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What do students care about?: An analysis of topics impacting student evaluation survey results in engineering

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ABSTRACT

CONTEXT

Student Evaluation of Teaching (SET) surveys are commonly used to measure student learning experience in higher education institutions (Spooren et al., 2013). SET surveys are typically administered at a subject level toward the end of a teaching period, with students encouraged to answer Likert-scale questions as well as provide rich comments that explain these scores and recommend improvements (Cunningham-Nelson et al., 2020). The qualitative comment component of SET survey results is often the most useful data for driving teaching, curriculum, and assessment enhancements. This is due to the specific detail and contextual information that can guide strategic actions. However, in recent years, there has been a growing focus on student experience as a key performance metric for higher education institutions. To improve satisfaction metrics (which are measured numerically), it would be useful to understand the relationship between the topics qualitatively discussed by students and their corresponding satisfaction scores. This can support educators and strategic leaders to focus their efforts on those areas that have the greatest influence on satisfaction scores, thus maximising impact within resourcing and time constraints.

PURPOSE

The purpose of this study is to identify the relationship between the topics discussed by students in SET surveys and their corresponding scores in Bachelor of Engineering subjects at a large Australian University. Specifically, the research questions are:

1. What attributes/characteristics do students discuss most frequently in SET surveys?
2. How do these attributes/characteristics relate to overall satisfaction scores in SET surveys?

APPROACH

SET survey results for subjects offered in the Bachelor of Engineering degree taught between 2016 and 2019 at the Queensland University of Technology were extracted. Key subject attributes and educator characteristics were searched for within the text data using lists of phrases. The chi-square test was used to test association between a topic being mentioned and the satisfaction outcome (either positive or negative).

OUTCOMES AND CONCLUSIONS

The subject attribute that students mentioned most frequently was *teaching quality*. The most frequently mentioned educator attribute was *organised*. Student comments mentioning *approachable* or *engaging* terms were more be associated with a positive satisfaction score. These results provide insight into areas which may be targeted to most positively influence student satisfaction scores.

KEYWORDS

Student Evaluation of Teaching, Surveys, Text Analysis

Introduction

Student Evaluation of Teaching (SET) surveys are commonly used to measure student learning experience in higher education institutions (Spooren et al., 2013). SET surveys are typically administered at a subject level toward the end of a teaching period, with students encouraged to answer Likert-scale questions as well as provide rich comments that explain these scores and recommend improvements (Cunningham-Nelson et al., 2020). It is important to note that these surveys measure student satisfaction with learning experiences, rather than teaching quality.

There has traditionally been a strong focus on quantitative data within SET surveys given this is relatively easy to analyse (Whiteley, 2016). For example, educators can compare their scores to those of others to identify relative strengths and weaknesses. This benchmarking can also be performed at a strategic level to identify high-performing educators and subjects, while prioritising those that require development and support. The qualitative comment component of SET survey results is often the most useful data for driving teaching, curriculum, and assessment enhancements. This is due to the specific detail and contextual information that can guide strategic actions. However, it is much more difficult to systematically analyse this qualitative data, especially when there are large numbers of comments. Improved use of qualitative data can also assist in mitigating against the bias towards gender (Boring, 2017) and culture (Fan et al., 2019) which has been shown in quantitative scores assigned to educators.

In recent years, there has been a growing focus on student experience as a key performance metric for higher education institutions. This is best-evidenced by the recent introduction of performance-based funding for Australian universities, whereby overall satisfaction with teaching quality forms a core measure in the calculation (Australian Government Department of Education & Skills and Employment, 2020). To improve satisfaction metrics (which are measured numerically), it would be useful to understand the relationship between the topics qualitatively discussed by students and their corresponding satisfaction scores. This can support educators and strategic leaders to focus their efforts on those areas that have the greatest influence on satisfaction scores, thus maximising impact within resourcing and time constraints. Thus, the purpose of this study is to identify the relationship between the topics discussed by students in SET surveys and their corresponding scores in Bachelor of Engineering subjects at a large Australian University. Specifically, the research questions are:

1. What attributes/characteristics do students discuss most frequently in SET surveys?
2. How do these attributes/characteristics relate to overall satisfaction scores in SET surveys?

Background

Thematic analysis is a qualitative analysis technique that can be applied to group textual data into broad themes (Braun & Clarke, 2012). This process involves manually identifying themes through a systematic process, and then coding the data according to these themes. As manual coding is time-consuming, various automated approaches have emerged for grouping text comments into topics. This includes Latent Dirichlet Allocation (LDA) (Song et al., 2009) and automatic topic analysis methods in software such as NVivo (Richards, 1999) and Leximancer (Smith & Humphreys, 2006). In addition, predetermined lists of terms or phrases can be used as a basis for distinguishing the prevalence of themes within the data. In this study, the latter approach is adopted for topics relating to subject attributes and educator characteristics respectively.

Firstly, the Student Experience Survey (SES) is run nationally in Australia each year by the Social Research Centre (SRC), with all Universities Australia institutions taking part (Social Research Centre, 2020). Students in their first and final year of their degrees are invited to complete the survey, with quantitative questions broadly grouped into five focus areas (Social

Research Centre, 2020). These are (1) teaching quality, (2) learner engagement, (3) learning resources, (4) student support, and (5) skills development. The SRC has developed a coding tool called SEQuery (Social Research Centre, 2019) which is designed to classify textual comments. As part of this tool, the SRC has identified specific phrases that align with the five focus areas. These phrases are used in the present study as topics related to subject attributes and are discussed further in the methods section below.

Secondly, educators are required to develop and demonstrate many attributes whilst teaching to be successful. Delaney et al. (2010) asked a large sample of students to rate the most important characteristics of effective educators. From this, seven attributes were identified as most important from students' perspectives. These characteristics were (1) respectful, (2) responsive, (3) knowledgeable, (4) approachable, (5) communicative, (6) organised, and (7) engaging. These are considered as topics relating to educator characteristics in the present study.

Method

Student Comment Dataset

The Queensland University of Technology is a large Australian university which offers engineering degrees across a range of majors including civil, mechanical, electrical, mechatronics, chemical process, and medical. Between 2016 and 2019, the university administered a SET survey toward the end of each semester which was open for 4 weeks. The survey consisted of three Likert questions (answered on a five-point scale from strongly disagree to strongly agree), and one open-ended question. These were:

1. This unit provided me with good learning opportunities (Likert).
2. I took advantage of opportunities to learn in this unit (Likert).
3. Overall, I am satisfied with this unit (Likert).
4. Please provide any further feedback you may have about this unit (open-ended).

For this study, we focus only on subjects offered in the Bachelor of Engineering degree taught between 2016 and 2019. Consequently, the dataset includes responses from students who may take engineering subjects as electives as part of other degrees (such information technology). As the survey responses were deidentified, further demographic information for the responding cohort is unable to be obtained. For this study, we focus on the overall satisfaction score given in Question 3 and the free text comment given in Question 4. Consequently, only responses in which students provided a free text comment and satisfaction score were included. This inclusion and exclusion criteria resulted in a total of 14,088 text responses to be analysed.

Identification of Subject and Educator Terms

Before analysing the survey comments, cleaning of the data was performed using programming packages in Python. The text data was converted to lowercase, stop words (such as *the* and *that*) and punctuation were removed, and words were stemmed to their base form (for example, *running* is replaced with *run*). This cleaning ensures that meaningful terms can be found more easily.

The key subject and educator attributes were then searched for within the cleaned data using lists of phrases. We chose to use the five focus areas from the SES surveys (and the terms used in SEQuery (Social Research Centre, 2019)) for the subject attribute lists. Example phrases for each attribute are shown below in Table 1.

Table 1 – Subject attribute and associated example phrases

Subject Attribute	Phrases	
	Example 1	Example 2
Learner Engagement	*group work*	*online discussion*
Learning Resources	*lecture material*	*unit outline*
Skills Development	*critical thinking*	*employable*
Student Support	*consultation*	*career advisor*
Teaching Quality	*teaching staff*	*lab work*

The seven effective educator characteristics identified by Delaney et al. (2010) were also considered. As lists of synonymous phrases did not exist for the list, these were generated by the authors. The seven characteristics and several examples of the phrases are presented in Table 2.

Table 2 – Educator characteristics and associated example phrases

Educator Characteristic	Phrases	
	Example 1	Example 2
Respectful	*inclusive*	*polite*
Responsive	*accessible*	*receptive*
Knowledgeable	*understanding*	*expert*
Approachable	*friendly*	*welcoming*
Communicative	*communication*	*clarity*
Organised	*clear*	*access*
Engaging	*interesting*	*exciting*

Statistical Analysis

Statistical analysis was performed in SPSS Statistics Version 27. The chi-square test was used to test association between a topic being mentioned (determined using the approach described immediately above) and the satisfaction outcome. The satisfaction outcome was considered *positive* if a student gave a strongly agree or agree response to Question 3 of *"Overall, I am satisfied with this unit"*. In contrast, if a student gave a neutral, disagree, or strongly disagree response to Question 3 then the satisfaction outcome was considered *negative*. Odds ratios and the corresponding 95% confidence intervals were used to assess the effect size.

Results and Discussion

Subject Attribute Analysis

Table 3 summarises the focus area analysis, including the number of positive and negative satisfaction responses by topic, and results of the chi-square tests and odds ratios. Figure 1 visualises the rate of comments mentioning focus areas by overall satisfaction outcome. It can clearly be seen that *teaching quality* is mentioned most often, and this is the case for students with both positive (79.0%) and negative satisfaction (85.0%). This large percentage of mentions signifies the importance of *teaching quality* in students' learning experiences. This is also in line with teaching quality being a key metric that performance-based funding is based upon in Australia (Australian Government Department of Education, 2019).

Applying the chi-square test of association between students' mentioning a subject attribute and their satisfaction outcome reveals strong support for a relationship for every focus area (Table 3). The odds ratios show that depending on the subject attribute, students with a positive satisfaction outcome had between 0.574 and 0.753 times the odds of mentioning the subject attribute, compared to those who had a negative outcome. That is, students who discussed a subject attribute were much more likely to be unsatisfied with the subject.

Learning resources is another attribute of interest. This area contains the largest chi-square value, and the difference between positive and negative mentions is significant (10.8% positive mentions and 17.1% negative mentions). Students who mention *learning resources* in their comment are very likely to rate the subject with a negative satisfaction. Examining *skills development*, it is the attribute with the second highest percentage of mentions, solidifying the importance of this area with respect to student satisfaction.

Although *student support* was identified as an attribute of interest, examining the results presented below we can see that a very small number of students mentioned terms in this topic group. From this we can conclude *student support* is not a large factor in the free text comments that students provide.

From the subject topic analysis, one common aspect that can be observed is that for all attributes, the percent of mentions is higher for the comments associated with negative satisfaction. This suggests that students make more detailed comments that highlight topics when they are not satisfied with a subject.

Table 3 – Results of focus area analysis (LE = Learning Engagement, LR = Learning Resources, SD = Skills Development, SS = Student Support and TQ = Teaching Quality, CI = Confidence Interval)

Attribute	LE	LR	SD	SS	TQ
Positive satisfaction responses					
Mentioning focus area	352	989	1869	257	7209
Not mentioning focus area	8777	8140	7260	8872	1920
Mentioning topic (%)	3.9	10.8	20.5	2.8	79.0
Negative satisfaction responses					
Mentioning focus area	324	846	1263	222	4214
Not mentioning focus area	4635	4113	3696	4737	745
Mentioning topic (%)	6.5	17.1	25.5	4.5	85.0
Chi-Square Test					
Value	50.438	109.963	46.385	27.009	75.639
Significance	0.000	0.000	0.000	0.000	0.000
Odds Ratio (Negative/Positive Satisfaction)					
Value	0.574	0.591	0.753	0.618	0.664
95% CI Lower Bound	0.491	0.535	0.694	0.515	0.605
95% CI Upper Bound	0.670	0.652	0.817	0.742	0.728

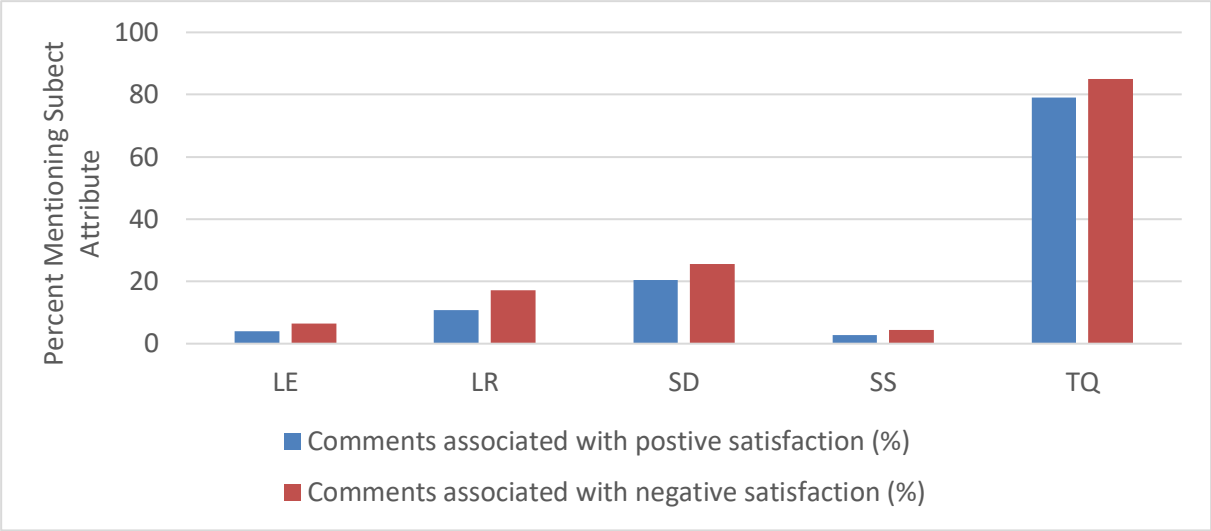

Figure 1 – Rate of students mentioning focus areas by overall satisfaction outcome (LE = Learning Engagement, LR = Learning Resources, SD = Skills Development, SS = Student Support and TQ = Teaching Quality)

Educator Attribute Analysis

Table 4 summarises the results for the educator characteristic analysis. The percentage of mentioned topics is visualised in Figure 2. Applying the chi-square test of association between students' mentioning an educator characteristic and their satisfaction outcome reveals strong support for a relationship for responsiveness, approachable, communicative organised, and engaging (Table 4). However, there is only weak evidence of a relationship for the knowledgeable characteristic, and no evidence of a relationship for respectfulness.

Table 4 – Results of educator characteristics analysis Topic Area Response Analysis (Rf = Respectful, Rv = Responsive, Kn = Knowledgeable, Ap = Approachable, Co = Communicative, Or = Organised and En = Engaging)

Attribute	Rs	Rv	Kn	Ap	Co	Or	En
Positive satisfaction responses							
Mentioning topic	32	284	622	1288	218	2661	1416
Not mentioning topic	9097	8845	8507	7841	8911	6468	7713
Mentioning topic (%)	0.4	3.1	6.8	14.1	2.4	29.2	15.5
Negative satisfaction responses							
Mentioning topic	19	263	383	603	306	2013	624
Not mentioning topic	4940	4696	4576	4356	4653	2946	4335
Mentioning topic (%)	0.4	5.3	7.7	12.2	6.2	40.6	12.6
Chi-Square Test							
Value	0.095	41.39	4.016	10.51	128.4	189.8	22.24
Significance	0.758	0.000	0.045	0.001	0.000	0.000	0.000
Odds Ratio (Negative/Positive)							
Value	0.915	0.573	0.874	1.187	0.372	0.602	1.275
95% CI Lower Bound	0.518	0.483	0.765	1.070	0.312	0.560	1.153
95% CI Upper Bound	1.615	0.681	0.997	1.316	0.444	0.647	1.411

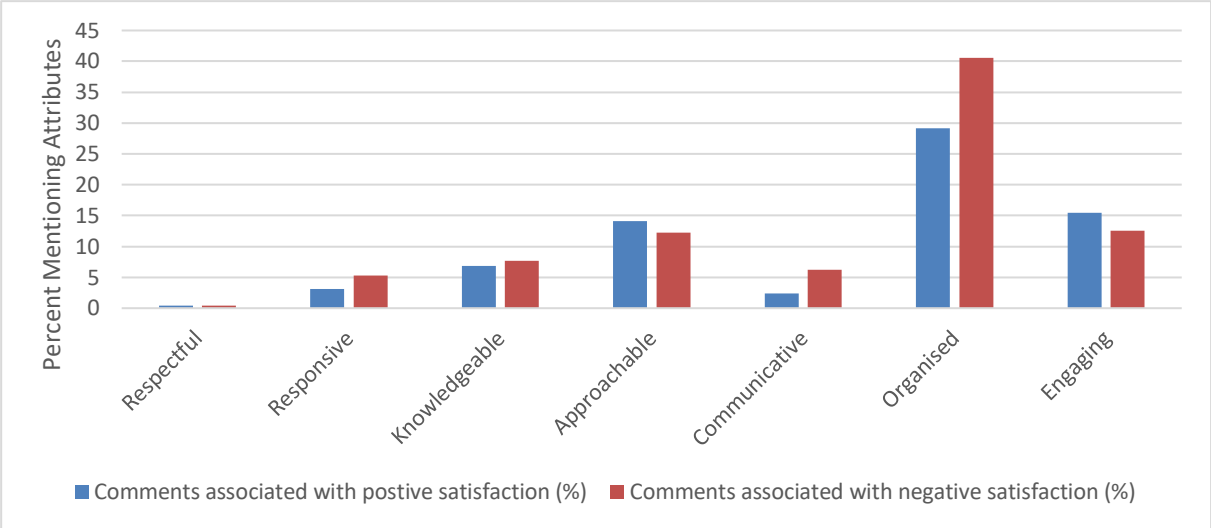

Figure 2 - Educator Attributes Mentioned Topics

Examining the table and figure, *organised* is clearly the most frequently discussed attribute, being mentioned in 29.2% of positive responses and 40.6% of negative responses. The significance of this is reiterated by the large chi-square value and corresponding significance value. This reinforces the importance of educators being organised which is emphasised in the literature (Delaney, 2010).

The *communicative* attribute shows the largest differences between positive and negative mentions. This demonstrates that if students mention words related to the *communicative* attribute, they are more likely to have given a negative satisfaction score. *Approachable* and *engaging* are the only two attributes from both the subject and educator topic lists that have a higher percentage of positive mentions, and this is reflected in the odds ratios which are greater than 1 (Table 4). This can be interpreted as students with a positive satisfaction outcome being about 1.2 to 1.3 times more likely to mention these attributes, compared to those with a negative satisfaction outcome. That is, students are more likely to have given a positive satisfaction rating if they have written about *approachable* and *engaging* educators.

Conclusions

This study analysed the responses from an end of semester SET survey for Bachelor of Engineering subjects. The satisfaction score and free text responses were analysed to understand the relationship between the score and references to five subject attributes and seven educator characteristics. The *teaching quality* subject attribute and *organised* educator characteristic were found to be most mentioned by students. Students who gave comments containing *approachable* or *engaging* terms were more likely to provide a positive satisfaction rating.

Potential future work for this study includes expanding the analysis of comments beyond engineering subjects to ascertain if similar conclusions can be drawn about all students. This will highlight to educators which aspects of their subject or teaching are most likely influencing their student evaluation scores. Analysis of the sentiment of text comments could be included to provide further insight into student satisfaction. Finally, further terms could be added to the existing attributes as well as additional attributes added to investigate the link between student satisfaction and free text comment provided.

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Ethics Approval

Ethics approval for the use of student text data in this study was granted by 1800001045.

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