A Multinomial Logistic Regression Analysis on Service Quality in Higher Education on the Behavioural Intentions of the Students

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Abstract: *Higher Education plays a significant role in the development of a country. Higher education inculcates knowledge, employability skills and entrepreneurial qualities thereby, it eradicates poverty and inequality. In the area of higher education, the concept of what constitutes quality is still developing and keeps on emerging because the educational environment is dynamic. Service industries are playing an increasingly important role in the economy of many nations. In today's global scenario of competition, rendering quality service is a key for success. Many experts concur that the most powerful competitive trend currently shaping the services marketing is service quality. Since Education being included in the service sector, the problem and the importance of quality in education also occupies significant position. The aim of this study is to analyse the behavioral intentions of the students in recommending their institutions to the future students based on the service quality dimensions like Curriculum, Co-Curriculum, Teaching Methodology, Examination, Infrastructure, Support Services, and Administration Staff. A Multinomial logistic regression is used to analyze relationships between a non-metric dependent (categorical) variable and metric (measurable) or dichotomous (variable with two outcomes) independent variable in order to analyze the behavioral intensions of the students based on Service Quality factors.*

Keywords: Higher Education, Service Quality, Behavioural intensions, & Multinominal logistic regression

1. Introduction

The service sector has grown considerably since the 1970's and services are now playing an increasingly an important role in the economy of many nations [1]. Among the industries that are dominant in the services, Higher Education Industry plays a predominant role towards the development of a country.

Higher Education plays a significant role in the development of a country. In the area of higher education, the concept of what constitutes quality is still developing and keeps on emerging because the educational environment is dynamic. Service industries are playing an increasingly important role in the economy of many nations. In today's global scenario of competition, rendering quality service is a key for success. Many experts concur that the most powerful competitive trend currently shaping the services marketing is service quality. Since Education being included in the service sector, the problem and the importance of quality in education also occupies significant position.

2. Literature Review

Due to global competition and competitive marketing strategies, it is essential for H.Ed institutions to apply these strategies that are applied in profit making institutions [2][3]. The higher educational institutions are increasingly realizing the significance of H.Ed as a service industry and emphasized on meeting the needs and expectations of its stakeholders [4]. [5] Contented that the students are the specific and primary target audience, stressing the need for academic administrators to focus on understanding their requirements. [6] Considers that students are the primary stakeholders and their opinion plays an important role in evaluation of SERVQUAL in H.Ed. Therefore, it is vital to take the opinion of the students in analyzing the behavioral intentions of students on SERVQUAL factors. During the past three decades, service quality has become a major are of attention to service providers and researchers because of its strong impact on cost, investment, performance, profit, customer satisfaction and loyalty [7][8][9][10][11]. [12] has used SERVQUAL model to judge the quality of service in universities & how that service is related with their performance. According to [13] SERVQUAL research in H.Ed sector is relatively new, at least when compared to that of commercial sector. With significant changes taking place in H.Ed institutions over the decade it seems H.Ed should be regarded as a business like service industry, which, focuses on meeting and exceeding the needs of students [5]. Quality in Higher Learning institutions can be fulfilled under SERVQUAL dimensions based on its characteristics. SERVQUAL dimensions can be applied to all service sectors and H.Ed does not seem to be exempted from this context [14][15]. [16] Stated that the beginning stage in developing 'quality in services' is analysis and measurement. SERVQUAL is a concept that has aroused considerable interest and debate in the research literature because of the difficulties in measuring them [17]. Different authors have propounded and measured various dimensions of SERVQUAL. The constructs and the variables for the measurement vary in the context of Higher Education. The higher education is a part of pure service, which, when combined with the complex combination of the SERVQUAL factors like intangibility, heterogeneity, variability, perishability, simultaneity and heterogeneity may pose a tough challenge in evaluating SERVQUAL in education. Based on the similarities and dissimilarities the SERVQUAL

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dimensions was classified as Curriculum, Co-Curriculum, Teaching Methodology, Examination, Infrastructure, Support Services and Administration Services.

3. Data Collection and Sample Size

Data Collection and Sample Size Primary data was collected through questionnaire and 1600 samples were collected from the students of the affiliated colleges of Bharathiar University. The sample was determined scientifically [18]. The affiliated colleges were classified as Government, Aided Autonomous, Aided Non-Autonomous, Self Financing Autonomous, Self Financing Non-Autonomous, and Constituent Colleges.

A Multinomial logistic regression analysis was used to analyze the behavioral intensions of the students based on the service quality factors.

4. Analysis & Discussion

Multinomial logistic regression is used to analyze relationships between a non-metric dependent (categorical) variable and metric (measurable) or dichotomous (variable with two outcomes) independent variables. Here, MLRA is used to find out the whether the students recommend future students in the same institutions they are studying now. The response to this question was framed as No, Probably and Yes. 29.5% of the students said 'No' and 17.9% of the students said 'Probably' and 52.6% of the students said 'Yes'. The MLRA attempts to find the probability of predicting the students to recommend the institutions for 'Probably' and 'Yes'. That is, the objective is to predict how likely the odds (chances) of the students recommend the institutions (Yes) or how likely the students say 'probably' against 'No'. The model is constructed based on a set of independent variables, to predict the outcome of the variable for "Probably" and "Yes". For this, the variable, 'I would recommend future students to join in my present institution' is chosen as the dependent variable with options as 0-No, 1 – Probably and 2-Yes'. Various statistical measures are introduced in this analysis to understand the study better. Since the dependent variable is a categorical variable (which takes up the form of two or more alternatives), which cannot be directly used as in Multiple Regression analysis, the relationship between the dependent categorical variable and set of independent variables are tested by log likelihood values. The model initially starts with the no independent variables and the log likelihood value is estimated and then the log likelihood value is found out after inclusion of all the independent variables in the model. Overall fit of the model is assessed by the reduction in log likelihood values from the initial estimate. The difference in the likelihood values follows a chi-square distribution, and is referred to as the model chi-square. A significant chi square value (p value less than or equal to 0.05) indicates presence of relationship between the dependent variable and the set of independent variables.

The personal variables, Institutional variables and the SERVQUAL variables were included in the analysis since they are likely to affect the outcome of the dependent variables. However, all these variables will not be included in the final model since Stepwise (Forward) method is used in this study. This procedure allows the variables, which significantly contribute to effect of outcome of dependent variable, and the variables, which indicate presence of the multicollinearity or do not contribute to the dependent variable, are removed and finally a reduced set variable which contribute towards the outcome dependent variable is given.

4.1 Model Fitting Information

The following table shows the overall effectiveness of the model.

Table 1: Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Test		
	-2Log Likelihood	Chi square	Df	Sig.
Intercept	3085.423			
Final	2488.153	597.27	30	0.05

As discussed, the presence of a relationship between the dependent variable and the set of independent variables is based on the statistical significance of the final model chi-square value and in this study, the probability of the model chi-square value is 597.270 and respective p-value is less than 0.05. This shows that there exists a relationship between the independent variables and the dependent variable. The goodness of fit of the model is assessed by the correlation measures which estimate the strength of the relationship which are called pseudo R square measures, (such as Cox and Snell, Nagelkerke's and Mc Fadden R²). The following table shows these correlations. However, these measures do not really tell us much about the accuracy or errors associated with the model.

Table 2: Pseudo R-Square

Pseudo R-Square	
Cox and Snell	.323
Nagelkerke	.372
McFadden	.194

The R square values show that there are moderate correlations between the dependent and independent variables. Instead of assessing the strength of relationship between the dependent and independent variables it will be more useful to assess classification accuracy of the model, which compares predicted group membership based on the logistic model to the actual, known group membership, which is the value for the dependent variable. That is the model equation was used to fit the data to see how successfully the model predicts the data into its own classification ('No', 'Probably' and 'Yes')

The classification table shows that overall; the model has predicted 61.8% of the cases correctly into their respective groups. Group wise, 47.1 % of the cases were correctly predicted into 'No' group and 22.5% and 83.5% of the cases were correctly predicted into their respective groups namely 'Probably' and 'Yes'.

Table 3: Classification Table

Observed	Predicted			
	No	Probably	Yes	Percent Correct
No	213	42	197	47.10%
Probably	90	62	123	22.50%
Yes	101	32	673	83.50%
Overall Percentage	26.40%	8.90%	64.80%	61.80%

The maximum likelihood method was used to calculate multinomial logistic regression coefficients. The regression table gives the signficance of the regression coefficients (logits), which when converted into odds, are the values given as Exp (B), (also called as Odds). The stepwise-logistic regression was performed hence the variables which were not significantly contributing or the variables which were correlated with other variables (multicollinearity) were removed from the model . Finally a set of reduced variables were included in the model. The Wald test (column marked as Wald) evaluates whether or not the independent variable is statistically significant in differentiating between the two groups in each of the embedded binary logistic comparisons. The results are discussed for each category of outcome of dependent variable separately keeping the outcome 'No' as reference category. That is, in the analysis, two comparisons will be made: One is 'Probably' will be compared to the 'No' group. The other one is 'Yes' will be compared to the 'No' group. In both the comparisons 'No' will be the reference category. The logistic regression results are given below.

Table 4: Variables in the Equation

I would recommend future students to join in my present institution			B	Std. Error	Wald	df	Sig.	Exp(B)
Probably	Intercept		8.752	5.465	2.565	1	Ns	
	Location of residence	Cosmo	1.291	.336	14.724	1	**	3.636
		Metro	.235	.340	.480	1	Ns	1.265
		Urban	.900	.232	15.013	1	**	2.460
		Rural	Reference category					
	college accredited with NAAC status	Yes	-.143	.227	.399	1	Ns	.867
		No	Reference category					
	Age		.180	.059	9.320	1	**	1.197
	Percentage of marks obtained until previous semester		.410	.106	14.957	1	**	1.507
	Lecturers/Academic staff –Perceived		-.017	.008	4.963	1	*	.983
	Infrastructure-Perceived		.005	.013	.161	1	Ns	1.005
	Support services-Perceived		.067	.016	16.502	1	**	1.069
	Office/administrative staff-Perceived		.017	.014	1.478	1	Ns	1.017
	Curriculum-expected		-.136	.035	15.186	1	**	.873
	Co-curriculum and extra curriculum-expected		.117	.102	1.320	1	Ns	1.124
	Lecturers/Academic staff –Expected		.114	.050	5.146	1	*	1.120
	Examination-Expected		-.224	.088	6.547	1	*	.799
	Support services-expected		-.182	.047	15.340	1	**	.833
Yes	Intercept		4.029	4.369	.850	1	Ns	
	Location of residence	Cosmo	.223	.284	.618	1	Ns	1.250
		Metro	-.556	.260	4.569	1	*	.573
		Urban	-.190	.167	1.302	1	Ns	.827
		Rural	Reference category					
	college accredited with NAAC status	Yes	.717	.189	14.425	1	*	2.049
		No	Reference category					
	Age		.124	.048	6.631	1	**	1.132
	Percentage of marks obtained until previous semester		.008	.079	.011	1	Ns	1.009
	Lecturers/Academic staff-Perceived		.028	.006	20.409	1	**	1.029
	Infrastructure-Perceived		.029	.011	6.540	1	**	1.029
	Support services-Perceived		.028	.013	4.513	1	*	1.029
	Office/Administrative staff-Perceived		.074	.011	46.229	1	**	1.077
	Curriculum-expected		-.002	.030	.004	1	Ns	.998
	Co-curriculum and extra curriculum-expected		-.165	.075	4.818	1	*	.848
	Lecturers/Academic staff –Expected		-.079	.041	3.774	1	*	.924
	Examination-Expected		.189	.083	5.155	1	*	1.208
	Support services-expected		-.109	.041	7.200	1	**	.897

(** - Sig. at 1% level * - Sig. at 5% level)

Among the 22 independent variables introduced in the logistic regression equation, finally only twelve variables were included in the equation. The column marked 'B' refers to the logistic regression coefficient of the respective independent variable. Standard Error value is to test the significance of the regression coefficients (called logits). In the third column Wald Satistic is given, which is used to test whether the effect of independent variables significantly influence the dependent variable. Next column gives the significant result of the Wald statistic. The column named Exp(b), is the exponential value of the regression coefficient

B, called Odds, interpreted as the effect of independent variable on the Odds Ratio.

4.2 Results for Probably vs No:

From the table 4, it can be interpreted as, in the case of the variable, Location, the odds of (meaning chances of) choosing 'Probably' to 'No' by about 3.636 times for the Cosmopolitan students compared to Rural students. Similarly Metropolitan students are 1.275 timely likely to say 'Probably' compared to rural students. In the case of Urban students, they are 2.46 times more likely to choose 'Probably' when compared to Rural students.

Regarding college accredited with NAAC status, two groups are defined. One is with NAAC status ('Yes') and other without NAAC status ('No'). The 'No' group was kept as reference category. The regression result shows that, those who study in NAAC accredited college are less likely to choose 'Probably' compared to those who are in the 'No' group by about to .867 times. In other words the odds are that those who study in NAAC accredited colleges choosing 'Probably' will decrease by 13.3% (0.867-1.00=.133*100=13.3%) to that of 'No' group.

Age is considered as a metric variable in this study and it indicates that, as age increase by 1 on average, then the odds of choosing 'Probably' will correspondingly increase by 1.197 times.

In the same way the other variables are defined. Percentage of marks show that as marks increase then for every unit increase in marks, the chances of choosing 'Probably' will increase by 1.507 times compared to students belonging to 'No' group.

Among the perceived scores, namely, Lecturers/academic staff, indicates that as the perception regarding Lecturers/academic staff increases the odds of choosing 'Probably' will decrease by 0.983 times (i.e, by 1.7%). All other perceived scores, that is, Infrastructure, Support services, office/administrative staff show that compared to 'No' group the 'Probably' group odds will not increase no more than 1 time approximately. That is, both the 'No' group and 'Probably' groups have equal odds of being selected, as the scores of these variables increase. As far as Expected scores are concerned Co-curriculum and extra curriculum scores-expected will increase the odds by 1.124 and 1.12 times respectively, of choosing 'Probably' than 'No' as the scores increase. The expected scores of Examination and Support services decrease the odds of choosing 'Probably' by approximately 20%.

The Wald statistics and their corresponding significant levels show that, among location categories, Cosmopolitan and Urban have significant effect on the outcome 'Probably'. Similarly Age, percentage of marks obtained also have significant effect on the outcome at 1% level. Among the perceived scores, Lecturers/Academic staff and Support services influence the 'Probably' outcome at 5% and 1% level respectively. The excepted scores of Curriculum, Examination and Support services decrease the outcome of 'Probably' significantly at either 1% level or at 5% level. Only the expected scores of Lecturers/Academic Staff increase the odds of choosing 'Probably' significantly at 1% level.

4.3 Results for 'Yes' vs. 'No'

The interpretation of the results of outcome 'Yes' is similar to 'Probably' discussed above. However, the results vary compared to 'Probably' group. Location wise, Metropolitan was the only significant group, which influences the outcome 'Yes'. That is, compared to rural students, Metropolitan students choosing 'Yes' decreases the odds by 0.573 times, that are, by 42.7% and are found to be significant at 5% level.

The other types of residence, namely, Cosmopolitan increases the odds by 1.25 times and Urban decrease the odds by 0.827 times, however they were not found to have significant effect on the outcome 'Yes'.

Those who are accredited with NAAC status are more likely to choose 'Yes' (Yes, I would recommend) by 2.46 times than those who study in colleges not accredited with NAAC status. The results are significant at 1% level.

Age is another important factor, which is found to significantly influence the outcome positively. As the age increases, the odds of choosing 'Yes' would increase by 1.132 times which is significant at 1% level.

Percentage of marks does significantly increase the odds of 'Yes' compared to 'No' group. The perception scores, namely, Lecturers/Academic staff, Infrastructure, Support services and Office/Administrative staff increase the chances of the outcome (Yes) significantly at either 5% or 1% level.

However, among Expectation scores, except the factor Examination, all other factors namely, Curriculum, Co-curriculum and extra-curriculum, Lecturers/Academic staff and Support services decrease the odds of choosing 'Yes' when scores of these variables increase. The unit increase in the Examination-Expected score will increase the odds of the outcome by 1.208 times which is found to be significant at 1% level.

5. Findings and Recommendations

NAAC accredited institutions students are likely to recommend their colleges to the future students compared to the Non-NAAC accredited institutions. Teaching methodology, Infrastructure, Support Services and Administration staff perception influences more in recommending the Institutions to the future students. Older students recommend the Institutions than the younger students. Teaching methodology and Support services might influence the students in probably recommending their institutions to the future students. Therefore, among the perception scores the Institution need to focus on the Teaching methodology, Infrastructure, Support services and Administration need to be paid more attention in order to attract the prospect customers in the future. The NAAC

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accredited institutions attract more customers compared to the Non-accredited institutions.

6. Conclusion

The student's perceptions on service quality in higher education are one of the most imperative concerns for the higher education institutions. The multinominal logistic regression thus analysed the relationship between the categorical and measurable independent variables and concluded that the service quality factors like Teaching methodology, Infrastructure, Support services and Administrative staff influence more on the behavioral intension of the students.

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