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UNDERSTANDING THE USE OF DATA ANALYSIS TOOLS FOR THE ASSESSMENT OF LIS SERVICE QUALITY: LIS SERVQUAL+, SPCM AND DISCONFIRMATION OF EXPECTATION'S THEORY

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Abstract

Evaluating service quality and user satisfaction are very important concepts that the LIS practitioners must know to the assessment of their services delivered and hence the level of user's satisfaction. For doing so, the study presents three LIS SQ&S tools – LIS SERVQUAL+, SPCM and Disconfirmation of Expectation's Theory with appropriate guidelines to use them. The main purpose is to explain how to use these tools based on raw data. Primary data were gathered from an earlier relevant study. To experiment the tools the questionnaire items were partially (16 items) selected from 4-dimensions (caring, competence, resources, and library as a place) of LIS SERVQUAL+ with respondents' fake opinion scores on three column formats. The study provides a corrective measure of service performance and the level of user satisfaction. It also demonstrates how each of these models can be applied step-by-step in the context of assessing library service quality and user satisfaction.

Keywords

SQ&S measurement tools, LIS SERVQUAL+, SPCM, Disconfirmation of Expectation's Theory.

INTRODUCTION AND BACKGROUND

Retaining and growing the user base and focusing more energy on meeting the users' expectations is the only way for academic libraries to survive in this volatile competitive environment (Cullen, 2001). The understanding of users' expectations and meeting those expectations is the only way for libraries to retain their users. Assessment of library service quality helps in identifying users' needs, wants and decreasing the gap between users' perceptions and expectations. It also provides users' feedback in order to improve the quality of library services. Hence, a thorough

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understanding of user expectations is the critical foundation on which perceived high quality service must rest (Hossain and Ahmed, 2014a).

Whenever we take any decision in our day-to-day life is by thinking about what happened last time or what will happen by choosing that particular decision. This is nothing but data analysis. Data analysis is defined as a process of cleaning, transforming, and modeling data to discover useful information for business decision-making. It relies on methods and techniques to taking raw data, mining for insights that are relevant to the business's primary goals, and drilling down into this information to transform metrics, facts, and figures into initiatives for improvement (Durcevic, 2020). The key purpose of data analysis is to extract useful information from data and taking the decision based upon the data analysis. There are various methods for data analysis, largely based on two core areas: quantitative data analysis methods and data analysis methods in qualitative research. This study is an initiative to practically explore about data analysis methods in quantitative research.

LITERATURE REVIEW

Available literature provides numerous service quality evaluation methodologies. Some of these methodologies came as a result of the realization of conceptual models produced to understand the evaluation process (Parasuraman *et al*., 1985), while others came from empirical analysis and experimentation on different retailing sectors (Cronin and Taylor, 1992; Parasuraman *et al*., 1988). the service quality was evaluated by Schvaneveldt *et al*. (1991) from two perspectives. The first is 'objective' that involves the presence or absence of a particular quality dimension, and the second is 'subjective' that involves the users' resulting sense of satisfaction or dissatisfaction. In 1992 Cronin and Taylor proposed a method called SERVPERF, which is focused on customers' perceptions only. Parasuraman, Berry and Zeithaml was first attempted to compare and classify different methods in 1991. They accordingly developed the most famous service quality measurement tool 'SERVQUAL' (Parasuraman *et al*., 1994b, 1993, 1991). In this model, service quality is evaluated by calculating the difference (gap) between what the customers expect and what they really perceive (Franceschini and Cignetti, 1998). The concept of measuring the difference between expectations and perceptions in the form of the SERVQUAL gap score proved very useful for assessing the level of service quality. Parasuraman argued that, with minor modification, SERVQUAL can be adapted to any service organization (Tazreen, 2012). Accordingly, in the field of LIS the one of the most useful data analysis tools for measuring library service quality and user satisfaction are LIS SERVQUAL+ (Hossain, 2016), SPCM (Hossain and Ahmed, 2013) and Expectancy disconfirmation theory (Hossain, 2019).

LIS SERVQUAL+

LIS SERVQUAL+ is a tool initially based on PZB's (1985) SERVQUAL and has developed special service quality dimensions on which library users judge the service quality of any library or information center. Although SERVQUAL was developed for the assessment of service quality, but it was totally related to profit-oriented business sectors. The questionnaire items of SERVQUAL are also irrelevant to library sectors (reference needed). In a paper, Hossain (2016) discussed the development of a new tool called LIS SERVQUAL+ which is based on SERVQUAL instrument to serve the particular requirement of libraries. The LIS SERVQUAL+ was launched with four service quality dimensions, such as: *caring, competence, resources,* and *library as a place*; and 26 questionnaire items. The model also introduced one modified scale, i.e. '*real service expectation'* and two types of quality measurement approaches, such as: 'SSQ: superior service quality' and 'MSQ: minimum service quality'.

Many LIS researches were conducted based on LibQUAL+ model, which was developed with the objective of measuring service quality in library sectors. LibQUAL+ survey instrument is based on conceptual framework on SERVQUAL scale (i.e., desired service, adequate service, and perception of service performance) which defines the service quality as "the difference between customers' perceptions and expectations" using disconfirmation/confirmation theory Rehman (2012). He (Rehman, 2012) carried out a survey using LibQUAL+ model with the intent of measuring difference between minimum and desired expectations of library users in Pakistan. The result showed that Pakistani users expected very high level of services. Correspondingly, In an earlier study, Hossain and Ahmed (2014a) asked respondents to rate their opinions on service quality in three columns, i.e., desired services, minimum services, and perception of service performance for 28 service items on a 7-point Likert type scale from 1 – 'lowest' to 7 – 'highest'. The authors found that students' ratings on desired services for all the service items were very high, and most of the ratings fell between the highest scores of 6 and 7. On the other hand, the perception of service performance achieved low ratings, that werefell below the average score of 4. From these findings, the paper reported that high expectation for services is a common phenomenon among users. Other studies (see Goodman, 2009; Yuksel and Rimmington, 1998; Halstead, Hartman and Schmidt, 1994; Babakus and Boller, 1992; Dorfman, 1979) also found that unreasonable expectation is one of the typical causes of user disappointment about the service performance.

Hossain and Ahmed (2014a) examined the relationship between respondents' expectation sources by gender, status, and the type of the university they are

attending. Result showed that the expectation source "it's my right" achieved the highest score than other expectation sources. This indicated that university students may consider library services as their right that may lead to greater expectations and resulted in lower ratings for service quality. Based on this finding it was argued that the prior measures of service quality assessment, 'MSS' (the gap difference between desired service expectation and perception of service performance) developed by Parasuraman, *et al*. (1994a) cannot produce a realistic result. The study suggested also when measuring service quality an alternative item-scale should be used to avoid this impractical consequence. Accordingly, to remove the weaknesses of the existing measurement practices., Hossain and Ahmed (2014a) proposed a new scale, namely real service expectation (RE), which is the average of desired and minimum scores, i.e., (DE+ME)/2. The study also validated the appropriateness of this new scale in order to introduce a new method to calculate the gap scores between perception and real service expectation instead of calculating the difference between perception and desired service expectation. The study advocated that service quality should be the measure of how well the 'perceived service' relates to the users' real service expectations (REs) and minimum service expectation (MEs), rather than Parasuraman *et al.*'s (1994a) desired and minimum service expectations. Thus, two types of measures (gap difference) were introduced in this model (Hossain, 2019). One is SSQ (superior service quality), that is calculated as P – RE; another is MSQ (minimum service quality), which is derived from the calculation of P – ME. The zone of tolerance was also determined as RE –ME. The difference between PZB's SERVQUAL method and LIS SERVQUAL+ method is presented in Table 1.

Table 1: Difference between SERVQUAL and LIS SERVQUAL+ method

Attributes	**SERVQUAL**	**LibQUAL**	**LIS SERVQUAL+**
Service dimension	5 dimensions	3 dimensions	4 dimensions (Hossain, 2016)
Questionnaire items	22 items	13 items	26 items (Hossain, 2016)
Number of scales	3 scales	3 scales	4 scales (Hossain & Ahmed, 2014a)
Name of scale	DE, ME, P	DE, ME, P	DE, ME, RE, P
Scale used for service quality assessment	DE, ME, P	DE, ME, P	RE, ME, P
Type of gap score	2 types	2 types	2 types
Name of highest quality gap	MSS	MSS	SSQ (Hossain, 2019)
Name of lowest quality gap	MSA	MSA	MSQ (Hossain, 2019)
Calculation of highest quality gap	P – DE	P – DE	P – RE (Hossain, 2019)
Calculation of lowest quality gap	P – ME	P – ME	P – ME

SPCM

Many service quality models are available to assist business organizations to identify service items that require improvement (Hung *et al*., 2003). Still, most of these models seem incomplete. In particular, some models are unable to effectively prioritize improvement goals (see Chen *et al*., 2006). The "SPCM" stands for "Service Performance Control Matrix" is an effective performance assessment model developed for LIS sectors by Hossain and Ahmed (2013). It was established to identify and evaluate the performance of service items and to establish the best strategy for improving service quality of academic libraries. The aim is to determine the service items which meet users' expectations, to provide strategic directions to sustain or improve or recover service performance, and the items which require improvement. It also suggests the measures to be taken to recover service performance or sustain the existing service situation. The SPCM model consists of four major zones, i.e. performance evaluation zone, study area zone, service strategy implementation zone, and zone of action or recommendations' zone. To evaluate the level of service performance the performance evaluation zone is divided into four zones, such as: problematic, improvement, maintain, and excellent zone. Performance of service item(s) represented by each of this performance evaluation zone indicates the ability to meeting or un-meeting user's information needs or expectations.

For imposing improvement criteria, the items located into each performance evaluation zones are addressed by the adjacent service strategy implementation zone. Consequently, the items of each study area corresponding to each of the performance evaluation zones are addressed by the adjacent zone of action to put through the recommendation. The recommendations for service items must set up according to strategic directions that are described in service strategy implementation zone. The model also shows the highest and lowest range of service performance and improvement priority for service items. Moreover, it shows how to establish improvement priorities for service items in the context of resource constraints academic libraries in developing countries. This model can be used as an essential indicator to devise an appropriate strategy for improving service quality of academic libraries (Hossain and Ahmed, 2013).

Disconfirmation of Expectation's Theory (DET)

Oliver's (1980) 'Expectancy disconfirmation theory' is the most popular and widely used model for studying customer satisfaction and dissatisfaction (CS/D) in the field of marketing in which disconfirmation is the customer's evaluation of a product's

performance relative to his or her expectations. This discrepancy was elaborated by Patterson in 1993. But, in terms of operational efficiency of this model in satisfaction measurement process, the use of expectation as a disconfirmation standard has been opposed by Hossain (2019). He (Hossain, 2019) claimed that, users' expectations for services are changeable depending upon the service situation, and they could not limit their expectations with a fixed point of score, rather within a certain range of scores. Consistently in an earlier study Franceschini and Cignetti (1998) claimed that, expectations may be interpreted by customers in two different ways: (1) at the ideal level, by giving each attribute the highest score, or (2) at the feasible level when considered under the actual conditions in which service may be delivered. It was therefore, emphasized that, 'Zone of tolerance' should be the confirmation and disconfirmation standard. With this regard, Hossain (2014b, 2019) primarily introduced four levels of assessment. He named it '4-level ZOT'.

In '4-level ZOT' the assessment is performed into three stages such as: negative disconfirmation, confirmation, and positive disconfirmation. It can be explained as: if perceived service found above the real service expectation, it falls into 'superior zone' indicating 'delightful users'; if it is found equivalent or above the desired service expectation, it falls into 'surprising zone' indicating 'surprised users'; if it is found below the minimum service expectation, it falls into 'defective zone' indicating 'frustrated users'; and if it is found within the range of real and minimum service expectation (P>=ME & <=RE) i.e., called ZOT, it falls into 'standard zone' that indicates 'satisfied users'.

The process of measuring satisfaction according to Smith and Houston (1982) is primarily based on disconfirmation of user's expectations. This is consistent with Yüksel and Yüksel (2001) assumption 'satisfaction with services is related to confirmation or disconfirmation of expectations'. In a prior study Parasuraman, Zeithaml and Berry (1985) stated, quality service means resources and services that satisfy the user's expectations, which indicates service quality and satisfaction are closely related constructs (Babakus *et al*., 2004). Several studies in service marketing literatures also illustrate, 'service quality may indirectly and directly affect customer satisfaction'. In terms of direct relationship perspective, Bitner (1990) examined that the service quality had been an important antecedent of customer satisfaction. A number of authors have also referred to service quality as an antecedent to satisfaction; satisfaction as the antecedent to service quality; or service quality and satisfaction as either interrelated or discrete concepts (Anderson *et al.*, 1994; Taylor and Cronin, 1994; Cronin and Taylor, 1992; Bolton and Drew, 1991). Considering numerous criticisms Hossain (2019) stated that service quality and satisfaction are viewed as two distinct constructs, but are closely related with each other. He also

added a new dimension 'service quality ranking' at the same model adjacent to the satisfaction ranking. This result is consistent with McColl-Kennedy and Schneider's (2003) assertion, which stated: "for research purpose, customer satisfaction is not measured alone, but in conjunction with service quality and success". However, considering the logical ground and empirical result of the study the disconfirmation of expectation's theory was redefined by incorporating it with the LIS SERVQAUL+ instrument.

For better use of LIS service quality and satisfaction assessment tools, first of all, the study presents a short overview of LIS SERVQUAL+, SPCM, and Disconfirmation of Expectation's Theory. It provides the readers an indication of which method to use and in which case. Finally, the study presents the experimentation of data to help the readers understand how to perform data analysis using LIS SQ&S assessment models and to explore the meaning of real-world service quality and satisfaction.

STUDY OBJECTIVES

Understanding how to analyze and extract true meaning from the raw data insights is the primary and major objective of this study. The central focus is to explain how to use LIS service quality and satisfaction (SQ&S) analysis tools based on raw data.

METHODOLOGY

Only three SQ&S (service quality & satisfaction) tools were selected from authors' own study of research. Data for showing experimentation were gathered from an earlier study (Hossain, 2016). Questionnaire items were partially (16 items) selected from 4-dimensions (caring, competence, resources, and library as a place). These are considered as primary data of this study, which covers respondents' opinions in 3-column formats i.e., desired service expectation (DE), minimum service expectation (ME), and perception of service performance (P) on a 7-point Likert scale. To demonstrate how to use LIS service quality and satisfaction measurement tools namely, LIS SERVQUAL+ (Hossain, 2016 and 2019), SPCM (Hossain and Ahmed, 2013) and Disconfirmation of expectation's theory (Hossain, 2019), the data (compiled) were experimented over each and every model of SQ&S. The review of literature regarding LIS SQ&S models were largely based on authors' earlier related research paper i.e., Hossain and Ahmed (2013), Hossain and Ahmed (2014a), Hossain (2016), and Hossain (2019). Other related literatures were also explored.

USE OF DATA ANALYSIS TOOLS

Gaining a better understanding of the use of different SQ&S assessment tools in LIS field (i.e., LIS SERVQUAL+, SPCM, and Disconfirmation of Expectation's Theory) the study uses same quantitative insights and descriptive data with clear directions. However, to easy experiment of data over the assigned SQ&S tools some common steps are taken.

Step-1: Data collection using 3-column format

Table 2: Response from a respondent

Item No.	Statement	Desired service expectation	Minimum service expectation	Perception/ Perceive service
01	Ability to make quick solution	1 2 3 4 5 **6** 7	1 2 3 4 **5** 6 7	1 2 **3** 4 5 6 7
02	Willingness to help users	1 2 3 4 5 6 **7**	1 2 3 4 **5** 6 7	1 2 3 **4** 5 6 7
03	Giving personal attention to users	1 2 3 4 5 **6** 7	1 2 3 **4** 5 6 7	1 2 3 4 **5** 6 7
04	Giving quick & timely service	1 2 3 4 5 6 **7**	1 2 3 4 5 **6** 7	1 2 3 4 5 **6** 7
05	Academic fitness of employees	1 2 3 4 5 6 **7**	1 2 3 4 5 **6** 7	1 2 **3** 4 5 6 7
06	Professional skills of employees	1 2 3 4 5 **6** 7	1 2 3 4 **5** 6 7	1 2 3 4 **5** 6 7
07	Ability to guide the users properly	1 2 3 4 5 **6** 7	1 2 3 4 **5** 6 7	1 **2** 3 4 5 6 7
08	Ability to understand user's problem	1 2 3 4 5 6 **7**	1 2 3 4 5 **6** 7	1 2 3 **4** 5 6 7
09	Sufficient number of documents	1 2 3 4 5 **6** 7	1 2 3 4 **5** 6 7	1 2 **3** 4 5 6 7
10	Up-to-date-ness of documents	1 2 3 4 5 6 **7**	1 2 3 4 5 **6** 7	1 2 **3** 4 5 6 7
11	Latest information services	1 2 3 4 5 6 **7**	1 2 3 4 5 **6** 7	1 2 **3** 4 5 6 7
12	Accessibility of e-resources	1 2 3 4 5 6 **7**	1 2 3 4 5 **6** 7	1 2 3 **4** 5 6 7
13	Appropriate study environment	1 2 3 4 5 6 **7**	1 2 3 4 5 **6** 7	1 2 3 **4** 5 6 7
14	Adequate learning space	1 2 3 4 5 **6** 7	1 2 3 4 **5** 6 7	1 2 **3** 4 5 6 7
15	Documents are at the right place	1 2 3 4 5 6 **7**	1 2 3 4 **5** 6 7	1 2 3 **4** 5 6 7
16	Users can easily complaint	1 2 3 4 5 **6** 7	1 2 3 **4** 5 6 7	1 2 3 4 **5** 6 7

Respondents opined their ratings on three columns (see Table 2). In the first column (*desired service*), he/she should mark his/her highest expectation level for the

concerned service items. In the second column (*minimum service*), respondent should mark his/her minimum or standard level of expectation for the concerned service item. Consequently, in the third column (*perception*), he/she should select the level of experience or perception of service performance. It is to be noted that the ***bold marked*** ratings represent the single user response for this questionnaire set.

Step-2: Calculation of mean scores for user responses

Suppose, 25 respondents were responded, and everyone was responded individually on the same set of questionnaire items. Now to calculate the mean scores for 25 sets of data items follow the instruction below:

Item-1: Ability to make quick solution;

Desired service = {(digit of 1st respondent + 2nd + 3rd + ……..… + 25th) / Total number of respondents}.

Minimum service = {(digit of 1st respondent + 2nd + 3rd + ……..… + 25th) / Total number of respondents}.

Perception = {(digit of 1st respondent + 2nd + 3rd + ……..… + 25th) / Total number of respondents}.

Accordingly, calculate the mean score for the item 2, 3, 4, 5, ……., and item no. 16. Thus, the whole items are calculated for deriving the mean scores (see Table 3).

Table 3: Mean score of the respondents' data

Item No.	Statement	Desired service	Minimum service	Perception
01	Ability to make quick solution	5.89	3.63	3.10
02	Willingness to help users	6.09	3.82	3.02
03	Giving personal attention to users	5.72	3.62	2.87
04	Giving quick & timely service	6.03	3.94	3.20
	Caring	**5.93**	**3.75**	**3.05**
05	Academic fitness of employees	5.99	3.86	3.40
06	Professional skills of employees	6.11	3.94	3.49
07	Ability to guide the users properly	5.99	3.85	3.29
08	Ability to understand user's problem	5.95	3.75	3.18
	Competence	**6.01**	**3.85**	**3.34**
09	Sufficient number of documents	5.95	3.60	3.83
10	Up-to-date-ness of documents	5.90	3.93	3.68
11	Latest information services	6.05	3.88	3.63
12	Accessibility of e-resources	6.07	3.94	3.22

	Resources	**5.99**	**3.84**	**3.59**
13	Appropriate study environment	6.30	4.15	3.78
14	Adequate learning space	6.28	4.29	3.60
15	Documents are at the right place	6.16	4.05	3.55
16	Users can easily complaint	5.92	3.82	2.99
	Library as a place	**6.17**	**4.08**	**3.48**

The overall mean score (according to 4-dimensions) for each dimension is also calculated as:

Dimension-1: Caring;
Desired service = {(mean score of 1st item + 2nd + 3rd + ……..… + 16th) / Total number of items}.
Minimum service = {(mean score of 1st item + 2nd + 3rd + ……..… + 16th) / Total number of items}.
Perception = {(mean score of 1st item + 2nd + 3rd + ……..… + 16th) / Total number of items}.
Accordingly, calculate the overall mean score for the dimension 2, 3, and 4.

Step-3: Calculation of Real service expectation
The real service expectation (RE) is the result of the average score of desired service expectation and minimum service expectation (see Table 4). However, the calculation of RE is for each service item is calculated as:

Item-1: Ability to make quick solution;
RE score for item-1 = {(DE score of item#1 + ME score of item#1) / 2}.
Item-2: Willingness to help users;
RE score for item-2 = {(DE score of item#2 + ME score of item#2) / 2}.
Item-3: Giving personal attention to users;
RE score for item-3 = {(DE score of item#3 + ME score of item#3) / 2}.
The other items 'item-4, 5, 6, 7, ……., and item no. 16' are accordingly follow the same formula to calculate the RE scores.

Table 4: Scores of real service expectation (RE)

Item No.	Statement	Desired service (DE)	Minimum service (ME)	Perception (P)	Real service RE=(DE+ME)/2
01	Ability to make quick solution	5.89	3.63	3.10	4.76
02	Willingness to help users	6.09	3.82	3.02	4.96
03	Giving personal attention to users	5.72	3.62	2.87	4.67

04	Giving quick & timely service	6.03	3.94	3.20	4.99
	Caring	**5.93**	**3.75**	**3.05**	**4.84**
05	Academic fitness of employees	5.99	3.86	3.40	4.93
06	Professional skills of employees	6.11	3.94	3.49	5.03
07	Ability to guide the users properly	5.99	3.85	3.29	4.92
08	Ability to understand user's problem	5.95	3.75	3.18	4.85
	Competence	**6.01**	**3.85**	**3.34**	**4.93**
09	Sufficient number of documents	5.95	3.60	3.83	4.78
10	Up-to-date-ness of documents	5.90	3.93	3.68	4.92
11	Latest information services	6.05	3.88	3.63	4.97
12	Accessibility of e-resources	6.07	3.94	3.22	5.01
	Resources	**5.99**	**3.84**	**3.59**	**4.92**
13	Appropriate study environment	6.30	4.15	3.78	5.23
14	Adequate learning space	6.28	4.29	3.60	5.29
15	Documents are at the right place	6.16	4.05	3.55	5.11
16	Users can easily complaint	5.92	3.82	2.99	4.87
	Library as a place	**6.17**	**4.08**	**3.48**	**5.13**

The overall RE score for each dimension is also calculated as:

RE for 'Caring' = {(overall DE score of *Caring* + overall ME score of *Caring*) / 2}.
RE for 'Competence' = {(overall DE score of *Competence* + overall ME score of *Competence*) / 2}.
RE for 'Resources' = {(overall DE score of *Resources* + overall ME score of *Resources*) / 2}.
RE for 'Library as a place' = {(overall DE score of *Library_place* + overall ME score of *Library_place*) / 2}.

How to use LIS SERVQUAL+?

In LIS SERVQUAL+ model, the new refined scale 'real service expectation' is used. To calculate the gap difference between expectations and perception of service performance, the model used two types of SQ measurement approach. For measuring highest service quality gap, it used SSQ (i.e., P-RE) instead of former MSS (i.e., P-DE). For estimating minimum service quality gap, it uses former measurement method (i.e., P-ME). But the difference is the new method of measuring minimum gap is known as MSQ (minimum service quality), while the former method is known as MSA (measure of service adequacy). Calculation of ZOT (zone of tolerance) is also differently calculated as 'RE-ME' instead of former 'DE-ME' score.

Components of LIS SERVQUAL+

Dimensions:	4-dimensions (caring, competence, resources and library as a place);
Questionnaire items:	26 questionnaire items;
Scales:	Desired service expectation (DE); Minimum service expectation (ME); Real service expectation (RE); Perception of service performance (P);
SQ gap measurement:	Superior service quality (SSQ); Minimum service quality (MSQ); Zone of tolerance (ZOT);
Gap measurement method:	SSQ = (P – RE) <real expectation vs. perception gap>; MSQ = (P – ME) <minimum expectation vs. perception gap>; ZOT = (RE – ME) <real expectation vs. minimum expectation gap>.

Calculation of Gap scores: SSQ, MSQ, ZOT

To calculate the gap difference using LIS SERVQUAL+ instrument, first of all we have to know about the SSQ, MSQ, and ZOT (see Table 5); and then follow a number of steps to experiment and produce result.

Superior service quality (SSQ)
The discrepancy between Perceived service and Real service expectation is referred to as superior service quality (SSQ). It indicates user's highest level of expectation and perception gap for service performance, which is calculated as: (Perceived service – Real service expectation).

Minimum service quality (MSQ)
The discrepancy between Perceived service and Minimum service expectation is referred to as minimum service quality (MSQ). It indicates user's standard or minimum level of expectation and perception gap for service performance, which is calculated as: (Perceived service – Minimum service expectation).

Zone of tolerance (ZOT)

The range between the Real service expectation and Minimum service expectation is referred to as Zone of tolerance (ZOT), which is calculated as: (Real service expectation – Minimum service expectation).

Step-1: Use Table 4 and expand it by adding *three* extra columns headed by 'Service quality gap score', and calculate the gap score according to defined formula.

Table 5: Calculation of service quality gap score

Service Items with dimension	**Respondent's opinion score**				**Service quality gap score**		
	Desired service (DE)	**Minimum service (ME)**	**Real service RE=(DE+ME)/2**	**Perception (P)**	**SSQ (P – RE)**	**MSQ (P – ME)**	**ZOT (RE – ME)**
Item - 01	5.89	3.63	4.76	3.10	-1.66	-0.53	1.13
Item - 02	6.09	3.82	4.96	3.02	-1.94	-0.80	1.14
Item - 03	5.72	3.62	4.67	2.87	-1.80	-0.75	1.05
Item - 04	6.03	3.94	4.99	3.20	-1.79	-0.74	1.05
Caring	**5.93**	**3.75**	**4.84**	**3.05**	**-1.79**	**-0.70**	**1.09**
Item - 05	5.99	3.86	4.93	3.40	-1.53	-0.46	1.07
Item - 06	6.11	3.94	5.03	3.49	-1.54	-0.45	1.09
Item - 07	5.99	3.85	4.92	3.29	-1.63	-0.56	1.07
Item - 08	5.95	3.75	4.85	3.18	-1.67	-0.57	1.10
Competence	**6.01**	**3.85**	**4.93**	**3.34**	**-1.59**	**-0.51**	**1.08**
Item - 09	5.95	3.60	4.78	3.83	-0.95	**0.23**	1.18
Item - 10	5.90	3.93	4.92	3.68	-1.24	-0.25	0.99
Item - 11	6.05	3.88	4.97	3.63	-1.34	-0.25	1.09
Item - 12	6.07	3.94	5.01	3.22	-1.79	-0.72	1.07
Resources	**5.99**	**3.84**	**4.92**	**3.59**	**-1.33**	**-0.25**	**1.08**
Item - 13	6.30	4.15	5.23	3.78	-1.45	-0.37	1.08
Item - 14	6.28	4.29	5.29	3.60	-1.69	-0.69	1.00
Item - 15	6.16	4.05	5.11	3.55	-1.56	-0.50	1.06
Item - 16	5.92	3.82	4.87	2.99	-1.88	-0.83	1.05
Library as a place	**6.17**	**4.08**	**5.13**	**3.48**	**-1.65**	**-0.60**	**1.05**

Step-2: Estimate the results of service quality gap;

Following *one of four types* of result can be found after analysis of tabular data:
Option-1: Positive gap for respondent's highest expectation and perception i.e., P>=RE;
Option-2: Negative gap for respondent's highest expectation and perception i.e., P<RE;

Option-3: Positive gap for respondent's minimum expectation and perception i.e., P>=ME;
Option-4: Negative gap for respondent's minimum expectation and perception i.e., P<ME.

Thus, according to above options, option-3 is activated for a single item "item-9: Sufficient number of documents". It means respondent's minimum expectation for the quantity of documents is satisfied. Perception of no other items is reached at either highest or minimum level of respondent's expectations.

Step-3: Ranking the quality gap;

In order to methodical recovery of service quality gap the gap scores can be ranked either ascending or descending order according to SSQ and MSQ (see Table 6 and Table 7).

Table 6: Ranking SSQ gap (descending order)

Service Items with dimension	**Respondent's opinion score**				**Service quality gap score**		
	Desired service (DE)	**Minimum service (ME)**	**Real service RE=(DE+ME)/2**	**Perception (P)**	**SSQ (P – RE)**	**MSQ (P – ME)**	**ZOT (RE – ME)**
Item - 02	6.09	3.82	4.96	3.02	-1.94	-0.80	1.14
Item - 16	5.92	3.82	4.87	2.99	-1.88	-0.83	1.05
Item - 03	5.72	3.62	4.67	2.87	-1.80	-0.75	1.05
Item - 04	6.03	3.94	4.99	3.20	-1.79	-0.74	1.05
Caring	**5.93**	**3.75**	**4.84**	**3.05**	**-1.79**	**-0.70**	**1.09**
Item - 12	6.07	3.94	5.01	3.22	-1.79	-0.72	1.07
Item - 14	6.28	4.29	5.29	3.60	-1.69	-0.69	1.00
Item - 08	5.95	3.75	4.85	3.18	-1.67	-0.57	1.10
Item - 01	5.89	3.63	4.76	3.10	-1.66	-0.53	1.13
Library as a place	**6.17**	**4.08**	**5.13**	**3.48**	**-1.65**	**-0.60**	**1.05**
Item - 07	5.99	3.85	4.92	3.29	-1.63	-0.56	1.07
Competence	**6.01**	**3.85**	**4.93**	**3.34**	**-1.59**	**-0.51**	**1.08**
Item - 15	6.16	4.05	5.11	3.55	-1.56	-0.50	1.06
Item - 06	6.11	3.94	5.03	3.49	-1.54	-0.45	1.09
Item - 05	5.99	3.86	4.93	3.40	-1.53	-0.46	1.07
Item - 13	6.30	4.15	5.23	3.78	-1.45	-0.37	1.08
Item - 11	6.05	3.88	4.97	3.63	-1.34	-0.25	1.09
Resources	**5.99**	**3.84**	**4.92**	**3.59**	**-1.33**	**-0.25**	**1.08**
Item - 10	5.90	3.93	4.92	3.68	-1.24	-0.25	0.99
Item - 09	5.95	3.60	4.78	3.83	-0.95	**0.23**	1.18

Table 7: Ranking MSQ gap (descending order)

Service Items with dimension	Respondent's opinion score				Service quality gap score		
	Desired service (DE)	Minimum service (ME)	Real service RE=(DE+ME)/2	Perception (P)	SSQ (P – RE)	MSQ (P – ME)	ZOT (RE – ME)
Item - 16	5.92	3.82	4.87	2.99	-1.88	-0.83	1.05
Item - 02	6.09	3.82	4.96	3.02	-1.94	-0.80	1.14
Item - 03	5.72	3.62	4.67	2.87	-1.80	-0.75	1.05
Item - 04	6.03	3.94	4.99	3.20	-1.79	-0.74	1.05
Item - 12	6.07	3.94	5.01	3.22	-1.79	-0.72	1.07
Caring	**5.93**	**3.75**	**4.84**	**3.05**	**-1.79**	**-0.70**	**1.09**
Item - 14	6.28	4.29	5.29	3.60	-1.69	-0.69	1.00
Library as a place	**6.17**	**4.08**	**5.13**	**3.48**	**-1.65**	**-0.60**	**1.05**
Item - 08	5.95	3.75	4.85	3.18	-1.67	-0.57	1.10
Item - 07	5.99	3.85	4.92	3.29	-1.63	-0.56	1.07
Item - 01	5.89	3.63	4.76	3.10	-1.66	-0.53	1.13
Competence	**6.01**	**3.85**	**4.93**	**3.34**	**-1.59**	**-0.51**	**1.08**
Item - 15	6.16	4.05	5.11	3.55	-1.56	-0.50	1.06
Item - 05	5.99	3.86	4.93	3.40	-1.53	-0.46	1.07
Item - 06	6.11	3.94	5.03	3.49	-1.54	-0.45	1.09
Item - 13	6.30	4.15	5.23	3.78	-1.45	-0.37	1.08
Item - 11	6.05	3.88	4.97	3.63	-1.34	-0.25	1.09
Resources	**5.99**	**3.84**	**4.92**	**3.59**	**-1.33**	**-0.25**	**1.08**
Item - 10	5.90	3.93	4.92	3.68	-1.24	-0.25	0.99
Item - 09	5.95	3.60	4.78	3.83	-0.95	**0.23**	1.18

How to use SPCM?

The SPCM (Service Performance Control Matrix) is an effective performance assessment model developed by Hossain and Ahmed (2013) to identify and evaluate the performance of service items and to establish the best strategy for improving service quality for academic libraries. The model consists of four major zones.

X = performance evaluation zone;
Y = study area zone;
Z = service strategy implementation zone; and
A = zone of action or recommendation zone.

Components of SPCM

Scales (used): P, ME, RE, DE;

Measure of performance:	Data fall into X^1 zone indicates 'Problematic zone'; Data fall into X^2 zone indicates 'Improvement zone'; Data fall into X^3 zone indicates 'Maintain zone'; Data fall into X^4 zone indicates 'Excellent zone';
Performance indicator:	(P<ME) indicates 'Need unmet'; (P>=ME) indicates 'Need met'; (P>=RE) indicates 'Expectation met'; (P>=DE) indicates 'Expectation exceeded';
Strategic direction:	Data fall into Z^1 zone indicates 'Prompt action to recovery'; Data fall into Z^2 zone indicates 'require improvement'; Data fall into Z^3 zone indicates 'Maintain service strictly'; Data fall into Z^4 zone indicates 'Sustain service as it is';

Evaluation of service items

To identify and evaluate the service items individually, each item is to be distributed in the specific cell of SPCM structure on the basis of 'comparing formula' (see Table 8).

Table 8: Evaluating service performance

		Performance evaluation zone (*X*)					
		Problematic zone (X_1)	Improvement zone (X_2)	Maintain zone (X_3)	Excellent zone (X_4)		
		($P < ME$) Need unmet	($P > = ME$) Need met	($P > = RE$) Expectation met	($P > = DE$) Expectation exceeded		
Study area zone (*Y*)	Caring	Item no. 1, 2, 3, 4	x	x	x	*A_1	**Zone of action (*A*)**
	Competence	Item no. 5, 6, 7, 8	x	x	x	*A_2	
	Resources	Item no. 10, 11, 12	Item no. 9	x	x	*A_3	
	Library as a place	Item no. 13, 14, 15, 16	x	x	x	*A_4	
		Prompt action to recovery of service performance	Require improvement of service performance	Maintain service performance strictly	Sustain service performance as it is		
		Service Strategy Implementation Zone (*Z*)					

Source: Hossain and Ahmed (2013)

Users' opinions on 16 service items are mapped onto SPCM structure. Table 8 shows that only one service item "sufficient number of documents" under *resources* dimension falls into *improvement zone*. For easy comparison, the SPCM results can be represented in a tabular form as shown in Table 9.

Table 9: Result of service performance

Item no.	Statement	Performance Indicator			
		Need Unmet	Need Met	Expectation Met	Expectation Exceeded
01	Ability to make quick solution	x	x	x	x
02	Willingness to help users	x	x	x	x
03	Giving personal attention to users	x	x	x	x
04	Giving quick & timely service	x	x	x	x
05	Academic fitness of employees	x	x	x	x
06	Professional skills of employees	x	x	x	x
07	Ability to guide the users properly	x	x	x	x
08	Ability to understand user's problem	x	x	x	x
09	Sufficient number of documents	x	√	x	x
10	Up-to-date-ness of documents	x	x	x	x
11	Latest information services	x	x	x	x
12	Accessibility of e-resources	x	x	x	x
13	Appropriate study environment	x	x	x	x
14	Adequate learning space	x	x	x	x
15	Documents are at the right place	x	x	x	x
16	Users can easily complaint	x	x	x	x

Priority ranking for improvement of service items

To set the order of improvement priority for individual service item, the ratings on user's perceived services should be taken. The lowest ratings of perceived services require highest range of improvement priorities, as shown in Table 10.

Table 10: Item's ranking for priority of improvement

Item no.	Statement	Score of Perception of service performance	Ranking for priority of improvement
03	Giving personal attention to users	2.87	01
16	Users can easily complaint	2.99	02
02	Willingness to help users	3.02	03
01	Ability to make quick solution	3.10	04
08	Ability to understand user's problem	3.18	05

04	Giving quick & timely service	3.20	06
12	Accessibility of e-resources	3.22	07
07	Ability to guide the users properly	3.29	08
05	Academic fitness of employees	3.40	09
06	Professional skills of employees	3.49	10
15	Documents are at the right place	3.55	11
14	Adequate learning space	3.60	12
11	Latest information services	3.63	13
10	Up-to-date-ness of documents	3.68	14
13	Appropriate study environment	3.78	15
09	Sufficient number of documents	3.83	16

Regarding the improvement of service items, Table 10 indicates that the item 09 'sufficient number of documents' achieved the highest perception score, and, therefore, obtained the lowest ranking in priority improvement; while item 03 'giving personal attention to users' got the lowest perception rate, but achieved highest ranking in priority improvement.

How to use Disconfirmation of Expectation's Theory?

Disconfirmation of expectation's theory (Hossain, 2019) is the adapted version of Patterson's (1993) 'Disconfirmation of expectations paradigm'. It is a synchronized method that is capable of determining the levels of service quality and satisfaction (SQ&S), and simultaneously calculating the gap differences between user's expected and perceived service performance for deciding which service items are to be recovered, improved, or sustained. For identifying the level of SQ&S, the model used 4-level ZOT, where zone of tolerance is assigned as confirmation and disconfirmation standard. At the same time, for identifying the size of disconfirmation (gap difference) it incorporates the method of LIS SERVQUAL+.

Components of Disconfirmation of Expectation's Theory

Disconfirmation standard: Zone of Tolerance (ZOT);

Measures: Negative disconfirmation;
Confirmation;
Positive disconfirmation;

Scales (used): Desired service expectation (DE);
Minimum service expectation (ME);
Real service expectation (RE);

	Perception of service performance (P)
Methods (used):	4-level ZOT (to identify the level of SQ&S); LIS SERVQUAL+ (to identify the size of disconfirmation)
Assessment process:	Defective zone (P<ME); Standard zone (P==ZOT); * ZOT = (P>=ME & P<=RE) Superior zone (P>RE); Surprising zone (P>=DE)
Level of service quality:	(P<ME) = Poor service; (P==ZOT) = Standard service; (P>RE) = Excellent service; (P>=DE) = Surprising service
Level of satisfaction:	(P<ME) = Poor service; (P==ZOT) = Standard service; (P>RE) = Excellent service; (P>=DE) = Surprising service

Identify the level of Quality and Satisfaction/Dissatisfaction

To recognize the level of quality and satisfaction/dissatisfaction, the whole service items are evaluated by 4-Level ZOT (see Table 11). For doing so, respondents' opinion (mean) scores and assessment process of quality and satisfaction/dissatisfaction should be placed side-by-side in tabular form is shown in Table 12.

Table 11: 4-Level ZOT

	(P < ME)	**(P == ZOT)**	**(P > RE)**	**(P >= DE)**
PROCESS	Negative disconfirmation	Confirmation (ZOT)	Positive disconfirmation	
	Defective zone	Standard zone	Superior zone	Surprising zone
OUTCOME	Poor service	Standard service	Excellent service	Surprising service
	Dissatisfaction	Satisfaction	Delightful	Surprised

According to 4-Level ZOT, the service items fall below the minimum level of expectation results in negative disconfirmation and categorized under *defective zone*. It results the service items are 'poor' in quality, and users are dissatisfied with these items. Accordingly, the service items fall between the zone of tolerance (i.e., P>=ME & P<=RE) occurs confirmation and are treated under standard zone. It indicates the service items are in standard quality and users are satisfied with these items. Moreover, the service items exceeded the ZOT occurs positive disconfirmation, which will be treated as superior and surprising zone. The items under this zone indicate the 'Excellent' and 'Surprising' level of service quality, and thus 'Delightful' and 'Surprised' level of satisfaction.

Table 12: Identifying the level of quality and user satisfaction/dissatisfaction

Item No.	Statement	Opinion Scores				Level of Quality and Satisfaction			
		DE	ME	P	RE	P<ME	P==ZOT	P>RE	P>RE
01	Ability to make quick solution	5.89	3.63	3.10	4.76	√	x	x	x
02	Willingness to help users	6.09	3.82	3.02	4.96	√	x	x	x
03	Giving personal attention to users	5.72	3.62	2.87	4.67	√	x	x	x
04	Giving quick & timely service	6.03	3.94	3.20	4.99	√	x	x	x
	Caring	**5.93**	**3.75**	**3.05**	**4.84**	√	x	x	x
05	Academic fitness of employees	5.99	3.86	3.40	4.93	√	x	x	x
06	Professional skills of employees	6.11	3.94	3.49	5.03	√	x	x	x
07	Ability to guide the users properly	5.99	3.85	3.29	4.92	√	x	x	x
08	Ability to understand user's problem	5.95	3.75	3.18	4.85	√	x	x	x
	Competence	**6.01**	**3.85**	**3.34**	**4.93**	√	x	x	x
09	Sufficient number of documents	5.95	3.60	3.83	4.78	x	√	x	x
10	Up-to-date-ness of documents	5.90	3.93	3.68	4.92	√	x	x	x
11	Latest information services	6.05	3.88	3.63	4.97	√	x	x	x
12	Accessibility of e-resources	6.07	3.94	3.22	5.01	√	x	x	x
	Resources	**5.99**	**3.84**	**3.59**	**4.92**	√	x	x	x
13	Appropriate study environment	6.30	4.15	3.78	5.23	√	x	x	x
14	Adequate learning space	6.28	4.29	3.60	5.29	√	x	x	x
15	Documents are at the right	6.16	4.05	3.55	5.11	√	x	x	x

	place								
16	Users can easily complaint	5.92	3.82	2.99	4.87	√	x	x	x
	Library as a place	**6.17**	**4.08**	**3.48**	**5.13**	√	x	x	x

Integrated evaluation of SQ&S over the service items could be done using 'Integrated framework for evaluating SQ&S' (Hossain, 2019). Such type of evaluation conducts the assessment process in a single platform concurrently (see Table 13). However, for doing so the mean of DE, ME and P scores, and RE score should be presented to identify the level of quality and satisfaction. Along with, the gap score is presented to identify the size of disconfirmation.

Table 13: Identifying the level of quality and user satisfaction/dissatisfaction

No. of Service Item	**Opinion Scores**				**Quality level**	**Satisfaction level**	**Size of Disconfirmation**		
	DE	ME	P	RE	Defective zone	Standard zone	P-ME	P-RE	P-DE
01	5.89	3.63	3.10	4.76	Poor service	Dissatisfaction	-0.53	-1.66	-2.79
02	6.09	3.82	3.02	4.96	Poor service	Dissatisfaction	-0.80	-1.94	-3.07
03	5.72	3.62	2.87	4.67	Poor service	Dissatisfaction	-0.75	-1.80	-2.85
04	6.03	3.94	3.20	4.99	Poor service	Dissatisfaction	-0.74	-1.79	-2.83
05	5.99	3.86	3.40	4.93	Poor service	Dissatisfaction	-0.46	-1.53	-2.59
06	6.11	3.94	3.49	5.03	Poor service	Dissatisfaction	-0.45	-1.54	-2.62
07	5.99	3.85	3.29	4.92	Poor service	Dissatisfaction	-0.56	-1.63	-2.70
08	5.95	3.75	3.18	4.85	Poor service	Dissatisfaction	-0.57	-1.67	-2.77
09	5.95	**3.60**	**3.83**	4.78	**Standard service**	**Satisfaction**	**0.23**	-0.95	-2.12
10	5.90	3.93	3.68	4.92	Poor service	Dissatisfaction	-0.25	-1.24	-2.22
11	6.05	3.88	3.63	4.97	Poor service	Dissatisfaction	-0.25	-1.34	-2.42
12	6.07	3.94	3.22	5.01	Poor service	Dissatisfaction	-0.72	-1.79	-2.85
13	6.30	4.15	3.78	5.23	Poor service	Dissatisfaction	-0.37	-1.45	-2.52
14	6.28	4.29	3.60	5.29	Poor service	Dissatisfaction	-0.69	-1.69	-2.68
15	6.16	4.05	3.55	5.11	Poor service	Dissatisfaction	-0.50	-1.56	-2.61
16	5.92	3.82	2.99	4.87	Poor service	Dissatisfaction	-0.83	-1.88	-2.93

CONCLUSION

The study contributes to the already existing studies of evaluating service quality and satisfaction within academic library perspective. It provides guidelines that other libraries or information centers can adopt for the corrective measures of their service quality and user satisfaction on the service performance. Summarily, the current research work presents three SQ&S model namely - LIS SERVQUAL+, SPCM and Disconfirmation of Expectation's Theory. It also demonstrates how each of these

models can be applied step-by-step in the context of assessing library service quality and user satisfaction. Moreover, to corrective measures of service performance and the level of user satisfaction the study addressed some fake data set for each of the models with appropriate sufficient guidelines. The results are also drawn from it for the convenience of the researchers, who will use these models in their research works.

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