Case study on the performance of an educational institution and its impact on engineering students

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ABSTRACT: In this article, a mission-oriented approach is detailed and used to evaluate the performance of the College of Engineering and Computer Science (CECS) at California State University, Northridge (CSUN). This approach considers mission statements from various CSUN institutions in light of student feedback as a metric to evaluate whether the institution is adequately fulfilling its goals. The mission statements were collected and keywords were extracted from their narratives. Based on common keywords, a questionnaire was developed to distribute among the students to gauge their satisfaction in meeting the stated objectives. Findings include the least amount of satisfaction within the following areas: teaching quality, incompatibility with different styles of learning and the need to place a greater focus on tackling community issues. Issues have been identified including the nature of the institution as a commuter school and impedance to academic progress by specific bottleneck courses. Suggestions are offered as solutions to such issues and future works will expand the scope of the study.

Keywords: Education, performance, organisational assessment, undergraduate

INTRODUCTION

There are 23 campuses that make up the entire CSU system. The Web site for the CECS at CSUN mentions that …*The College [partners with] the professional communities of computer science and engineering [to provide] ... essential link[s] between students' education and [their long term goals of] professional [engineering] practice* [1]. This research hopes to analyse the CECS goals and through the use of student feedback reach an understanding of what the institution excels at and where performance needs to be improved. At the time of this writing, CSUN boasts a student body consisting of about 40,000 undergraduate students [2], with around 4,500 graduate and undergraduate students in the CECS; the graduate headcount in the CECS is about 500, leaving a bit over 3,900 undergraduate students in the CECS [3]. The main focus of this study will be to target a subset of the undergraduate CECS students as distributed throughout a host of courses. Utilising a mission-oriented approach, a questionnaire based upon multiple keywords that have been identified from CSU mission statements was formulated to gauge students' feedback on the College's overall performance and attainment of such goals and objectives.

METHODOLOGY

Processing CSU Mission Statements

To develop the questionnaire, the authors began with the mission statement of the CECS at CSUN to better understand what this particular college considered as being important. Next, they identified specific keywords that were found to occur with some degree of frequency among the various mission statements of the 23 CSU institutions. Each CSU mission statement was run through a word-frequency algorithm to ascertain those words as occurring the most and, as a result, bearing special significance towards the fulfilment of institutional goals and objectives. Using some of these keywords they began to formulate a questionnaire to distribute to CECS students at CSUN to gauge whether or not they believed the institution was meeting their stated mission.

Formulating the Questionnaire and Distributing

After the algorithm identified the list of words that appeared with the greatest frequency, the authors were able to formulate a questionnaire concerning:

1) student needs in general;
2) the tackling of community problems;
3) issues of diversity;
4) the availability and potential for conducting research;
5) institutional services offered;
6) students' aptitude, i.e. their ability to learn;
7) teaching quality;
8) student health needs.

Umbach and Porter elaborated on how academic departments can enhance student satisfaction [4]. For instance, it was shown that the amount of student contact time with faculty members had a direct bearing on their overall satisfaction involving resources and the engaging in meaningful relationships that contributed to their efforts in learning. Meaningful contact time spent between the student and their professors also intersects another part of the questionnaire that addresses the availability and potential for students in conducting research.
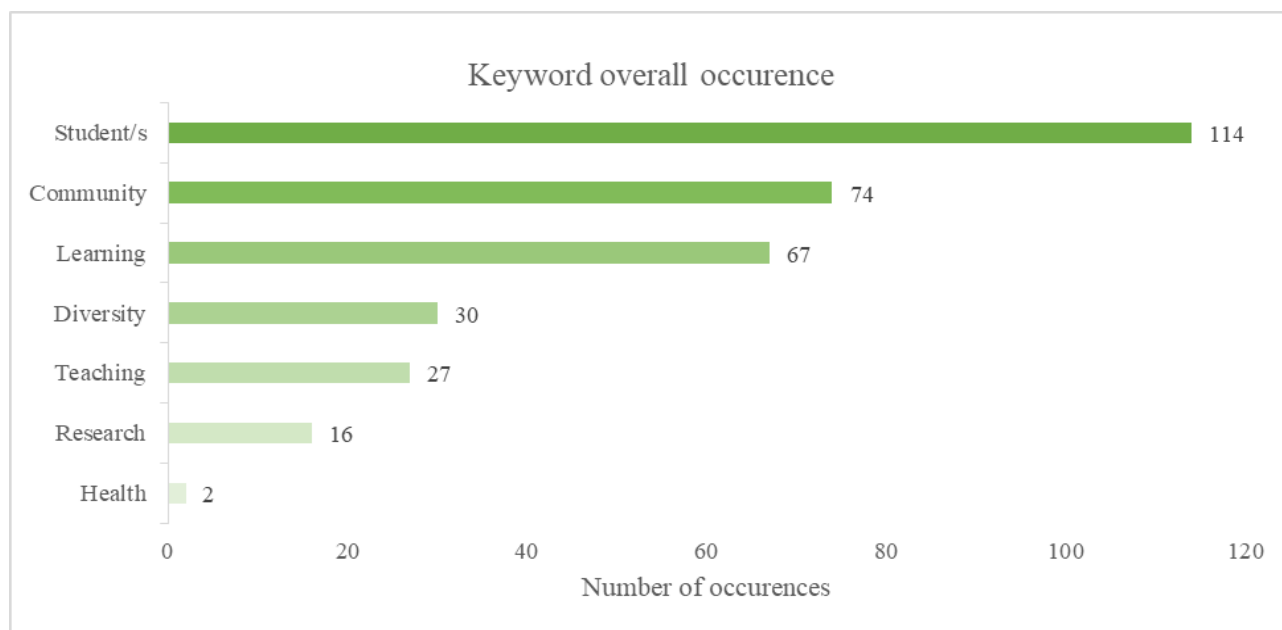

Figure 1: CSU mission statement keyword frequencies.

In addition to being a part of the CSU mission, diversity is also an important factor for students and the fostering of a healthy university climate. According to Umbach and Porter, gender diversity within a department is a factor that students consider when deciding their level of satisfaction with their department and, more generally, their institution [4]. Furthermore, Gurin et al studied different institutions and found that students benefit from interaction with a more diverse group of students [5]. The results in the aforementioned papers signify that a higher level of diversity perceived by students should reflect on their rating of the institution's performance itself in a positive manner.

Giving students access to research opportunities, in particular to undergraduate students, has been shown to reflect positively on one's perception of their respective institution. Another of the findings from Umbach and Porter state that …*departmental research emphasis all appear to have a significant relationship with satisfaction* [4]. John and Creighton found that their so-called undergraduate research opportunity programmes (UROP) helped students gain a better appreciation of the research process and a heightened ability to more astutely participate in academic discourse [6].

Although an institution of higher learning's main focus is on education, other services they afford to students is deemed as being important to them as well. Bini and Masserini found a significant correlation between higher teaching efficiency, which is described as the …*organisation of the teaching activities, learning materials, receiving hours and information about courses...* and higher student satisfaction with the institution [7]. Lenz-Rashid found that a service offered by SFSU dubbed the guardian scholars programme (GSP), which includes …*Case management, year round career planning, social activities, leadership opportunities, and scholarships*, led to much higher retention and academic performance rates of 84% for freshmen, when compared to the university average of 70% [8]. Offerings at universities concerning health, whether mental or physical in nature, are also services that students value greatly. Deshwal et al found college health services - including staff reliability, professionalism, accessibility to the clinic and cleanliness - to have a positive effect on students' overall satisfaction [9].

A total of 350 undergraduate students were targeted in the survey. Survey responses were compiled into a spreadsheet from which statistical analyses could be facilitated, e.g. accounting for the proportions of *yes* versus *no* responses for each of the eight questions. Based on such raw percentages, conclusions and evaluations of questions could be made,

e.g. those with a mean dissatisfaction rate at a demarcation of over 25% were considered to be taken as the institution underperforming in those areas. Graphical representations of the data were also prepared to facilitate in this process (see Figure 1 and Figure 2), thus enabling suggestions to be made in addressing such existing issues in the future.

RESULTS

Based on the collected survey data, students in the CECS seemed to be most satisfied by CSUN's efforts to acknowledge and appreciate diversity, address student health needs and in furnishing certain educational services. There was also a consensus among students in the important role that research can potentially play in their overall experience in educational quality. Other areas did not receive the same degree of agreement as in the preceding four categories just mentioned. According to the compiled data results, more than 25% of the students who were surveyed felt that the institution did not adequately prepare them to handle community issues, and more immediate to their education, that diverse teaching styles were not implemented to adequately address the different learning styles present among students.
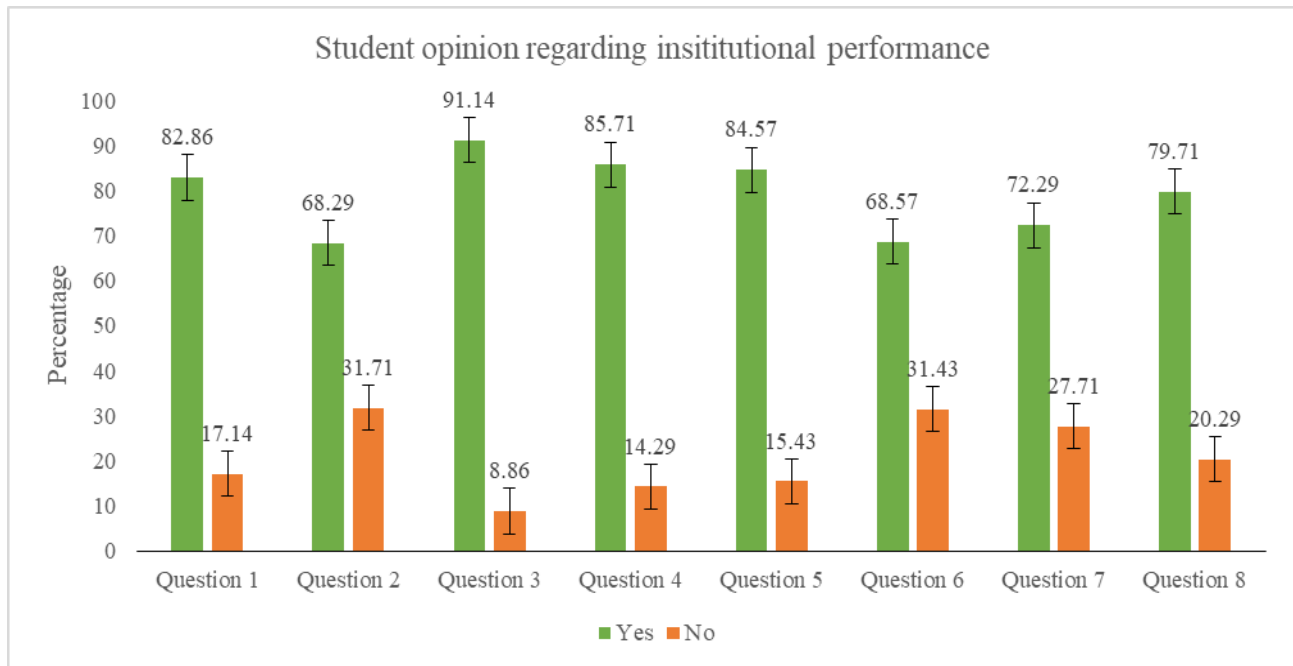

Figure 2: Survey data represented as *Yes* and *No* proportions on a bar graph with margins of error.

Students agreed that the category of research has a great potential for enhancing their knowledge and insights on a given subject of study within regular classroom lectures, but that the CECS did not adequately address how students may become more engaged in such significant activities themselves. Also, concerning learning and teaching, approximately 30% of the students surveyed felt that the CECS generally needed to make greater strides for enhancing the quality of future instruction, both in terms of its delivery and reception.

According to Maric et al, different approaches can be taken to improve the learning experience for students [10]. One such example is for educators to better utilise the vast resources available to them on the Web in both supplementing and enhancing the quality of their classroom instruction. Different learning styles also exist, as Maric et al state …*Some students for instance may learn better with concrete, experimental type of educational experiences while others prefer reflective types of learning opportunities*, as such a diverse profile of teaching strategies can help cover multiple types of learning which students may have preference of one over the other [10].

Kiss describes courses labelled *bottlenecks*, in which these courses hinder students' progress towards degrees and increase the difficulty of learning by *stacking* more classes since they were not able to enrol in them earlier [11]. A leading issue with bottleneck courses is insufficient funding for the hire of enough faculty to teach the variety of classes that must be taken to fulfil programme requirements, and according to Kiss, STEM fields have the greatest lack in courses being offered to accommodate their students [11]. The bottleneck issue leaves few options to mend it, with funding being the primary solution or a restructuring of programmes which suffer from the bottleneck issue.

The institution considered in this study may generally be considered as a *commuter* school as opposed to its more traditional *residential* counterparts, where the majority of students either dorm on campus or else have established living arrangements within a close proximity to campus. Bruning et al posited that the more inviting the university campus can be made for its students and community, the more its students will feel comfortable and prone to participate in campus events, such as concerts and sports games, and in so doing will have a heightened sense of community that ultimately fosters a more effective university experience for them [12].

Reliability of the Results

Judging by the sample size of 350 and a population of 3,900, the authors have approximately a 95% confidence level that their results are within +/-5% of the population's proportions. Having an insufficient data set cannot adequately capture the population to be studied, thus invalidating the conclusions to be drawn and the suggested measures to be taken to make university operations more effective. In determining the proper sample size, one must first know the population. In this present study, the student body within the CECS consists of 3,900 undergraduates.

To obtain a 95% confidence level with a margin of error of +/-5%, a Z-score of 1.96 is needed, hence, the authors would use the formula $n = (N*X)/(X+N-1)$, where N is the population size, and X is equal to: $X = Z^2 * p * (1-p)/MOE^2$, where Z is the Z-score, p is the sample proportion, and MOE is the margin of error. Using the value of 1.96 for the Z-score corresponds to a 2.5% split on each side of the distribution, which in total results in a 5% split cumulative and through this the authors obtain the range of 95% confidence. From this, they would ideally need to calculate this for each of the questions to see if they each are fairly representative of the population as a whole since they do not all have the same proportions. This information is reflected in Table 1, showcasing the questionnaire results.

	Survey questions	Survey		Total number of students	Percentage		Required CI sample size
		Yes	No		Yes	No	
1	Is the educational institution successful in addressing the students' needs in general?	290	60	350	82.86	17.14	206
2	Does your academic education prepare and help you to tackle the community problems and issues?	239	111	350	68.29	31.71	307
3	Do you think that diversity and inclusion are practically appreciated in your educational institution?	319	31	350	91.14	8.86	120
4	Does research enhance the knowledge obtained through classroom lectures?	300	50	350	85.71	14.29	180
5	Do the institutional services provided positively influence your educational experience?	296	54	350	84.57	15.43	190
6	Does your educational institution properly address students' learning abilities, needs and styles?	240	110	350	68.57	31.43	305
7	Are you satisfied with the overall teaching quality?	253	97	350	72.29	27.71	285
8	Does your educational institution address students' health needs?	279	71	350	79.71	20.29	233

Table 1: The questions of the survey, as well as their answer proportions.

DISCUSSION AND CONCLUSIONS

The purpose of this research was to determine the College's performance in varying categories, categories which the University deems important. By analysing the mission of multiple CSU institutions, the authors developed a questionnaire to distribute to students to get a better idea of how they feel the institution is performing. Using this questionnaire, they diagnosed *gaps* in the institution's performance of certain services, which a concerning amount of students felt was not being adequately delivered, with multiple suggestions given on possible routes to improving these areas.

The authors found that the institution was underperforming at handling community issues, lack of diverse teaching strategies and the overall learning experience. To help bridge the satisfaction gap in these fields, they recommended additional funding/funding changes, restructuring of programmes or courses that suffer from the bottleneck issue, inviting the local community to the campus itself, utilising various teaching resources and diversifying the types of teaching employed by faculty.

Workshops can be held in order to brief faculty on taking advantage of on-line materials, experimenting with teaching styles to include a more diverse learning experience as to include class discussions or reflective teaching styles. The institution may also make initiatives to invite community members and create groups responsible for organising such events in order to boost community interaction and touch on community issues.

At this point in time, the authors have their surveys, results, analysis, as well as recommendations to the CECS. From here however, they have touched on this College of roughly 4,500 students only 3,900 of which the surveys should be representative of. However, the University considered in this study has almost 10 times that number in total enrolled students. Studies pertaining to this topic specifically can now go to get a bigger picture by possibly trying to tackle a larger population, such as the CSU considered in this study as a whole or the state wide CSU system.

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BIOGRAPHIES
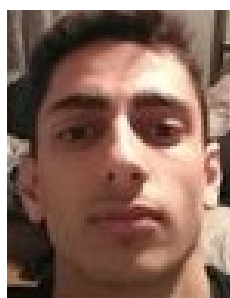
Samuel Agazaryan is a computer science undergraduate student in the Department of Computer Science at California State University, Northridge (CSUN). Currently, he is a senior looking to graduate in spring 2021. He has won second place in the CSUNPosium 2020 event, also known as the Annual Student Research and Creative Works Symposium. Samuel is currently working on a real time disaster data mobile application map with four other students as a senior design project.

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