A DISCRIMINANT FUNCTION ANALYSIS ON SERVICE QUALITY IN HIGHER EDUCATION

(A CASE STUDY OF ISO RECOGNIZED INSTITUTION VS. NON ISO RECOGNIZED INSTITUTION)

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ABSTRACT

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 Abdullah,2006a). Among the industries that are dominant in the services, Higher Education Industry plays a predominant role towards 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. These components must be regularly measured with the responding changes of environment. The outcomes of the measurement will be very useful for the administrators as well as for the academicians to provide plans and solutions for the continuous improvements so that the service offered by the institutions will be significant to the students.

This study describes the perception of customers across different disciplines of arts, science, commerce and management into one activity. This study aids to synthesize the broad perspectives, knowledge, skills, interconnections and epistemology in an educational setting. The aim of this study is to identify the SERVQUAL factors that significantly discriminate the ISO recognized Institution students from the Non- ISO recognized institution student's perception of Service Quality.

Keywords : Service Quality, Higher Education, Discriminant Function Analysis, and ISO recognized Institution.

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1. Introduction

Education is one of the strategic drivers of economic growth. Higher Education is the rapid emerging service industry in the world, which, needs appropriate methods and strategies to meet the needs of the customers in order to retain the existing customers as well as to attract the prospects customers. Every educational institution needs to understand its internal strength & weakness as well as external opportunities & threats. Most of the studies consider delivering service quality as an essential strategy for success and survival of any organization. Recent research emphasizes on the construct of service quality measurement in order to identify the gap between the perceptions and expectations of the primary service recipients. However, there is still no consensus on how best to measure and manage quality within higher education institutions. The aim of this study is to identify the SERVQUAL factors that significantly discriminate the ISO recognized Institution students from the Non- ISO recognized institution student's perception of Service Quality.

II. Literature Review

Kotler (1985) defines service as any act or presentation that one party can offer to another that is fundamentally intangible and does not transfer ownership. Its production may or may not be clenched to a physical product. The general difficulty in defining and measuring services is generally due to its unique characteristics (Parasuraman, Zeithaml, & Berry, 1988). Higher education is thus viewed as service industry though in recent years it has also been viewed as business industry. Higher Education as a business is dangerous, because the service providers would not concentrate on learning; instead, they will focus on results measured by standardized exams. This consequently will result in overlooking of Quality in H.Ed. It is also significant to note that like any other industry, H.Ed institutions also have different stakeholders with different interests and agendas.

Identifying the stakeholders involved in H.Ed Institutions is an essential phase for determining competitive advantage for educational institutions as well as identifying needs of the customers. Meeting the needs of these individuals or groups is an important competitive factor for higher education institutions (Dobni & Luffman, 2003). Weaver (1976) identified four parties as potential customers, viz., the government- its administrators, teachers/academicians, learners-their families, employers and society as a whole. The prospective consumers in Higher Education are students and secondary customers are alumni, parents, employers, employee,

government, industry and society (Owila&Aspinwall, 1996). Rowley (1997) advises that the attempt to measure quality in general terms should take into account all stakeholders perspectives, which include students, parents, staff, employers, business and legislators.

It is common for many organizations to have a number of stakeholders with different opinions, interests and attitudes towards the organization. This is no difference in the context of H.Ed, where a number of stakeholders exist, all experiencing the institutions in different ways. Therefore, it is essential to identify the primary stakeholder in an organization to identify his/theirs appropriate perception towards the SERVQUAL in H.Ed.

Mazur (1996) also believed that instructors do not view students as customers, rather as raw materials being developed into a product for the ultimate customers- industry and society. Reavill (1998) outlined a product/process model where education of undergraduates is a process that produces a product: graduates. This model suggested that the customers of higher education are the future employers of the students.

An alternative is the service/process model that assumes education is a service and the students are customers who wish to improve their level of education. Reavill rejected both models as too simplistic and suggested that a more robust and comprehensive model was needed and should be identified by asking who pays for and benefits from education. During the past decades the world has witnessed drastic changes, which has been reflected in policy, governance, structure and status of higher education. The survival of fittest has been no exemption to H.Ed with the prevalence of privatization, liberalization and globalization.

The three categories are seen as the main stakeholders of H.Ed and as the main clients, with the students being the primary ones (Chapleo, 2004; Voss, Gruber & Szmigin, 2007; Kantonen, 2007).

This illustrates the significance of SERVQUAL in the context of H.Ed. The authors have demonstrated a similar view that SERVQUAL is meeting and exceeding student's needs. In today's environment H.Ed need to be more efficient in fulfilling the expectations of its stakeholders, whose demands are continuously increasing. Therefore, it is necessary to understand student's expectations and perceptions in SERVQUAL of H.Ed. This needs to be substantiated with appropriate dimensions, which should be applied to measure quality in H.Ed. Based on the similarities and differences, the study has formulated seven constructs towards the dimensions of SERVQUAL – Curriculum, Co-Curriculum, Examination, Teaching

Methodology, Support Services, Infrastructure and Administrative Staff.

III. Research Methods

Primary data was collected from the students of the affiliated colleges of Bharathiar University for the study purpose. Scientifically designed & structured questionnaire will be administered to the service recipient for the collection of data. The Questionnaire consists of Part A and Part B. Part A consists of questions pertaining to respondent's personal and institutional factors. Part B consists of questions related to different aspects of services offered by the college. These items were measured on a five point likert scale that varied from 1=Strongly Disagree to 5 = Strongly Agree. The sample size was determined scientifically as 1600, which was collected from the students as the primary stakeholders in Higher Education. A Discriminant functional analysis was used to differentiate the perception of students in ISO recognized Institution and Non-ISO recognized Institution.

IV. Results and Discussion

How do the students studying in ISO recognized institutions differ from those students who are studying in non-ISO institutions in terms of service quality factors derived at earlier sections and also in their personal variables like age, gender education and income. Based on this classification of students, it was decided to study, what are all the factors, either service quality perceived or service quality expected or both, and the personal variables which differentiate between these students, which will help the researcher to identify the variables which maximum discriminate between ISO and non_ISO institutions.. Do service quality factors like Examination, Infrastructure, support services or other personal factors significantly exist between these two groups? In general, what are all the variables, which significantly discriminate the students of one group (ISO) from other group (Non-ISO)?. Discriminant Function Analysis was attempted to answer these questions in 3 stages namely: 1. Construction of Discriminant Function,2.Classification and Interpretation.

4.1. Construction of Discriminant Function

Discriminant Function Analysis attempts to construct a function with these and other variables so that the students belonging to either of these two groups are differentiated at the maximum. The linear combination of the variables is known as Discriminant Function and its parameters are called Discriminant Function coefficients.

A typical Discriminant Function will be of the form,

$Z = a_0+a_1X_1+a_2X_2+.....+a_nX_n$

where, a_0 - constant

$a_1,a_2,.....a_n$ - Discriminant Function coefficients of the independent variables $X_1,X_2,.....X_n$,respectively.

Since the objective is to determine the variables , which discriminate most efficiently between ISO certified institutions and non-ISO institutions, Stepwise approach was used. The following variables were included the model:

Curriculum-perceived score,Co-curriculam & extra curricular aspects-perceived score, teaching methodologies-perceived score, Examination-perceived score, Infrastructure-perceived score, Support services-perceived score, Office/administrative staff-perceived score, Curriculum-expected score, Co-curriculum & extra curricular aspects-expected score, Lecturers/academic staff/teaching methodologies-expected score, Examination-expected score, Infrastructure-expected score, Support services-expected score, Office/administrative staff-expected score Gender, Age, Degree, Does your college accredited with NAAC status?, Level of Study, Percentage of marks obtained until previous semester.

4.2.Variable Selection Method:

In constructing the function all variables , which contribute to differentiate these two groups maximally, are examined. Among the several methods available for selection of variables, 'Mahalanobis Minimum D Squared' method, was employed for this study. The Mahalanobis procedure is based on the generalised squared Euclidean distance that adjusts for unequal variances in the variables. The major advantage of this procedure is that it is computed in the original space of the predictor (independent) variables rather than as a collapsed version, which is used in other methods. In general 'Mahalanobis Minimum D Squared ' is the preferred procedure since the researcher is interested in the maximum use of available information.

Stepwise Selection**:** In the process of constructing Discriminant Function, after deciding about Mahalanobis Min. D Squared' method, the type of computation is also to be decided. One is Simultaneous Method and the other one is Stepwise Method. The Simultaneous Method involves computing the Discriminant Function so that all the Independent variables are considered concurrently regardless of the discriminating power of each independent variable. The Stepwise Method is an alternative to the above-discussed

method. In involves entering the independent variables in the Discriminant Function one at a time on the basis of their discriminating power. The stepwise approach begins by choosing the single best discriminating variable. The initial variable is then paired with each of the other independent variables one at a time, and a second variable is chosen. The second variable is the one that is best able to improve the discriminating power of the Function in combination with the first variable. The third and any subsequent variables are selected in a similar manner.

As additional variables are included, some already selected variables may be removed if the information they contain about group differences is available in some combination of the other already included variables (Multicollinearity). Eventually either all independent variables will have been included in the function or the excluded variables will have been judged as not contributing significantly to further discrimination. By sequentially selecting the next best discriminating variable at each step, variables that are not useful in discriminating between the groups are eliminated and a reduced set of variables is identified. The reduced set typically is almost as good as, and sometimes better than, the complete set of variables.

The results of the discriminate function analysis are given in table 1 with the values of discriminant function coefficients for each of the discriminating variable.

Table 1. Canonical Discriminant Function Coefficients

	Function
Lecturers/academic staff/teaching methodologies-perceived score	.011
Examination-perceived score	.043
Infrastructure-perceived score	-.063
Support services-perceived score	-.036
Office/administrative staff-perceived score	.018
Co-curriculum & extra curricular aspects-expected score	-.210
Lecturers/academic staff/teaching methodologies-expected score	.056
Examination-expected score	-.505
Infrastructure-expected score	.108
Gender	.668
Age	.252

Degree	-.681
Does your college accredited with NAAC status?	1.759
Percentage of marks obtained until previous semester	-.407
(Constant)	17.325

It could be seen from Table that out of 20 variables selected for the analysis, stepwise approach included only 14 variables in the model. The others were either deemed to have not contributed in differentiating between the two groups or would have correlations with the already selected items. Using the values given in table 1 the Discriminant Function (Z) for the problem under study can be written as,

Using the values given in table 1 the Discriminant Function (Z) for the problem under study can be written as,

Z= 17.325+0.011X1+0.043X2 -0.063X3 -0.036X4+0.018X5 -0.210X6+0.056X7 -0.505X8+0.108X9+ 0.668X10+ 0.252X11 -0.681X12+ 1.759X13 -0.407X14-----(A)

Where,

X1=LECTURERS/ACADEMIC STAFF/TEACHING METHODOLOGIES-PERCEIVED SCORE

X2=EXAMINATION-PERCEIVED SCORE

X3=INFRASTRUCTURE-PERCEIVED SCORE

X4=SUPPORT SERVICES-PERCEIVED SCORE

X5=OFFICE/ADMINISTRATIVE STAFF-PERCEIVED SCORE

X6=CO-CURRICULAM & EXTRA CURRICULAR ASPECTS-EXPECTED SCORE

X7=LECTURERS/ACADEMIC STAFF/TEACHING METHODOLOGIES-EXPECTED SCORE

X8=EXAMINATION-EXPECTED SCORE

X9=INFRASTRUCTURE-EXPECTED SCORE

X10=Gender

X11=Age

X12=Degree

X13=Does your college accredited with NAAC status?

X14=Percentage of marks obtained until previous semester

Table 2 provides the multivariate aspect of the model given under the heading 'Canonical Discriminant Function'. Note that Discriminant Function is significant at 1% level (Wilks lambda and chi-square test values given in the table indicate that the model is significant at 1% level) and displays a correlation of 0.666, which explains that there is good level of correlation between the grouping variable and the independent variables.

Table 2. Canonical discriminant function

Canonical Correlation	Wilks' Lambda	Chi-square	df	Sig.
0.666	.556	893.774	14	**

4.3. CLASSIFICATION

Once the Discriminant Function is arrived at, then the efficiency of the function as to, how accurately it predicts the students in to the respective groups must be assessed. For this a classification matrix is to be developed using actual and 'predicted' group membership of the students. Before a Classification Matrix can be considered, several things must be decided beforehand. First, the group centroids (means), second cutting score and third a prior probabilities of each group.

Group Centroids:

Using the Discriminant Function given in (A) the discriminant score for each student is calculated by substituting the values for discriminating variables from the analysis data. Then mean scores for ISO certified group (Z_o) and Non-ISO group (Z_1) are calculated, which are called Group Centroids are given Table 3.

Table 3. canonical discriminant functions evaluated at group means

Student group	Function
Colleges with ISO	-.508
Colleges without ISO	1.568

Table 4. Prior Probabilities for Groups

Student group	Prior	No.
Colleges with ISO	.755	1158
Colleges without ISO	.245	375
Total	1.000	1533

Cutting Score:

Using the sample sizes and centroids for these two groups Cutting Score is calculated as follows:

$$Z_c = \frac{N_0Z_0+N_1Z_1}{N_0+N_1}$$

where, Z_c = Cutting Score

Z_0 = Centroid for ISO certified Institution group

Z_1 = Centroid for Non-ISO institution group

N_0 = Sample size of ISO certified Institution group

N_1= Sample size of Non-ISO Institution group

Hence substituting the respective values the cutting score is

$$Z_c= [\ 1158*(-0.508)+ 375*(1.568]/(1158+375)=0.00$$

Against this Cutting Score each student's discriminant score is examined. If his score is less than Z_c value, then he is classified in ISO certified institution group, otherwise in Non-ISO institution group.

Prior Probabilities:

Prior probabilities are calculated for each group based on the proportionate size of the sample in the respective groups. Using these prior probabilities, centroids and cutting score the Classification Matrix is formed. Table 5 is the Classification Matrix giving how many of the students were correctly classified into the respective groups and the overall correct classification percentage. Thus it is seen that the discriminant function has predicted 93.7% of the students correctly in the ISO certified institution group and 64.8% of the students in the ISO not certified institutions group and on the whole classified 86.6% of the students correctly.

Table 5. Classification Results

			Predicted Group Membership		
		Type of institution	ISO certified	ISO not certified	Total
Original	No.	ISO certified	1085	73	1158
		ISO not certified	132	243	375
	%	ISO certified	93.7	6.3	100.0
		ISO not certified	35.2	64.8	100.0

86.6% of original grouped cases correctly classified.

Table 6. Structure Matrix

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions Variables ordered by absolute size of correlation within function.

	Function	R^2%
Examination-expected score	-.405	16.40
Infrastructure-perceived score	-.366	13.40
Does your college accredited with NAAC status?	.297	8.82
Percentage of marks obtained until previous semester	-.269	7.24
Co-curriculum & extra curricular aspects-expected score	-.256	6.55
Infrastructure-expected score	-.214	4.58
Support services-perceived score	-.213	4.54
Age	.146	2.13
Gender	.126	1.59
Degree	-.111	1.23

Lecturers/academic staff/teaching methodologies-perceived score	.061	0.37
Examination-perceived score	.046	0.21
Lecturers/academic staff/teaching methodologies-expected score	.008	0.01
Office/administrative staff-perceived score	.003	0.00

Once the Discriminant Function and its classification efficiency are assessed, then the next question remains to be answered is: how efficient are the discriminating variables in the Discriminant Function? This cannot be answered directly. However, the discriminating power or the contribution of each variable to the function can sufficiently answer the question. That is, by examining the Discriminant Function to determine the relative importance of each discriminating variable in the D.F between the two groups. Table 6 gives the structural correlations , which measure the simple linear correlations between each independent variable and the Discriminant Function. The R^2% gives the percent contribution of each variable to Discriminant Function. By looking at the structure matrix it is seen that the variable **'EXAMINATION-EXPECTED SCORE'** is the maximum discriminating variable (R^2%=16.40%) between ISO certified and ISO not certified institutions, followed by '**INFRASTRUCTURE-PERCEIVED SCORE** (13.40%)' then **'College accredited with NAAC Status'** (8.82%) and '**Percentage of marks obtained till previous semester'** (6.55%) in that order. Other variables, namely, 'Co-curriculum& Extra curricular aspects-Expected' and 'Infrastructure-Expected' contribute less than 5 % in discriminating between ISO Certified Institutions and ISO not certified Institutions .

V. Conclusion

Higher Education is one of the strategic drivers in the economic growth and development of a country. This service industry requires appropriate methods and strategies in order to meet the needs and ends of its customer in order to retain the existing as well as to attract the prospects. This study has resulted that 86.6% of the groups were classified correctly. Thus it implied that the sample has demonstrated an appropriate discriminant functional analysis on the ISO certified and Non-ISO certified Institution students.

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