; Biggs & Tang, 2011). All these teaching approaches and theories have one-end as teacher-centric approach and the other end as student-centric approach with the centre being mixed of these two approaches.

Study method

As previously discussed, the primary objective of this study is to capture the graduating engineering students' learning approaches and their perception of curriculum and teaching quality in an undergraduate Civil Engineering Course/Program. Literature synthesis confirmed that the questionnaire survey was the most appropriate instrument for eliciting such perception. The student learning experience survey questionnaire was designed that included a range of statements that help capture these perception 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. Ethical clearance was granted for this research from Deakin University.

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 requested respondents to provide their perception and opinions about statements related to curriculum, teaching quality and their own learning approaches 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). Unidentifiable background information about the respondents was also collected. These 5 point Likert-type ordered responses were statistically analysed in order to gain insight into the research questions.

Data analysis and results

Data profile

The respondents profile is included in Table 1. The data profile is similar in both 2012 and 2013. It is interesting to note that there were more mature-age, off-campus, part-time respondents in 2013 compared with in 2012.

Table 1: Respondents profile

Description	Category	2012	2013
Gender	Female	12.5%	0.00%
International student		16.67%	21.40%
English as first language		20.83%	28.60%
Age (years)	<=25	100%	80%
Study mode	On-campus	>90%	>80%
Study commitment	Full time	>90%	>80%
Industry experience (years)	<=1	>70%	>55%
	3 +	<10%	<10%

Data Scrutiny

The data were first treated as pooled cross-sectional data as samples contained different samples of individuals, reflected population at the time it was drawn and exactly the same statements were asked to both cohorts. However, only a small number of responses were obtained from two consecutive years, data from both years were combined to increase the sample size and perform further statistical analysis. Moreover, several statistical testing methods were employed to compare the similarities and differences of the data collected over two years and arrived at a conclusion that the combined data did not lose its statistical validity.

Students' learning approaches

The resulting descriptive statistics (median, mode, range and percent difference) of the responses relating to students' learning approaches are summarised in Table 2. Median varied from 2 (disagree) to 4 (agree), mode varied from 2 (disagree) to 4 (agree) and range was 4 (strongly agree minus strongly disagree) for all statements. The large ranges indicate that students' responses varied widely. It is interesting to see that median scores of the statements relating to deep learning (the first four statements) are slightly higher than those related to surface learning meaning that majority of students agreed with the statements relating to deep learning. Percentage differences between Strongly Agree/Agree and Disagree/Strongly Disagree also show similar trend. However, it is important to note that the contemporary engineering students do not have sufficient time to study materials provided in advance and to study the materials in depth even though they prefer deep learning (third and fourth statements in Table 2).

Table 2: Descriptive statistics of students' learning approaches

Study Process Questionnaire (SPQ) Statements	Median	Mode	Range		Percent Difference (Strongly Agree/Agree MINUS Disagree/Strongly Disagree)
			Max.	Min.	
At times studying gives me a feeling of deep personal satisfaction	3.00	3	5	1	13.16%
I spend extra time trying to obtain more information about new topics to understand them completely before I am satisfied	3.00	4	5	1	23.68%
I come to most classes with questions in mind that I want answering	3.00	3	5	1	-5.26%
I feel that virtually any topic can be interesting once I get into it	3.00	2	5	1	-5.26%
I do not find this course very interesting so I keep my work to a minimum	2.00	2	5	1	-47.37%
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	2.00	2	5	1	-52.63%
I see no point in learning materials which is not likely to be in the assignments and exams	2.00	2	5	1	-36.84%
I find the best way to pass the unit is to try to remember answers to likely questions	3.00	3	5	1	-26.32%
My aim is to pass the course while doing as little work as possible	2.00	1	5	1	-60.53%

Students' perception of curriculum and teaching quality

The resulting descriptive statistics (median, mode, range and percentiles) of the responses relating to the curriculum and teaching quality are summarised in Table 3. Median varied from 2 (disagree) to 4 (agree), mode varied from 2 (disagree) to 4 (agree) and range varied from 3 to 4 (strongly agree-strongly disagree or strongly agree-disagree) for all statements. Similar to students' responses to learning approaches, the large ranges indicate that students' responses varied widely. The median and mode scores of the students'

responses to course curriculum (the last nine statements) are comparatively higher than the scores of the students' responses to teaching quality (the first ten statements). This is also verified by percentage differences between Strongly Agree/Agree and Disagree/Strongly Disagree in the last column of Table 3 where majority of students 'agreed' with the statements related to course curriculum (the last nine statements) but students had mixed responses with the statements related to teaching quality (the first ten statements)

Table 3: Descriptive statistics of students' responses to curriculum and teaching quality

Study Process Questionnaire (SPQ) Statements	Median	Mode	Range		Percent Difference (Strongly Agree/Agree MINUS Disagree/Strongly Disagree)
			Max.	Min.	
There were sufficient and adequate number of teaching (academic) staff for the Course	3.00	3	1	5	18.42%
The study materials were clear and concise	3.00	3	1	5	-7.89%
Teaching approach adopted by teaching staff were relevant to my need	3.00	4	1	5	7.89%
Modern teaching and learning tools were incorporated in teaching and learning activities	3.00	4	1	5	26.32%
Teaching staff were well prepared and good at explaining the subject materials	3.00	3	1	5	-10.53%
Assignments and examinations of the units were appropriate	3.00	3	1	5	50.00%
I received appropriate and constructive feedback from teaching staff	3.00	3	1	5	-13.16%
There was adequate consultation environment with teaching staff when needed	3.00	4	1	5	21.05%
The teaching staff made a real effort to understand difficulties I might be having with my study	2.00	2	1	5	0.00%
The teaching staff motivated me to do my best work	3.00	3	1	5	-23.68%
The course developed my comprehensive (theory and practice) understanding of civil engineering discipline	4.00	4	1	5	36.84%
This course helped me develop my leadership skills	3.00	3	1	5	2.63%
The course helped me to develop the ability to plan my own	3.00	3	1	5	57.89%
The course developed my skills & confidence to explore new ideas	4.00	4	1	5	31.58%
This course helped me develop my skills to solve a problem with limited information and guidance	4.00	4	2	5	73.68%
As a result of this course, I feel confident about tackling unfamiliar problems	4.00	4	2	5	50%
The course developed my interest in civil engineering field	4.00	4	1	5	47.37%
The course prepared me well for the employment in civil engineering	4.00	4	1	5	7.89%
The course met my expectation	3.00	3	1	5	18.42%

Interactions between students' learning approaches and their perception of curriculum and teaching quality

Bivariate correlations between students' learning approaches and their perception of curriculum and teaching quality at the university are summarised in Table 4.

Table 4: Interactions between students' learning approaches and their perception of curriculum and teaching quality

		Correlations (Spearman's rho)	Stundents learning approaches								
			Deep learning approach				Surface learning approach				
			At times studying gives me a feeling of deep personal satisfaction	I spend extra time trying to obtain more information about new topics to understand them completely before I am satisfied	I come to most classes with questions in mind that I want answering	I feel that virtually any topic can be interesting once I get into it	I do not find this course very interesting so I keep my work to a minimum	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	I see no point in learning materials which is not likely to be in the assignments and exams	I find the best way to pass the unit is to try to remember answers to likely questions	My aim is to pass the course while doing as little work as possible
Students' perceptions of curriculum and teaching quality	Teaching	There were sufficient and adequate number of teaching (academic) staff for the Course	**.388***	.141	-.055	.267	**-.404***	**-.500****	-.241	**-.424****	-.267
		The study materials were clear and concise	**.362***	.127	0.161	**.358***	**-.394***	-.247	**-.341***	**-.385***	-.314
		Teaching approach adopted by teaching staff were relevant to my need	**.420****	.028	-.070	.315	**-.385***	-.219	-.202	**-.386***	-.303
		Modern teaching and learning tools were incorporated in teaching and learning activities	.172	-.198	-.037	.154	**-.325***	-.316	**-.349***	-.303	-.173
		Teaching staff were well prepared and good at explaining the subject materials	0.308	-.064	-.005	**.403***	**-.328***	-.193	-.239	**-.354***	**-.323***
		Assignments and examinations of the units were appropriate	**.358***	.112	.067	**.392***	**-.504****	-.298	**-.331***	**-.392***	**-.499****
		I received appropriate and constructive feedback from teaching staff	**.442****	.188	.021	.312	**-.445****	**-.346***	**-.365***	**-.601****	**-.377***
		There was adequate consultation environment with teaching staff when needed	**.403***	.051	.017	.198	**-.418****	**-.587****	**-.454****	**-.620****	**-.390***
		The teaching staff made a real effort to understand difficulties I might be having with my study	**.454****	.094	.114	.314	**-.406***	**-.446****	**-.325***	**-.487****	**-.384***
		The teaching staff motivated me to do my best work	**.390***	.149	0.140	**.456****	**-.446****	**-.387***	**-.345***	**-.508****	**-.413****
		Overall, I am satisfied with the teaching staff	**.480****	.252	.016	**.342***	**-.357***	-.253	-.252	**-.377***	-.245
	Curriculum	The course developed my comprehensive (theory and practice) understanding of civil engineering discipline	**.498****	.062	.003	**.395***	**-.510****	**-.489****	**-.348***	**-.556****	**-.447****
		This course helped me develop my leadership skills	0.252	.024	.091	.181	-.127	-.170	-.062	-.190	**-.470****
		The course helped me to develop the ability to plan my own	.305	.021	-.216	.151	-.313	-.285	.013	**-.358***	**-.375***
		The course developed my skills & confidence to explore new ideas	**.553****	.209	.186	**.402***	**-.418****	**-.434****	-.184	**-.389***	**-.507****
		This course helped me develop my skills to solve a problem with limited information and guidance	**.471****	**.458****	.319	.213	-.205	-.180	.018	-0.197	-.236
		As a result of this course, I feel confident about tackling unfamiliar problems	**.576****	**.563****	**.355***	.286	**-.365***	**-.373***	-.195	**-.359***	**-.428****
		The course developed my interest in civil engineering field	.308	-.126	-.097	**.343***	**-.489****	**-.394***	**-.379***	**-.532****	**-.469****
		The course prepared me well for the employment in civil engineering	.109	-.030	-.172	.244	**-.345***	-.303	-.132	**-.401***	**-.473****
		The course met my expectation	**.407***	.050	-.151	.268	**-.384***	**-.377***	-.325	**-.520****	**-.349***
		**. Correlation is significant at the 0.01 level (2-tailed).									

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

It is clear from Spearman's (rho) correlation coefficients in Table 4 that surface learners perceived the same curriculum and teaching quality quite differently than the deep learners. Deep learners had positive or insignificant correlations with the statements relating to the curriculum and teaching quality whereas surface learners had overwhelmingly negative or insignificant correlations. It means that, in contrast to the deep learners, the curriculum and teaching quality is not positively perceived by surface learners. Anecdotal belief that 'good program/course curriculum and good teaching methodologies and practices are good for all engineering students and vice-versa' may not always be true for contemporary heterogeneous student cohorts. These differences affect the manner in which engineering students approach a learning opportunity. Hence, adopting a homogenous curriculum and teaching strategies might involve a risk alienating sections of the cohort whose learning approaches are incompatible with the curriculum and teaching quality employed.

Conclusion

This study adopted a questionnaire survey approach to collect data that help explore the interactions between students' learning approaches and their perception of curriculum and teaching quality in an undergraduate civil engineering program/course. The statistical analysis shows that there is a distinct difference between surface learners' perception and deep learners' perception of curriculum and teaching quality. Deep learners had positive or insignificant correlations with the statements relating to the curriculum and teaching quality whereas surface learners had overwhelmingly negative or insignificant correlations. This finding highlights the challenge for curriculum designer to design appropriate curriculum and teaching staff to implement efficient teaching strategies that benefit both surface and deep learners, who are usually enrolled together. It may be beneficial to provide diversity and flexibility in the curriculum and teaching approaches (rather than a uniform approach). It can be done by dividing student cohort and using different teaching approaches based on the requirement. Surely, this approach may have other resource and social consequences. Future studies can focus on these issues. It is also important to note that due to relatively a small dataset, the results may not be generalised.

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Acknowledgement

This study was partly supported by internal research grants from School of Engineering, Deakin University, Australia. Author would like to thank school for the support.

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