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Identification of Critical Factors Driving Student Satisfaction with Teaching Learning Process in Engineering Education

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Abstract—These Student satisfaction plays a pivotal role in assessing the impact and quality of engineering education. Student satisfaction can be determined from the degree to which the aspirations of students are satisfied from the teaching learning activities at an academic institution. Hence, it is an imperative task for all academic institutions including engineering education institutions, to maintain the quality of teaching and learning activities for attaining maximum student satisfaction. Yet, due to the fast growth of engineering education in recent years, there are serious concerns associated with quality of teachers, teaching infrastructure and proper learning environment. The present study is an attempt to explore some of these critical concerns for improving the quality of teaching learning practices in engineering education. The major objective of the study is to identify critical factors driving student satisfaction with teaching learning processes in engineering education. It also explores important quality dimensions of engineering education and highlights its impact on students' learning experience. Based on an empirical analysis of the structured survey responses from a large group of diverse engineering stream students, the study results outline detail indicators of student satisfaction and also provide practical insights on the specific perceptions of the students about their learning experience and what drives their satisfaction with the entire learning process. The implications of the study are highly useful for academicians and policy makers for deciding on the ways to improve the quality of teaching learning processes in engineering education. The major contribution of the study lies in identification of the most important factors of student satisfaction in engineering, which can provide valuable insights for establishing sound Outcome Based Education systems at engineering education institutions.

Keywords- Engineering Education; Student Satisfaction; Learning; Learning Experience; Teaching

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1. Introduction

Quality of teaching learning processes and the student satisfaction associated with it, is important in all sectors of education. But considering the mushroom growth of the number of engineering colleges in India in recent years, there is a serious need to assess both these factors as together they may

impact the overall learning experience and learning outcomes of the students. Engineering education is rapidly growing, not only in India but all across the globe. However, the rapid expansion of engineering education has brought up severe issues with regards to the quality of teaching, availability of teaching infrastructure, and a suitable learning environment for holistic development of students. Student satisfaction refers to the degree to which the students' expectations and desires related to teaching and learning activities are fulfilled in reality. In most of the cases, it is observed that there are no sound mechanisms available for measuring the actual student satisfaction with various factors of teaching and learning while students are studying or pursuing their engineering education. In a few colleges, exit surveys are conducted but there are concerns related to the incorporation of the feedbacks received from students. Majority of the times, those feedbacks are taken for documentation purpose and the real objectives of student satisfaction survey are ignored by all important stakeholders and decision makers. There is an absence of systematic continuous student satisfaction assessment while the students are there in campus and which further leads to a lack of system or a practice for implementing constructive changes drawn from student satisfaction assessment surveys.

This highlights the need for a system that ensures quality, as well as its measurement and implementation. The present study tries to fill this gap in the extant literature by empirically examining the student satisfaction of engineering students and commenting on the important parameters to focus on for improving the quality of teaching learning in engineering education. The current research primarily aims to identify the variables influencing the quality of teaching and learning, more specifically in engineering education and also attempts to highlight the importance of measuring student satisfaction, applying its results and implementing a system of ongoing improvement. This is a significant index and it is directly connected to facilitation of the learning process. The reason being that every satisfied student is more likely to be high in receptiveness in the teaching learning process and consequently, there is a lesser possibility of his/her remaining absent or on leave during their studies. This problem is predominantly relevant in application oriented and complex knowledge areas like engineering. We present here the results obtained through an experimental survey conducted in a private university in India.

2. Literature Review

The review of extant literature on factors responsible for student satisfaction with teaching learning process, highlights various aspects of educational system.

Importance of student satisfaction in higher education

Satisfaction of all stakeholders is important for all higher education institutions and the most critical in that is, students (Mahapatra S.S. & Khan M.S., 2007). But it is not so easy to satisfy students. Their assessment of quality in the teaching learning process and what they actually receive, might be a relative aspect. In general, quality of education is a 'stakeholder specific' and to an extent an ambiguous and a relative term as point out by Cheng and Tam (1997). The main reason for that is, perceptions about quality may differ from person to person (Filippakou O., 2011, Cheong C. Y.& Ming T.,1997). Although it can be difficult to satisfy students, doing so can give colleges a competitive advantage. Campuses with the best rates of institutional and academic performance are those that consistently evaluate student satisfaction metrics and take appropriate action (2022).

Fortino (2012) asserted that the goal of higher education is to prepare students' minds. Additionally, the greater objective of higher education is knowledge generation and distribution for the advancement of humanity through originality and creativity (Elliott, K., and Shin, 2002). The purpose is also to ensure students' academic performance and to improve their education. The encouraging growth in higher education everywhere, validates the critical importance of student satisfaction in these academic institutions for sustaining and growing in a cutthroat environment (Yusoff, M. et al., 2015). Thus, it is necessary for higher education institutions to be more aware of and emphasize on the need of satisfying the wants and expectations of their key stakeholders, i.e., the students (DeShields O. W., Ali, & Erdener, 2005).

Student happiness is a straightforward but ever-changing phenomenon. The complexity of higher education and the ambiguity surrounding "students as customers" make it challenging to measure student happiness (Elliott K.M., 2002). According to an appraisal of students' educational experiences, students' happiness is a short-term attitude (Elliott, K. & Healy, 2001). According to Navarro, Iglesias, and

Torres (2005), it is a favourable predictor of student loyalty and the result of an educational system (Zeithaml, 1988). Once more, Elliot & Shin (2002) describe student satisfaction as the attitude of students as determined by their subjective assessment of their educational experience and results. As a result, the comparative extent of experiences and the students' perception related to performance of educational services during their study period, can be utilized to quantify student satisfaction (Mukhtar, U., et al. 2015). According to Hon, W. (2002), satisfaction is the feeling that an expectation has been met.

Determinants of student satisfaction as outlined in the literature

Quality of lecturers, quality of physical facilities, and efficient use of technology were highlighted by Wilkins, S. & Balakrishnan M.S. (2013) as the main determinants of student satisfaction. Apart from the aforementioned factors, student satisfaction in higher education institutions is critically impacted by the facilities and the overall atmosphere of the classroom where learning is happening, the relationship between the teacher and the students, the nature of interactions with other students, the quality of feedback provided to the student, the contents of the courses taught, the availability of relevant learning material and other resources, alongwith the overall quality of the learning environment (Kuh, G. & Hu, S., 2001; Garcl a-Aracil, A., 2009; Sojkin, B. et al., 2012). In addition to this, Douglas, J. (2006) and Palacio, A. (2002), have identified a few more important factors which highly impact student satisfaction such as: flexible syllabus, teaching competence of faculty members, the status and brand name of the university or college, autonomy, care, growth and development avenues, student centric approach, campus infrastructure, social settings and overall institutional effectiveness.

Professional setting, assessment of student learning experiences, classroom setting, facilitating materials for classes and tutorials, textbooks and other facilities that support student learning, commercial practices, relationships with the faculty, knowledgeable faculty and with a sense of responsibility, helpfulness of staff, feedback and class sizes are some of the important factors influencing students' satisfaction with their higher education, maintain Mazirah Yusoff et al., (2015) in their study.

Academic and non-academic elements, as well as access, reputation, and program difficulties, were identified by Ali et al. (2016) as having a stronger impact on students' satisfaction. Alvis, H., and Rapaso, M. (2006) looked into how university reputation affected student loyalty and satisfaction in Portugal and similar factors were found to be crucial for student satisfaction by them. According to Hanssen & Solvoll's (2015) research, students' satisfaction is strongly influenced by the institution's reputation, attractiveness of the host university city, and the quality of facilities available. However, in the Norwegian university system, the impact of job prospects was found to be minimal by them. In their study of Armenian higher education, Martirosyan, N. (2015) found out that faculty services, academic experience, student support facilities, campus life and social integration are major factors contributing to student satisfaction. Dhawan, S. (2022) in her study identified following six dimensions of student satisfaction from the existing literature. They are: excellence of teachers, their teaching quality, quality of curriculum design, quality of physical evidence, administrative services quality and student support quality. It is further mentioned in her study that higher levels of student satisfaction will be associated with academic success, which will also have an impact on how well graduates do after they enter the workforce and society (Dhawan, 2022).

Engineering Education and Student Satisfaction

Majority of educational institutions that provide technical skills to industry are influenced by the ideas of multiple stakeholders under the umbrella of total quality management. The quality of education is greatly improved by student feedback on the educational process. To increase the quality of education at the institute, the management must be clear about its mission, objectives, and dedication to the satisfaction of the stakeholders (Junnarkar & osekar, 2011).

Students are the most significant group of engineering education stakeholders. Development of their intellectual and analytical abilities, specialized technical skills, practical hands-on training, and accommodating the rapidly changing expectations of the industrial world (Belytschko T. et al., 1997) should therefore be given top priority in their curriculum (Davies H. A. et al., 1999). For teachers and students alike, the internet plays a critical role in fostering academic performance (Richard Daughenbaugh et al., 2002). Students are more satisfied when lectures, assignments and solutions are available online (Rajev

Kumar et al. 2006). All these factors need to be addressed while thinking about student satisfaction in engineering education. On the other hand, there are studies which point out that the lack of interaction between students and teachers owing to the web-based courses has a negative impact on the satisfaction level of students.

The use of student-centred didactic methodologies that incorporate collaborative learning, learning resources, and evaluation into the learning process, therefore, aid in the improvement of the student learning process because, in addition to enhancing results, the use of this type of methodology raises student satisfaction, which in turn encourages and facilitates learning (González-Rogado et al. 2014).

It is clear from the review of extant literature that there is a need to find out innovative and constructive methods focused on the needs of the students for improving teaching learning process. Factors of student satisfaction identified in various studies point out diverse and multiple issues. Though there are a few studies available about overall student satisfaction survey conducted with reference to educational systems in some countries, there is a lack of such studies specifically referring to teaching learning process and explicitly for engineering education in India. The current study attempts to fill this gap in literature by finding out critical factors impacting satisfaction of students related to teaching learning process in engineering education.

Research Objectives

1. To identify the critical factors impacting student satisfaction with reference to teaching learning processes in engineering education

2. To explore important dimensions of quality in engineering education and highlight its impact on students' learning experience

3. To examine the relationship between student satisfaction and teaching learning processes in engineering education

4. To identify the key aspects of teaching learning practices from students' perspective

3. Research Methodology

Sample and Setting

The survey was conducted with final year engineering students studying in one of the largest and highly reputed private universities in Pune city of Maharashtra, India. The university is known for offering quality engineering education in various specialized engineering domains. Its physical campus is equipped with modern infrastructure and offers a variety of facilities to students for pursuing their academic as well as co-curricular and extra-curricular activities. Descriptive research design was adopted for this study. For the purpose of the study, the students were sent an online form with permission of the university. Some students were interviewed and were given hard copy questionnaire as well. The students were asked to comment on their satisfaction with reference to different aspects of their teaching learning activities in the university.

The original planned sample size was 600, that is 100 students each from Civil, Mechanical, Electrical, Computer, Electronics and Communication and Chemical engineering. Every engineering branch in the university has intake capacity of 240 making the population size of 1440. The survey forms were sent to around 650 students. The actual valid and complete sample received was: Civil Engineering- 98, Mechanical Engineering- 99, Electrical engineering-98, Computer Engineering -100, Electronics and Communication Engineering -100, Chemical Engineering-98. Total 593 was the actual sample data considered for further analysis. Since the study was aimed to understand the amount of students' satisfaction towards teaching-learning processes adopted by an institution, the sample for the study was made up of students studying in different branches of engineering. Since most of the teaching-learning processes are followed at an institution level irrespective of different branches of engineering, the sample consisted of students studying in different branches of engineering. It is to be noted that the university chosen for this research has an intake capacity of not more than 240 students for each branch of engineering. This is the reason why sample in this study was designed by including students from different branches of engineering to achieve a bigger sample size. In addition to this, an attempt was made to design sample based on academic performance of students so as to include varied responses for study. The University was generous to provide the information on academic performance of the students of various branches. The quota sampling was used for the research. The resultant sample consisted students from different branches of engineering with above

Table 1 :
The Resultant Sample For The Study

Sr. No.	Engineering Branch	Number of Students			
		Top 20% performers in academics	Middle 60% performers in academics	Bottom 20% performers in academics	Total
1	Civil	20	58	20	98
2	Mechanical	20	59	20	99
3	Electrical	20	58	20	98
4	computer	20	60	20	100
5	Electronics & Communication	20	60	20	100
6	Chemical	20	58	20	98
	Total	120	353	120	593

average, average and below average academic performance. The same is shown in table 1:

Measures

A self-structured questionnaire was prepared based on the survey of extant literature and drawing important points of student satisfaction from them. Many researchers have used different scales to measure student satisfaction regarding quality or service quality of higher education. Some important points of the survey questionnaire were taken from the standard measures like SERVQUAL scale (Service Quality) developed by Parasuraman et al. (1985, 2002), SERVPERF (Service Performance) developed by Cronin and Taylor (1992) and HiEdQUAL (Higher Education Quality) developed by Annamdevula S & Bellamkonda R.S. (2012) for measuring service quality in Indian higher education sector. Total 21 questions were prepared for the survey which covered most highlighted factors in the literature review for being important in student satisfaction, like course contents, teacher's preparedness for the class, pedagogy, fairness of evaluation, student support facilities, employability etc. This questionnaire was validated with the help of elite academicians, industry experts and a few meritorious alumni of the university. In order to bring precision in questionnaire development, academicians of different cadre were chosen. This consisted of two vice chancellors and three professors from another private universities from Pune. The questionnaire was further validated with the help of five alumni of the university and five industry executives who happened to be the regular recruiters for the university. The suggestions given by these fifteen experts were incorporated to refine the questionnaire. Later, pilot testing was conducted by administering this questionnaire to randomly chosen 40 final year engineering students of the university to ensure comprehensiveness and clarity. The data was analysed in statistical software, SPSS Version 21. First, weighted Mean scores were calculated for all surveyed questions and their responses. In the next stage, Exploratory Factor analysis was conducted to understand the interrelationship between the student satisfaction and the teaching learning process. Critical factors driving student satisfaction were identified after analysis of Rotated component matrix.

4. Results And Analysis

The Weighted Mean scores presented in the Table 2 show the student satisfaction with twenty-one measured factors related to the teaching learning processes in students' specific engineering domains. The mean scores indicate that the students are overall satisfied in this university with most of the aspects of their teaching and learning. The mean satisfaction score for all aspects is greater than 4. Comparing mean scores of different factors, it is found out that the students are most satisfied with:

1.Extent to which teachers were able to communicate effectively- 4.65, 2. Extent to which teachers were prepared for classes - 4.6 and 3. Extent to which the teaching learning process facilitated the use of various ICT tools by teachers - 4.64. This clearly highlights the importance of 'quality of teachers' and the 'innovative technology enabled pedagogy' in engineering education.

It can also be seen from the results that the students seem to be comparatively least satisfied by the factors such as: 1. Frequency with which institute promotes internship, field visits, student exchange etc.- 4.38, 2. Teachers' initiatives to identify students' weaknesses and help to overcome them – 4.40, 3. Whether institute makes efforts to inculcate functional skills and life skills to enhance employability-4.41. This asserts the need of institutional initiatives for increasing industry interaction, practical inputs and special measures required for development and mentoring of weaker students in Engineering colleges. The results of KMO and Bartlett's Test, Reliability test, Variance and detail results of factors analysis are presented in Tables 3, 4, 5 and 6.

Table 3 indicates Kaiser-Meyer-Olkin (KMO)

measure of significance and Bartlett's Test of Sphericity. These tests are conducted to know whether there is substantial amount of correlation present between variables under the study (Malhotra, 2010). It also is a measure of collinearity between variables that indicate how strongly one variable is corelated with other variables in the study. In short, the KMO and Barlett's measure is a check whether data is suitable for execution of EFE. The KMO value of above 0.5 and Barlett's value of less than 0.05 indicates strong correlation between variables in the given data and that the data is suitable for performing EFE. KMO and Barlett's value in the Table 3 for the given data qualify on these criteria and hence the data is suitable for performing EFE.

In addition to these, the Cronbach's α value of 0.959 displayed in the table 3 is much higher than required level of 0.70. The Cronbach's αis a measure of internal consistency reliability that means whether all the variables under the study measure the same thing. The higher alfa value proves the reliability of the measured factors in the test.

The EFE is a data reduction method which merges factors with greater similarity in one component and therefore only few principal components are extracted from many parameters in the study. The extracted components are able to explain majority of variance in the data and they represent the significant correlation.

The table 4 shows that three major components were extracted from total 21 factors which together explain 65.98% variance in the study. This means 21 factors are categorized into three principal components and these three components can explain all relationships existing in the given data.

Table 2 :
Weighted Mean Scores of 21 Aspects of Student Satisfaction

Question	Parameter (1-5-point scale where 1 - Poor, 2 - Fair, 3 - Good, 4 - Very Good, 5 – Excellent)	Weighted Mean score
Q1	Extent to which the syllabus and course content are comprehensive	**4.55**
Q2	Extent to which teachers were prepared for classes	**4.6**
Q3	Extent to which teachers were able to communicate effectively	**4.65**
Q4	The teachers' approach to teaching	**4.58**
Q5	Fairness of the internal evaluation process by the teachers.	**4.45**
Q6	Frequency with which performance in assignments are discussed with students	**4.47**
Q7	Whether teachers explain concepts using examples & applications	**4.54**
Q8	Intensity with which teaching learning process facilitates cognitive, social, and emotional growth	**4.44**
Q9	Whether institute provides ample opportunities to grow and learn	**4.51**
Q10	Extent to which students find alignment of course content delivery with course as well as program outcomes.	**4.52**
Q11	Extent to which students believe that the course and program design will be able to enhance the employability	**4.4**
Q12	Frequency with which institute promotes internship, field visits, student exchange etc.	**4.38**
Q13	Whether the process provides enough scope for teachers to identify students' strengths and encourage them with providing right level of challenges	**4.42**
Q14	Teachers' initiatives to identify students' weaknesses and help to overcome them	**4.40**
Q15	Whether institute engages students in monitoring, reviewing, and improving the quality of teaching learning process	**4.5**
Q16	Whether institute makes efforts to inculcate functional skills and life skills to enhance employability	**4.41**
Q17	Whether teachers encourage students to participate in co-curricular and extracurricular activities.	**4.49**
Q18	Whether teachers use student centric methods to enhance learning experience.	**4.48**
Q19	Extent to which the teaching learning process facilitates the use of various ICT tools by teachers	**4.64**
Q20	Whether students are empowered enough to provide feedback about faculty, program & institute.	**4.42**
Q21	Overall quality of teaching learning process	**4.54**

Interpretation of exploratory factor analysis (EFE) results:

Table 3 :
Kmo And Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.918
Bartlett's Test of Sphericity	Approx. Chi-Square	10808.884
	df	210
	Sig.	.000
	N	593
	Cronbach's α	.959

Interpretation of Rotated Component Matrix:

The table 5 displays the rotated components matrix which shows the factor loadings for all 21 parameters. After analyzing the SPSS output of factor analysis and

tracking the values of factor loadings from the rotated component matrix, it is evident that twenty-one parameters concerning the students' satisfaction towards the institution's teaching-learning process got reduced to three factors. The grouping of these twenty-one parameters along with their factor loadings into three factors is depicted in the table 6.

The analysis in table 6 concludes that students' satisfaction towards teaching-learning process of the institute is a function of mainly three components:

1. Quality of various teaching-learning processes

2. Quality of teaching inputs provided by teachers

3. Quality of program and course design

i. Quality of various teaching-learning processes

The first component, quality of teaching learning process is a function of eleven factors as displayed in table 6. This is the most significant component among the three components as it explains maximum variance of 29.55% as depicted in table 4. Amongst these eleven factors, five factors: 1) Students' perception of overall quality of teaching learning process (loading 0.817); 2)Whether students are empowered enough to provide feedback about faculty, programme and institute (loading 0.794); 3) Whether the process provides enough scope for teachers to identify students' strengths and encourage them with providing right level of challenges (loading 0.754); 4) Whether institute provides ample opportunities to grow and learn(loading 0.701); 5) Whether institute engages students in monitoring, reviewing, and improving the quality of teaching learning process (loading 0.699) are found to be relatively more important than remaining factors.

The highest loading of 0.817 and weighted mean of 4.54 indicates extreme satisfaction of students towards overall quality of teaching learning processes. The same is justified by the data in table 2 indicating weighted mean score above 4 for all the twenty-one factors. This finding proves that the institution has done well to enhance and maintain students' satisfaction towards overall quality of teaching learning processes. The significantly higher loading of 0.794 and weighted mean score of 4.42 on institution's process of gathering students' feedback about faculty, programme and institute indicates that the institution has robust mechanism of feedback collection in place and students are completely empowered to provide very frank & honest feedback about faculty, programme, and institute.

It is inferred from significantly high rating given by students that institution has not kept the feedback collection process merely for the sake of maintaining evidence or documentation, but it really wants to know the effectiveness of teaching learning processes adopted by the institute and faculty. Similarly, higher loading of 0.754 and weighted mean score of 4.51 for institution's inclination to provide multiple opportunities to students for personal and weighted mean score of 4.42 indicates effectiveness of teaching-learning processes in terms of enabling teachers to identify students' strengths and work on them by providing right kind of challenges. The relatively higher loading of 0.701 growth and learning indicates its commitment towards holistic development of students. It was observed that institution provides financial assistance to students for participation in inter-college competitions and conferences for paper presentation. Students also get funds for doing collaborative research with faculty. Apart from these, relatively higher loading of 0.699 and weighted mean score of 4.5 was found on institution's commitment to engage students in reviewing and improving the teaching learning processes. The teaching-learning processes designed based on differential learning needs of students effectively facilitates the cognitive, social, and emotional growth of students.

The same is endorsed by the relatively higher loading of 0.659 and weighted mean of 4.44 for cognitive, social, and emotional growth of students. Similarly, as an evidence to provide superior experience to students, institute scores high on introducing site visits & internships (loading 0.646) in curriculum and use of ITC tools by teachers (loading 0.606) for enhancing the effectiveness of teaching learning process. Apart from these eight factors, remaining three factors have absolutely higher but relatively lower loading of less than 0.60. These factors are 1) Whether institute makes efforts to inculcate functional skills and life skills to enhance employability (loading 0.578) 2) Frequency with which performance in assignments are discussed with students (loading 0.562) and 3) Whether the process provides enough scope for teachers to identify students' weaknesses and help to overcome them (loading 0.517). However, institute fares well on these factors also with respective weighted mean scores of

Table 4 :
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.410	54.332	54.332	11.410	54.332	54.332	6.205	29.550	29.550
2	1.292	6.150	60.482	1.292	6.150	60.482	5.476	26.075	55.625
3	1.155	5.498	65.980	1.155	5.498	65.980	2.175	10.355	65.980
4	.978	4.658	70.638						
5	.813	3.871	74.509						
6	.758	3.610	78.119						
7	.697	3.319	81.439						
8	.582	2.773	84.212						
9	.547	2.605	86.817						
10	.420	2.002	88.819						
11	.395	1.879	90.698						
12	.375	1.784	92.482						
13	.288	1.369	93.852						
14	.260	1.237	95.089						
15	.240	1.141	96.230						
16	.208	.992	97.222						
17	.157	.746	97.969						
18	.144	.684	98.653						
19	.114	.543	99.196						
20	.103	.490	99.686						
21	.066	.314	100.000						

Extraction Method: Principal Component Analysis.

4.41, 4.47, and 4.40. Hence, these eleven factors together make the first component namely "Quality of various teaching-learning processes" and institute enjoys overall very good students' satisfaction score on this component.

ii. Quality of teaching inputs provided by the teachers

The second component, quality of teaching inputs provided by the teachers is a function of seven factors as displayed in table 6. This is the second most significant component amongst the three components as it explains maximum variance of 26.075% as depicted in table 4. From these seven factors, five factors with loading above 0.70 are more important than remaining factors. These factors are: 1) The teachers' approach to teaching (loading 0.772); 2) Extent to which teachers were able to communicate effectively (loading 0.763); 3) Fairness of the internal evaluation process by the teachers (loading 0.749) 4) Whether teachers encourage students to participate in extracurricular activities (loading 0.714) and 5) Extent to which teachers were prepared for classes (loading 0.705).

Table 5 :
Rotated Component Matrix

		Component	
	1	2	3
Extent to which the syllabus and course content are comprehensive	0.279	0.275	0.634
Extent to which teachers were prepared for classes	0.281	0.705	0.289
Extent to which teachers were able to communicate effectively	0.254	0.763	0.229
The teachers' approach to teaching	0.3	0.772	0.054
Fairness of the internal evaluation process by the teachers.	0.196	0.749	0.036
Frequency with which performance in assignments are discussed with students	0.562	0.45	0.289
Whether teachers explain concepts using examples and applications	0.185	0.576	0.402
Intensity with which teaching learning process facilitates cognitive, social, and emotional growth	0.659	0.511	0.102
Whether institute provides ample opportunities to grow and learn	0.701	0.395	0.341
Extent to which students find alignment of course content delivery with course as well as program outcomes.	0.478	0.12	0.658
Extent to which students believe that the course and program design will be able to enhance the employability	-0.078	-0.009	0.502
Frequency with which institute promotes internship, field visits, student exchange etc.	0.646	0.293	0.322
Whether the process provides enough scope for teachers to identify students' strengths and encourage them with providing right level of challenges	0.754	0.297	0.24
Whether the process provides enough scope for teachers to identify students' weaknesses and help to overcome them	0.517	0.495	0.294
Whether institute engages students in monitoring, reviewing, and improving the quality of teaching learning process	0.699	0.492	0.091
Whether institute makes efforts to inculcate functional skills and life skills to enhance employability	0.578	0.441	0.482
Whether teachers encourage students to participate in extracurricular activities.	0.542	0.714	0.085

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 5 iterations.

Table 6 :
Interpretation of Rotated Component Matrix

Sr. No.	Parameters	Factor Loadings	Extracted Factor
1.	Frequency with which performance in assignments are discussed with students	.562	Quality of various teaching-learning processes
2.	Intensity with which teaching learning process facilitates cognitive, social, and emotional growth	.659	
3.	Whether institute provides ample opportunities to grow and learn	.701	
4.	Frequency with which institute promotes internship, field visits, student exchange etc.	.646	
5.	Whether the process provides enough scope for teachers to identify students' strengths and encourage them with providing right level of challenges	.754	
6.	Whether the process provides enough scope for teachers to identify students' weaknesses and help to overcome them	.517	
7.	Whether institute engages students in monitoring, reviewing, and improving the quality of teaching learning process	.699	
8.	Whether institute makes efforts to inculcate functional skills and life skills to enhance employability	.578	
9.	Extent to which the teaching learning process facilitates the use of various ICT tools by teachers	.606	
10.	Whether students are empowered enough to provide feedback about faculty, program & institute.	.794	
11.	Overall quality of teaching learning process	.817	
12.	Extent to which teachers were prepared for classes	.705	Quality of teaching inputs provided by teachers
13.	Extent to which teachers were able to communicate effectively	.763	
14.	The teachers' approach to teaching	.772	
15.	Fairness of the internal evaluation process by the teachers.	.749	
16.	Whether teachers explain concepts using examples & applications	.576	
17.	Whether teachers encourage students to participate in co-curricular and extracurricular activities.	.714	
18.	Whether teachers use student centric methods to enhance learning experience.	.612	
19.	Extent to which the syllabus and course content are comprehensive	.634	Quality of program and course design
20.	Extent to which students find alignment of course content delivery with course as well as program outcomes.	.658	
21.	Extent to which students believe that the course and program design will be able to enhance the employability	.502	

According to students, teaching approach was regarded as one of the most important factors to determine the quality of teaching inputs provided by teachers. Teaching approach is described as whether teacher designs the session plan and carry out all the teaching learning activities in a course in a well-planned manner. It is the methodology used by teacher to engage students and facilitate the learning. The institution scores very well on this aspect with loading of 0.77 and weighted mean score of 4.58. Similarly, students rated teachers very high on their ability to communicate with weighted mean of 4.65 and loading of 0.763. This indicates that students were happy with the way teachers explained them different concepts and methodology/pedagogy adopted by them. This also means that teachers have come down to the level of students' understanding to make things easier for them to understand. Teachers were also rated high on amount of fairness maintained by them in the internal evaluation process with weighted mean of 4.45 and loading of 0.749. It was observed that fairness means whether teachers announce the assessment plan in advance, conduct the assessment with transparency and discuss the assessment with students along with

proper reasons for the assessment. In addition to these, students rated teachers relatively higher with weighted mean of 4.49 and loading of 0.714 for the encouragement they provide to students for participating in extracurricular and co-curricular activities. It was reported that many activities planned by teachers not only lead to holistic development of students but they are also designed in alignment with academics. Further teachers were rated higher by students with weighted mean of 4.6 and loading of 0.705 on degree of preparedness for class. Students reported that most of the teachers come very well prepared in the class with proper plan for every session.

Apart from these five factors, remaining two factors have absolutely higher but relatively lower loading of less than 0.70. These factors are 1) Whether teachers use student centric methods to enhance learning experience (loading 0.612) 2) Whether teachers explain concepts using examples & applications (loading 0.576). However, institute fares well on these factors also with respective weighted mean scores of 4.48 and 4.54. Hence, these seven factors together make the second component namely "Quality of teaching inputs provided by the teachers" and institute enjoys overall very good students' satisfaction score on this component.

iii. Quality of program and course design

The third component, quality of program and course design is a function of remaining three factors from total twenty-one factors as displayed in table 6. This is the least significant among the three components as it explains maximum variance of 10.35% only as depicted in table 4. From these three factors, extent to which students find alignment of course content delivery with course as well as program outcomes (weighted mean of 4.52 and loading of 0.658) was the most important factor. This is because students can experience the teaching-learning processes adopted in the class and verify whether the course delivery is in line with course and programme outcomes. Further, students also emphasized the extent to which the syllabus and course content were comprehensive and detailed (weighted mean of 4.55 and loading of 0.634). Finally, students rated the programme relatively lower compared to other factors on its ability to enhance employability (weighted mean of 4.4 and loading of 0.502). This is the learning for the institute to improve the programme and make it more industry and employment oriented by introducing more relevant site visits, industry assignments, industry guest lectures, internships etc.

5. Discussion

The results of the present study align with the findings of extant literature and clearly extend it further contributing to the area of student satisfaction in higher education institutions and more specifically in the context of engineering education. The study results assert that the quality of teaching-learning processes implemented at an engineering institution is the most significant factor which influences student satisfaction. This supports the importance of teaching quality highlighted by Wilkins & Balakrishnan (2013). Since, teaching is the factor which students get the maximum exposure to, evidently, the quality of teaching learning processes is a key determinant of student satisfaction which shapes their positive or negative opinions about the educational experience (Garclá-Aracil, 2009). Multiple factors related to teaching learning processes were rated high by the students which implies that this factor greatly affects the student satisfaction. This is supported by many researches works which assert that the student teacher relationships as well as the effectiveness of the teaching methodologies, plays a pivotal role in student satisfaction (Kuh & Hu, 2001).

The second most important category impacting student satisfaction as identified in the current study is the factors related to quality of teaching inputs provided by the teachers. Factors such as importance of teaching ability, feedback mechanisms and the instructional approach are important for shaping positive student satisfaction. This is also highlighted in the studies by Douglas (2006) and Palacio (2002). The present study suggests that institutions should focus on enhancing teacher quality through professional development programs, such as Outcome-Based Education (OBE), to improve student satisfaction. The outcomes-based education is particularly relevant in the context of engineering education as an emphasis on measurable learning outcomes is vital for aligning engineering education with industry expectations to fulfill the demands and challenges of the dynamic environment around (Belytschko et al., 1997).

Quality of program and course design was found to be the third important category of factors affecting student satisfaction. This category of factors was

identified to be less significant than the teaching processes and inputs. These results indicate an important point that students tend to evaluate the quality of their academic experience more through their direct interactions with teaching processes, than the indirect impact factors like the strategic aspects of program design. These findings contrast with certain earlier studies like Elliott & Shin (2002), who had suggested that curriculum design plays a significant role in overall student satisfaction. However, as Cheng and Tam (1997) had noted, students' perceptions of quality are often formed by their immediate experiences, which may explain why program and course design are rated comparatively lesser in this study. The particular findings of this study, assert the importance of paying more attention to the delivery of the curriculum for shaping positive student satisfaction and not just to the structural elements of course design that may not be as visible or impactful to the students.

To examine the second research objective of the study, various dimensions of quality in engineering education were explored. The study results reveal that various teaching-learning practices, such as empowering students to provide feedback or engaging them for improvement in teaching processes, may have a substantial impact on student satisfaction. This finding aligns with the research work of González-Rogado et al. (2014), who maintain that the student involvement in the learning process is crucial for improving their satisfaction with the educational experience provided in the academic institutions. In addition to this, the study recommends that the academic institution's ability to implement feedback mechanisms and effective mentoring of students, can lead to positive improvements in satisfaction levels. This is consistent with the findings of Dhawan (2022).

Moreover, the relationship between student satisfaction and teaching-learning processes was examined and confirmed in the study. Teaching methods, assessment strategies and teacher-student interactions were identified as critical factors influencing student satisfaction. These results reflect the broader theme found in the extant literature, which says that the student satisfaction is strongly linked to their positive perceptions of the quality of teaching (Wilkins & Balakrishnan, 2013; Elliott & Shin, 2002).

Finally, by identifying the key aspects of teaching-learning practices from students' perspectives, the study reveals that areas such as the approachability of faculty, the clarity of feedback, and the active engagement of students in learning process, are critical for improving student satisfaction. These aspects are neglected in many cases and hence definitely deserve more attention to increase student satisfaction. The findings of the study point out the need of increased focus on creating an interactive and supportive learning environment to foster greater student satisfaction at engineering education instituions, in line with the recommendations of researchers like Mazirah Yusoff et al. (2015).

Conclusion

The present study adds significantly to the previous understandings in the area of student satisfaction in engineering education and also provides useful practical insights on student perceptions related to teaching learning processes received by them. It highlights the point that to improve satisfaction of students in engineering education, the educational institutes should focus on the quality of various teaching learning processes and the quality of teaching inputs provided by the teachers. The study results suggest that the 'quality of program and course design' is an important factor but does not significantly affect the positive or negative student perceptions about the overall teaching learning process and their ultimate satisfaction with it. The reason could be the tendency to react to the factors which they directly experience. As the quality of program and course design is more of a strategic aspect and students do not directly participate in it, the factors shaping their satisfaction are more from their experience of the teaching learning process. It can be inferred that the program and course design impact the student satisfaction indirectly. The major contribution of the study lies in identification of critical factors impacting student satisfaction with teaching learning processes in engineering education. The study highlights the most important aspects affecting students' overall learning experience and provides practical insights on how that learning experience could be enriched through certain systematic initiatives leading to increased student satisfaction.

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