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Measuring Student Satisfaction Using Decision Tree Algorithm in Private Higher Education England

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Abstract

The primary purpose of this study was to assess student satisfaction variables and their association with overall satisfaction.
All Higher Education Institutions (HEIs), regardless of whether public or private, have rigorous processes in place to measure student satisfaction. In addition, they focus on student satisfaction with their learning and teaching and the provision of facilities and resources.

This quantitative study aimed to test a single hypothesis regarding student satisfaction variables with overall student satisfaction. The online survey was conducted using Google Forms to collect data from 2010 students studying in a large private higher education institution in England.

The data were quantitatively analysed using Statistical Package for the Social Sciences (SPSS) version 26. The hypothesis testing results found a significant positive association between all independent variables and overall satisfaction.

This study was limited to students in the private higher education sector. However, other students in public HEIs could be included to compare their satisfaction levels.

Keywords: Student Satisfaction, Decision Tree Algorithm, Private Higher Education

1 Introduction

The most straightforward understanding of a private higher education institution is that of an organisation with private ownership and funding, while a public higher education institution has state ownership and funding (Qureshi and Khawaja,2021). However, in terms of functionality, both public and private higher education institutions are equivalent, differing only in terms of ownership or funding (Duczmal, 2006).

Private higher education is rapidly growing and competing with public higher education (Qureshi and Khawaja,2021). In this challenging competitive environment, all HEIs, whether public or private, have rigorous processes to measure student satisfaction. Such a move is no astonishment considering that student satisfaction is now often used as a measure of HE institutions' performance (Jereb et al., 2018; McLeay et al., 2017) and brand image (Dam & Dam, 2021) or reputation (Gibson, 2010; Helgesen & Nesset, 2007; Parahoo et al., 2013; Sung & Yang, 2009).

Satisfaction is a global concept with many facets and is usually encountered in academic literature and daily life, yet it is interpreted in many ways. For example, patient satisfaction, Job satisfaction or Employee satisfaction, Customer satisfaction and student satisfaction are all familiar terms one frequently encounters (Qureshi et al., 2021). For example, Patient satisfaction depends on safe, effective, timely, efficient and quality, patient-centred healthcare (Prakash, 2010, Travis & Kennedy, 2014). Generally, Job satisfaction is defined as the level of contentment employees feel with their job. Many researchers agree that contentment (satisfaction) depends on pay, promotions, job security, recognition, working conditions and management. Customer satisfaction depends on meeting or exceeding customer expectations related to a product/service (Fornell et al., 1996), perception of happiness (Kotler and Keller,2016), and surpassing customers' needs and wants better than its competitors (Minta, 2018). Finally, student satisfaction is similar to customer satisfaction, as it is rooted in customer satisfaction (Qureshi et al., 2021). Student satisfaction is subjective and has been referred to as a dynamic, complex and continually changing construct, primarily because of repeated interactions (Elliott and Shin, 2002) and many influencing factors (Hanssen and Solvoll, 2015) have been examined in literature (Wong and Chapman,2022).

Student satisfaction seems to reflect a student‘s assessment of the services provided by an educational institution (Wiers-Jenssen, Stensaker and Grogaard, 2002). Similarly, Petruzellis et al. (2006) consider student satisfaction as resulting from students’ assessment of a service based on comparing their perceptions and expectations of service delivery. Both definitions have the commonality of service quality assessment; however, Petruzellis‘definition corresponds perceived expectations with the actual outcome.

Elliott and Shin's (2002) definition confirms it is a subjective evaluation:

[…] the favourability of a student’s subjective evaluation of the various outcomes and experiences associated with education. Student satisfaction is being shaped continually by repeated experiences in campus life. p.198)

The above definition of student satisfaction denotes the overall perception and experience of the educational service. Hence, this holistic perception is often explained by the multidimensionality of service attributes (Duque 2014; Mansori, Vaz, and Ismail 2014).
This definition also emphasises that students‘ service evaluations derive from several factors. We find a similar definition

> “An outcome of the expectations and experiences of the subject, study course, or study programme as a requisite element of the integrated educational environment” (Stukalina, 2012, p.92).

Indeed, to understand and appreciate the complexity of the learning experience, it is crucial to comprehend the multidimensional facets that contribute to student satisfaction. As Bianchi states, both the core (teaching and learning) and peripheral (accommodation, facilities, social life, etc.) services of a university are *“directly related to overall service quality and customer satisfaction” (2013, p.397)*.

However, some authors emphasise the purely academic aspects of student satisfaction, especially teaching-related activities (Douglas et al. 2006). Indeed, this is the most crucial aspect when dealing with the measurement of student satisfaction, which influences the overall quality perceptions of the service students to receive (Skrbinjek, Dermol,2019). For example, Aldridge and Rowley (1998) split aspects into two general categories: (1) aspects associated with teaching and learning and (2) aspects associated with the overall student experience. Initially, researchers were solely interested in the former category (Browne et al., 1998; Franklin and Knight, 1995).

However, more recently, increasing importance has been placed on the totality of the student experience (Brown and Mazzarol, 2009; Delaney, 2005; Kuh and Hu, 2001).

This paradigm shift is because teaching and learning cannot be separated from all the other services and experiences the student encounters. Moreover, knowing and understanding all the aspects influencing student satisfaction makes it a more prosperous and valuable resource for future management interventions. Therefore, some researchers have endeavoured to define student satisfaction within this context. For example, according to Parahoo et al., the following six aspects can impact student satisfaction when viewing the academic experience as a whole:

(1) University reputation,
(2) Faculty academic competence,
(3) Faculty communications,
(4) Interactions among students,
(5) Student interactions with admin and IT staff, and
(6) Service quality of electronic communications (2013, pp. 147-149).

Petruzzellis et al. (2006) identified nineteen variables which are essential to student satisfaction. These can be classified under the headings of facilities (such as lecture halls, laboratories, equipment, libraries, refectories, accommodation and internet access), students services and support (such as language courses, scholarships, examination booking, administrative services and counselling), teaching services (such as contact with teachers, tutoring, internship and placement), and student life (such as leisure and sports facilities).

For this particular study, we have included fifteen variables of satisfaction which directly or indirectly contribute to overall student satisfaction. These variables are the Admission process, *Enrolment process, Induction, Student Loan Company (SLC) Funding Experience, Timetables, Knowledge of Academic Staff, Quality of Teaching, Feedback, Assessment Grades, Friendly Admin Staff, Student Support (Academic), Learning Resources, Student Council, Events and Overall Satisfaction.*

Sweeney and Ingram (2001) define overall student satisfaction as,
"the perception of enjoyment and accomplishment in the learning environment" (p.57).

The literature acknowledges that student satisfaction is a holistic evaluation of one's 'student experience'; it is not confined to academic factors alone, such as 'teaching quality' and 'perceived faculty competence' (Parahoo et al., 2013; Xiao and Wilkins, 2015). This is best encapsulated by Alves and Raposo (2009), who argue that

> *"..the dimensions [of student satisfaction] found practically cover the whole educational product, as well as the way it is provided"* (2009, p.204).

In reality, student satisfaction' is inseparably tied to other concepts, such as the student experience, employability and service quality. Therefore, makes it even more challenging to define and conceptualise. Within this context, Qureshi et al (2021) attempted to define overall student satisfaction as:

> *student satisfaction is the short-term pleasure of the academic journey and, in the long run, the pride of securing a job primarily based on the student's academic qualification (p, 74).*

1.1 Research Aims And Objectives

This study aimed to assess the various variables of student satisfaction, including academic and non-academic, and their association with overall satisfaction.

- *To test the association between student satisfaction variables under study.*
- *To assess student satisfaction using decision tree algorithm (chi-square measurement).*

1.2 Research Questions

Q1. What are the student satisfaction variables and their association to the overall student satisfaction?

Q2. How do satisfaction variables contribute to the variances in overall student satisfaction?

1.3 Hypothesis

Ho1. *There will be no significant association between all variables under study with overall student satisfaction.*

2 Methods

Quantitative research is the process of collecting and analysing numerical data. It can be used to find patterns and averages, make predictions, causal test relationships, and generalise results to broader populations. Quantitative research's primary goal, according to Saunders et al. (2009), is to quantify data, measure the construct of each variable, compare answers, and emphasise correlation. As we are testing the single hypothesis, the quantitative research was found suitable for achieving the study's objectives and testing the single hypothesis.

2.1 Research Population Sampling And Sample Size

Creswell (2008) defines *the research population* as "the large set of people having similar characteristics". This research study's population was students studying in a large private higher education institution in England. Saunders, Lewis and Thornhill (2009) define a research sample as "the part of the research population that is broken down in a small section for the given study but which can be generalised to the total population". The research sample of this study was selected through the convenience sampling technique. As Saunders, Lewis and Thornhill (2009) define; convenience sampling is the sampling technique that helps approach the respondents within reach of a researcher. As the researchers are associated with the institutions, it was convenient for them to approach respondents easily. The selected sample was comprised of two thousand and ten (2010) students. Primary data was collected through online mode using Google forms

2.2 Data Gathering Procedure

Before distributing the questionnaires to the participants, formal approval from the College's Head Office was obtained. Then, following the Executive Principal's permission, arrangements were made with the student services department for the data collection schedule.

2.3 Data Analysis

Data analysis is the most crucial part of any research. Data analysis summarises collected data. Quantitative research was used to analyse the data using Statistical Package for the Social Sciences (SPSS) version 26. This statistical package is very user-friendly, and various statistical tests can be conducted using this software. Moreover, this statistical software undertakes both comparison and correlational statistical tests in the context of univariate, bivariate and multivariate analysis for both the parametric and non-parametric statistical techniques.

2.4 Research Ethics

The participants were assured that their information would be kept confidential and used for research purposes only. The literature was cited correctly with all proper references of work done by researchers.

3 Results And Interpretation

A quantitative analysis was conducted for 16 categorical variables, including the admission process, enrolment process, induction, SLC funding experience, timetables, knowledge of academic staff, quality of teaching, feedback (on assignments including formative), assessment (grades), friendly admin staff, student support (academic), student support (non-academic), learning resources, student council, events and overall student satisfaction. We intended to measure overall student satisfaction as a dependent variable in our study. The other variables served as independent categorical factors. SPSS version 26 was used to perform various statistical analyses, including descriptive statistics such as measures of central tendencies, percentage, frequency, and chi-square test since all variables were measured on an ordinal scale.

Our data showed a negatively skewed distribution. Although log10 transformation was tried to address the skewness, it actually made things worse, necessitating the excision of outliers. In the preliminary analysis, we removed 187 outliers from a total of 2010 responses and analysed 1823 responses.

Table 1. ***Descriptive Statistics1 (N=1823)***

Variables (Categorical)	Mean	Standard Error	Variance	SD
Admission process	4.54	0.017	0.521	0.722
Enrolment process	4.49	0.018	.569	.755
Induction	4.49	0.020	0.726	0.852
SLC Funding Experience	4.39	0.021	.817	.904
Timetables	4.41	0.021	0.776	0.881
Knowledge of Academic Staff	4.51	0.018	0.605	0.778
Quality of Teaching	4.60	0.016	0.444	0.666
Feedback	4.42	0.019	0.688	0.830
Assessment Grades	4.37	0.019	0.683	0.827
Friendly Admin Staff	4.50	0.018	0.570	0.755
Student Support (Academic)	4.44	0.020	0.712	0.844
Student Support (Non-Academic)	4.40	0.019	0.637	0.798
Learning Resources	4.44	0.020	0.734	0.857
Student Council	4.27	0.023	1.000	1.000
Events	4.26	0.024	1.019	1.010
Overall Satisfaction	4.43	0.019	0.649	0.805

SD=Standard Deviation, Median=5.00, Mode= 5.00, Minimum=1, Maximum=5, Range=4

Two variables, Student council and events, showed a higher variance and standard deviation compared to other categorical variables under study (Table1). This shows the considerable variance and that the data points are far off from the mean and one another. All categorical variables had five responses: 1- Excellent (very happy), 2- Good (happy), 3- Average (neutral), 4- Poor (unhappy), and Very Poor (very unhappy). Later, we combined the responses of each variable into three categories, 1- Excellent (very happy), 2 Average (neutral), and 3- Poor (unhappy), to facilitate further analysis.

Table 2. ***Descriptive Statistics2: Frequencies and Percentages (N=1823)***

Variables	Admission process			Enrolment process			Induction			SLC Funding Experience			Timetables		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Frequency	31	104	1688	41	108	1674	85	56	1682	97	113	1613	28	56	1739
Percentage	1.7	5.7	92.6	2.2	5.9	91.8	4.7	3.1	92.3	5.3	6.2	88.5	1.5	3.1	95.4

1- Excellent (very happy), 2 Average (neutral), 3- Poor (unhappy)

Table 3. ***Descriptive Statistics3: Frequencies and Percentages (N=1823)***

Variables	Knowledge of Academic Staff			Quality of Teaching			Feedback			Assessment Grades			Friendly Admin Staff		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Frequency	46	107	1670	28	1.5	1.5	88	87	1648	89	97	1637	38	126	1659
Percentage	2.5	5.9	91.6	56	3.1	3.1	4.8	4.8	90.4	4.9	5.3	89.8	2.1	6.9	91.0

1- Excellent (very happy), 2 Average (neutral), 3- Poor (unhappy)

Table 4. ***Descriptive Statistics4: Frequencies and Percentages (N=1823)***

Variables	Student Support (Academic)			Student Support (Non-Academic)			Learning Resources			Student Council			Events		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Frequency	67	136	1620	52	124	1647	79	72	1672	113	162	1548	110	163	1550
Percentage	3.7	7.5	88.9	2.9	6.8	90.3	4.3	3.9	91.7	6.2	8.9	84.9	6.0	8.9	85.0

1- Excellent (very happy), 2 Average (neutral), 3- Poor (unhappy)

Table 5. ***Descriptive Statistics5: Overall Satisfaction (N=1823)***

Variables	Overall Satisfaction		
	1	2	3
Frequency	51	127	1645
Percentage	2.8	7.0	90.2

1- Excellent (very happy), 2 Average (neutral), 3- Poor (unhappy)

The overall descriptive statistics indicated that students were very happy with the institution's services including admission process, enrolment process, induction, SLC funding experience, timetables, knowledge of academic staff, quality of teaching, feedback (on assignments including formative), assessment (grades), friendly admin staff, student support (academic), student support (non-academic), learning resources, student council, and events. First, however, it is necessary to examine if an association exist between these factors and students' overall satisfaction. To test this association, we used a non-parametric test of association.

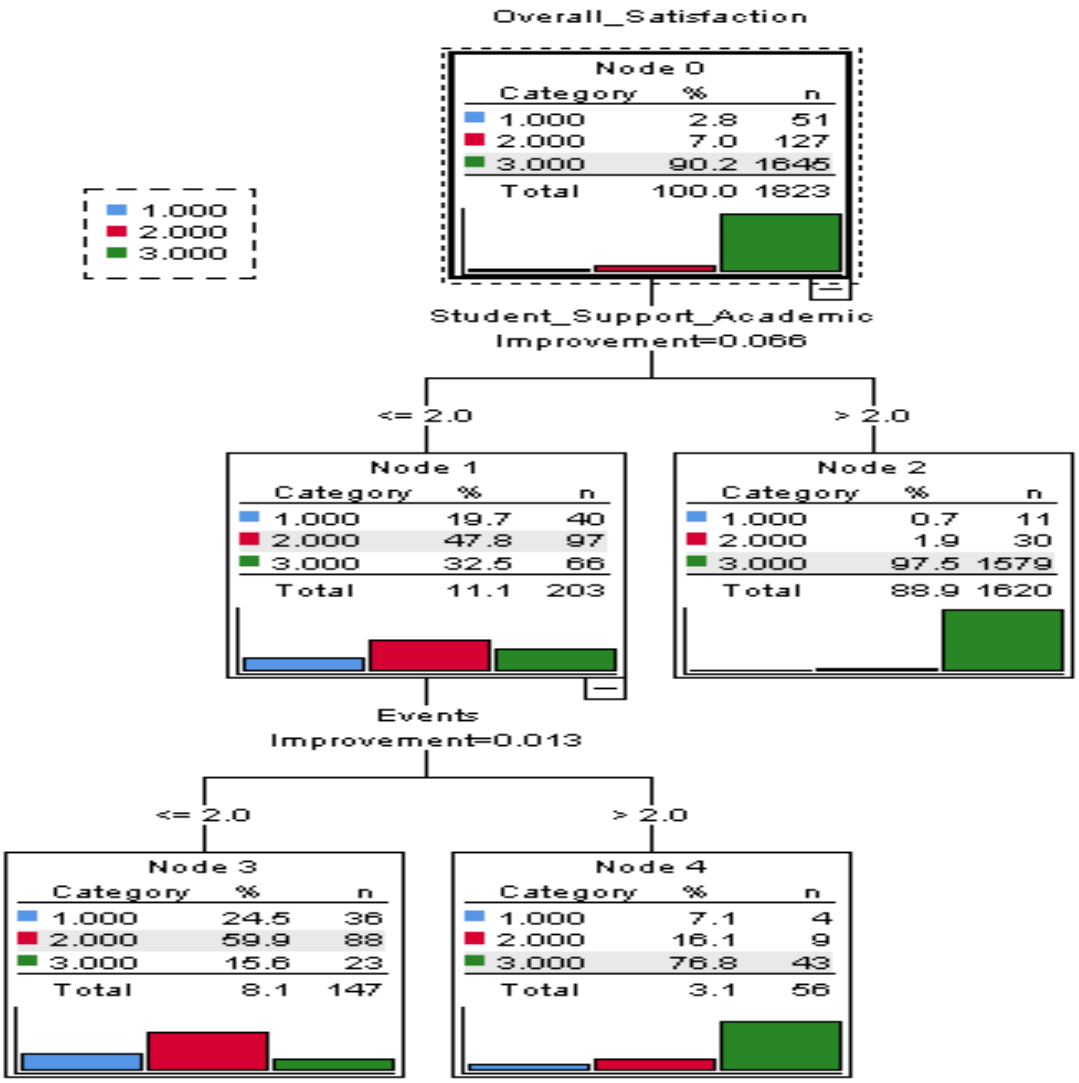
Table 6. ***Chi Square Test***

Variables (Categorical)	$\chi 2$ value (Chi Square)	Asymptotic Significance	Somer's d	Contingency Coefficient
Admission process	964.810	0.00	0.657	0.588
Enrolment process	940.732	0.00	0.653	0.583
Induction	866.825	0.00	0.666	0.568
SLC Funding Experience	728.421	0.00	0.580	0.534
Timetables	782.072	0.00	0.619	0.548
Knowledge of Academic Staff	1331.879	0.00	0.668	0.650
Quality of Teaching	614.384	0.00	0.411	0.502
Feedback	751.823	0.00	0.608	0.540
Assessment Grades	788.187	0.00	0.614	0.549
Friendly Admin Staff	1064.699	0.00	0.638	0.607
Student Support (Academic)	1151.760	0.00	0.679	0.622
Student Support (Non-Academic)	625.087	0.00	0.479	0.505
Learning Resources	800.386	0.00	0.633	0.552
Student Council	875.433	0.00	0.613	0.570
Events	895.394	0.00	0.629	0.574

The chi-square test of association indicated a moderate and positive association between all independent categorical factors and overall satisfaction. In other words, the expected and observed results were well-fitting.

The Somers' delta (Somer's d) indicates the strength of the association between each variable and overall satisfaction. In our analysis, we found Somer's d value to be more than 0.5 and significant for most variables, which shows a moderate to stronger association with overall satisfaction except the variable 'Student Support (Non-Academic)', which has low strength of association with overall satisfaction (Table 6).

The contingency coefficient will never be more than one and will only go close to one for big tables. In other words, the larger the contingency coefficient, the stronger the association between variables. Since we analysed the association test separately for each variable, the contingency value was significant in all cases indicating the two variables are dependent on each other.



For further analysis we used a tree classifier to find the best predictor for overall student satisfaction. CHAID results showed that the best predictor obtained was student support followed by events. Students who were moderately satisfied with the events and academic student support were found to be highly satisfied overall. On the other hand, those who were highly satisfied with both the events in the college and academic student support were also highly satisfied overall. The results indicate that events and student support in academics facilitate students to engage more and be highly satisfied with the college events, amenities and support services. Moreover, the CHAID model predicted 93.8% correct classification with approximately 6% risk involved.

4 Discussion

The objectives of the study were two-fold. First, to test the association between variables and to find the best predictor for student satisfaction. Our results found a significant positive association between all independent variables and overall satisfaction. This result rejects our null hypothesis '*There will be no significant association between all variables under study with overall student satisfaction*'. Secondly, we wanted to predict the overall student satisfaction in terms of other independent variables such as admission process, enrolment process, induction, SLC funding experience, quality of teaching, feedback (on assignments including formative), student support (academic), student support (non-academic), learning resources, student council, events, etc. The chi-square model of the tree classifier (CHAID method) showed that student support (academic) and events are the two best predictors for overall student satisfaction in OBC. Our prediction results support previous research, which showed a moderate positive correlation between student satisfaction and student involvement in different types of activities with a variance of 12% (Silva & Stephanie, 2006).

Institutions often need to maintain or enhance their student enrollment and retain academically successful students to survive in today's economy. Many private and public higher education institutions make an effort to better analyse student retention, increase it, and forecast college achievement (Rice & Darke, 2000). The degree to which students are content with their college experience is vital to retention and performance. As a result, colleges have started concentrating on the variables that affect student satisfaction (Noel-Levitz, 2005-06).

5 Conclusion

This study determined the students' satisfaction levels with the services of a large private College with five campuses in England. We used the descriptive research design through the survey method. The study was participated by 2010 conveniently chosen students from all campuses of the College. Results revealed that the Student Council and Events have shown the least satisfaction. Concerning events, may be the COVID-19 Pandemic did not allow the College to organise events in post COVID-19 and in the year 2022, the College only organised Halloween event and Student Christmas parties at each campus. The student council is the Nascent organisation which was recently formulated.

A student council is an elected body of student leaders whose day-to-day mandate is to represent students' interests according to the council constitution's dictates (Chemutai & Chumba, 2014).
The most favourable findings of this study indicated that students' academic support and activities conducted in the college may have the most significant impact on how satisfied and content they are with their overall learning experience. Students who are given the proper assistance and encouragement to learn, do better in academics, and effectively engage in extracurricular activities and other events to exhibit their skills will benefit both the institution and themselves. These results may aid academicians and institutions in emphasising student assistance, both academic and extracurricular, and in ensuring that every student has an equal opportunity to participate in activities that promote their personal and social development.

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