Student Satisfaction Analysis of Service Quality University of Sumatera Utara (USU) Library with Fuzzy Service Quality Method

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Article Info	ABSTRACT
	Lack of service quality becomes one obstacle to student satisfaction. Service quality can be known by comparing the service that is in real acceptable with the service that the student expects. In this research method used to measure the level of satisfaction of acceptable service and which the student expects is the Fuzzy Service Quality method. The Fuzzy method is a method used to resolve issues where descriptions of activities, research and assessment are subjective, uncertain and inappropriate. The Fuzzy method is combined with the Service Quality method so that the student's perception and expectation measurement can be measured easily and precisely. In Service Quality There are five dimensions that are used to improve the quality of service such as Tangible, Reliability, Responsiveness, Assurance and Empathy. The results of this study show that the gap value of the five dimensions has a negative value, meaning that the quality of service has not been expected so that the students perceived dissatisfaction occurs. This indicates that the quality of service provided by the library needs to make repairs, one of them on the physical attributes (Tangible) 6 with the availability question and ease of Internet access. At the value of gap per dimension, the dimensions that need to be prioritized by the library of USU to be done improvement is the dimension of Empathy.

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INTRODUCTION

One of the facilities to support the success of a university is through the provision of a library. Every university library is required to provide high quality services, namely services that can meet the needs and expectations of library users. Libraries as service providers are expected to fulfill user satisfaction by providing various sources of information and providing quality services.

The University of North Sumatra (USU) is one of the state universities in Indonesia which annually opens new student admissions. The University of North Sumatra (USU) as a higher education institution is expected to be able to provide quality services so that it can produce skilled and superior students and alumni. The library is an institution that has an important role because it provides information services. The current condition demands an increase in the quality of library services to users by taking into account

their needs.

Service quality is a comparison between the service expected by consumers and the service received (Parasuraman and Z. dan Berry 1991). User response to service quality is a comprehensive assessment of the superiority of a service. Satisfaction is the level of one's feelings after comparing the perceived performance or results compared to expectations (F. Tjiptono, 2004). Meanwhile, satisfaction and dissatisfaction are responses to the perceived disconfirmation between previous expectations and actual performance that is felt after its use. The level of satisfaction arises because of a special transaction between producers and consumers which is a psychological condition that results when emotional factors encourage expectations and are adjusted to previous consuming experiences (perception) (S. I. Wahjono, 2010).

The fuzzy method is a method used to solve the problem of activity description, research and subjective assessment. The fuzzy system is based on the concept of a fuzzy set that maps the input domain into the output domain. The method used in this study is the Service Quality approach combined with fuzzy theory so that the measurement of customer perceptions and expectations can be measured accurately. One of the methods to analyze service quality is Service Quality (Servqual), QFD (Quality Function Development), Kano Model and so on. Among various service quality measurement models, Service Quality is the most widely used method, so it is considered to meet the statistical validity requirements. (A. Brysland and A. Curry, 2001) In the assessment of perceptions, expectations and weighting on Service Quality will result in a person's assessment of a qualitative criterion.

The service quality model that is widely used as a reference in service marketing research is the Service Quality method developed by Parasuraman, Zeithaml, and Berry. The method used in measuring the level of service satisfaction in this study is the Service Quality method with the aim of knowing the gap that occurs between the services received by students and student expectations. The Service Quality method consists of five quality dimensions, namely Physical (Tangible), Reliability, Responsiveness, Assurance and Empathy.

Several studies have used this method to overcome several problems related to customer satisfaction. This method has also been used to improve the service quality of banks, companies, hotels and so on. Previous research (Kargari, 2018) is regarding the rating of performance appraisal measurements at Tehran hotels by combining DEMATEL, ANP and SERVQUAL models in Fuzzy conditions (M. Kargari,2018). The study concluded that the method used is not only to increase customer satisfaction but also to reduce hotel costs in the long run. In this study, the Fuzzy method with Service Quality was used which aims to assist respondents in providing a more objective assessment of the data obtained from USU students.

RESEARCH METHOD

In this study, data were obtained from the library of the University of North Sumatra (USU), namely the number of students registered as members of the library (USU). The data is used as the determination of the sample. Then data was also obtained from students through a questionnaire. The questionnaire contains questions related to the services of the library (USU). The questionnaire is divided into three parts of the question, the first part contains the respondent's personal data, the second part contains the attributes that ask for the level of importance/expectation and the third part contains the level of acceptance/perception. Measurements were made using a Likert scale consisting of five points.

Questionnaires were distributed to students both inside and outside the library (USU). From the questionnaire, data will be obtained through the questions contained in the questionnaire. The questionnaire contains questions in the form of the level of service expected or the level of importance and level of service that is perceived or felt. Data collection was carried out using a questionnaire consisting of two parts, namely:

1. Customer perception questionnaire. This data is collected to find out how customers evaluate the services provided by the library.
2. Questionnaire of customer expectations. This data is needed to find out the expectations or desires of customers after using existing services as a response and input to the library as a service provider

Sampling step:
1. Data obtained from the library of the University of North Sumatra (USU) were analyzed and calculations were carried out on the data to obtain the many samples to be used. To get the sample used slovin formula.
2. Then the questionnaire contains questions based on the 5 dimensions of measuring service quality using a Likert scale for assessment measures with a scale of 1 to 5, then will be distributed as many samples as obtained.

Data analysis:
1. The data obtained from students is then tested, namely the validity test and reliability test. The purpose of this validity test is to determine the level of accuracy of a questionnaire and validity testing is carried out using the Pearson Product Moment correlation (correlation coefficient of the question item scores with the total value). The data reliability test was carried out to show that the measuring instrument used in the study has reliability as a measuring tool. If the tests carried out obtain valid and reliable results, it means that the questionnaire data can be used as a research reference and can be continued in the next process.
2. After the testing is done, then the data will be processed by Fuzzy Service Quality by conducting Fuzzification and Defuzzification. This process is carried out so that the measurement of perceptions and expectations of students can be measured easily and precisely
3. From Fuzzy Service Quality processing, a Gap value will be obtained. With this Gap value, it will be known to what extent the discrepancies occur in USU's library services.

RESULTS AND DISCUSSION

DATA VALIDITY TEST

Data validity test was conducted to determine the accuracy of the questionnaire data. The validity   v Value for each attribute can be seen in the following table:

Table 1. Validity test on expected service/interest

No	Attribute	r_{count}	r_{table}	Validity
Validity Physical (T*angible*)				
1	Library room and temperature	0,552	0,197	Valid
2	Cleanliness and tidiness of the library room	0,627	0,197	Valid
3	Library chairs and tables	0,450	0,197	Valid
4	The arrangement of books on the shelves is neat	0,565	0,197	Valid
5	Library room lighting	0,521	0,197	Valid
6	Availability and ease of internet access	0,584	0,197	Valid
7	The instructions provided are clear and make it easier for users to find information	0,447	0,197	Valid
8	Storage rack available	0,421	0,197	Valid
Reliabiliy				
9	Uncomplicated service procedures	0,626	0,197	Valid
10	Operational service hours	0,754	0,197	Valid

11	Maximum number of borrowed books as needed	0,516	0,197	Valid
12	Selection of books and non-books (CD, E-journal, etc.) as needed	0,507	0,197	Valid
	Responsiveness			
13	Adequate online catalog	0,755	0,197	Valid
14	Skilled lending services	0,731	0,197	Valid
15	Skilled return service	0,769	0,197	Valid
16	Library staff willing to help	0,816	0,197	Valid
	Assurance			
17	Guaranteed safekeeping of goods	0,785	0,197	Valid
18	Skillful service	0,747	0,197	Valid
19	Time of service (open / close) discipline	0,799	0,197	Valid
20	Comfort and cleanliness inside and out	0,714	0,197	Valid
	Empati (*Empathy***)**			
21	Library staff are able to communicate well with visitors	0,749	0,197	Valid
22	The library staff is polite and friendly	0,767	0,197	Valid
23	Library staff are serious when responding to visitor requests	0,814	0,197	Valid

The Test the validity of the service received (perception) is:

Table 2. Validity test of the service received (perception)

No	Attribute	r_{count}	r_{table}	Validity
	Validity Physical (T*angible)*			
1	Library room and temperature	0,711	0,197	Valid
2	Cleanliness and tidiness of the library room	0,381	0,197	Valid
3	Library chairs and tables	0,559	0,197	Valid
4	The arrangement of books on the shelves is neat	0,649	0,197	Valid
5	Library room lighting	0,597	0,197	Valid
6	Availability and ease of internet access	0,735	0,197	Valid
7	The instructions provided are clear and make it easier for users to find information	0,662	0,197	Valid
8	Storage rack available	0,693	0,197	Valid
	Reliabiliy			
9	Uncomplicated service procedures	0,694	0,197	Valid
10	Operational service hours	0,663	0,197	Valid

11	Maximum number of borrowed books as needed	0,670	0,197	Valid
12	Selection of books and non-books (CD, E-journal, etc.) as needed	0,695	0,197	Valid
Responsiveness				
13	Adequate online catalog	0,803	0,197	Valid
14	Skilled lending services	0,795	0,197	Valid
15	Skilled return service	0,789	0,197	Valid
16	Library staff willing to help	0,787	0,197	Valid
Assurance				
17	Guaranteed safe keeping of goods	0,787	0,197	Valid
18	Skillful service	0,828	0,197	Valid
19	Time of service (open / close) discipline	0,734	0,197	Valid
20	Comfort and cleanliness inside and out	0,817	0,197	Valid
Empathy				
21	Library staff are able to communicate well with visitors	0,763	0,197	Valid
22	The library staff is polite and friendly	0,770	0,197	Valid
23	Library staff are serious when responding to visitor requests	0,795	0,197	Valid

DATA RELIABILITY TEST

The data reliability test was conducted to show that the measuring instrument used in the study had reliability as a measuring instrument. The results of the reliability test manual for the expected services/interests are:

$$r_{11} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right)$$

$$= \left(\frac{23}{23-1}\right)\left(1 - \frac{9.502}{92.166}\right)$$

$$= (1.045)(1 - 0.103)$$

$$= (1.045)(0.897)$$

$$= 0.938$$

The results of the reliability test manual for services received (perceptions) are:

$$r_{11} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right)$$

$$= \left(\frac{23}{23-1}\right)\left(1 - \frac{38.822}{310.134}\right)$$

$$= (1.045)(1 - 0.125)$$

$$= (1.045)(0.875)$$

$$= 0.915$$

DETERMINATION OF FUZZY SETS

At this stage, it is done to determine the interval for each criterion and the weight given. Linguistic variables are variables that have the value of words/sentences, while those used for services are expected/interested, namely:

Table 3. Fuzzy System for expected services/interests

Universe of Conversation	Fuzzy Set Name	Domain	Range	Unit
0-100	Not important	[0-25]	$0; 0; 25$	Person
0-100	Not too important	[0-50]	$0; 25; 50$	Person
0-100	Quite important	[0-75]	$25; 50; 75$	Person
0-100	Important	[50-75]	$50; 75; 100$	Person
0-100	Very important	[75-100]	$75; 100; 100$	Person

In this study, the membership function used is the membership function of the shoulder shape curve. The shoulder shape membership function is used to terminate the variable of a fuzzy region. The left shoulder moves from right to wrong, so does the right shoulder move from wrong to right. The membership function is used for the expected service/interest in the following figure.
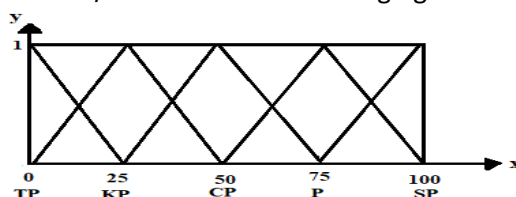

Figure 6. Function diagram of expected service membership

Table 4. Fuzzy system for services received (perception)

Universe of Conversation	Fuzzy Set Name	Domain	Range	Unit
0-100	Not satisfactory	[0-25]	$0; 0; 25$	Person
0-100	Less satisfactory	[0-50]	$0; 25; 50$	Person
0-100	Good enough	[0-75]	$25; 50; 75$	Person
0-100	Satisfying	[50-75]	$50; 75; 100$	Person
0-100	Very satisfy	[75-100]	$75; 100; 100$	Person

The membership function used for services received (perception) is shown in the following figure:
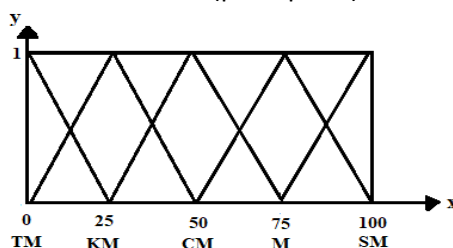

Figure 7. Functions membership service received

FUZZIFICATION AND DEFUZZIFICATION

Fuzzification is the determination of the Triangular Fuzzy Number (TFN), the Triangular Fuzzy Number (TFN) is the range of values from the weight of the respondents' answers. TFN consists of three limits, namely the middle limit value (a_i), the upper limit (b_i), and the lower limit (c_i). Fuzzification of manual calculation of attribute values from the results of the questionnaire recapitalization for the expected service/interest (x_1), namely:

1. Determination of the upper limit value (b_{x1})

$$b_{x_1} = \frac{x_{1\,2}n_1 + x_{1\,3}n_2 + x_{1\,4}n_3 + x_{1\,5}n_4 + x_{1\,5}n_5}{n_1 + n_2 + n_3 + n_4 + n_5}$$

$$= \frac{25 \cdot 0 + 50 \cdot 0 + 75 \cdot 11 + 100 \cdot 28 + 100 \cdot 61}{0 + 0 + 11 + 28 + 61}$$

$$= \frac{0 + 0 + 825 + 2800 + 6100}{100}$$

$$= \frac{9725}{100} = 97.25$$

2. Determination of the middle limit value (a_i)

$$a_{x_1} = \frac{x_{1\,1}n_1 + x_{1\,2}n_2 + x_{1\,3}n_3 + x_{1\,4}n_4 + x_{1\,5}n_5}{n_1 + n_2 + n_3 + n_4 + n_5}$$

$$= \frac{0 \cdot 0 + 25 \cdot 0 + 50 \cdot 11 + 75 \cdot 28 + 100 \cdot 61}{0 + 0 + 11 + 28 + 61}$$

$$= \frac{0 + 0 + 550 + 2100 + 6100}{100}$$

$$= \frac{8750}{100} = 87.50$$

3. Determination of the lower limit value (c_i)

$$c_{x_1} = \frac{x_{1\,1}n_1 + x_{1\,1}n_2 + x_{1\,2}n_3 + x_{1\,3}n_3 + x_{1\,4}n_4}{n_1 + n_2 + n_3 + n_4 + n_5}$$

$$= \frac{0 \cdot 0 + 0 \cdot 0 + 25 \cdot 11 + 50 \cdot 28 + 75 \cdot 61}{0 + 0 + 11 + 28 + 61}$$

$$= \frac{6250}{100} = 62.50$$

Defuzzification of manual calculation of attribute values from the results of the questionnaire recapitalization for services expected/interests (x_1), namely:

$$Defuzzification_{x_1} = \frac{a_{x_1} + b_{x_1} + c_{x_1}}{3}$$

$$= \frac{87.50 + 97.25 + 62.50}{3}$$

$$= \frac{247.25}{3} = 82.42$$

For further calculations calculated using Microsoft Excel. The results obtained are as in the following table.

Table 5. The results of the recap of values on expected services / interests and Defuzzification

No	Attribute	TFN			Defuzzification
		a_{x_i}	b_{x_i}	c_{x_i}	
1	Tangible 1	87.5	97.25	62.5	82.42
2	Tangible 2	92.75	99.5	67.75	86.67
3	Tangible 3	91.75	99	66.75	85.83
4	Tangible 4	92.25	99	67.25	86.17
5	Tangible 5	91.5	98	66.5	85.33
6	Tangible 6	92.25	98.75	67.25	86.08
7	Tangible 7	92.75	98.75	67.75	86.42
8	Tangible 8	93.25	99.5	68.25	87.00
9	Reliability 1	88.25	98.5	63.25	83.33
10	Reliability 2	90.5	98.5	65.5	84.83
11	Reliability 3	83	95	58.25	78.75
12	Reliability 4	86	96.5	61	81.17
13	Responsiveness 1	86	96.5	61.25	81.25
14	Responsiveness 2	88.5	98.25	63.5	83.42
15	Responsiveness 3	89	98.5	64	83.83
16	Responsiveness 4	90.75	98	65.75	84.83
17	Assurance 1	92	98.5	67.25	85.92
18	Assurance 2	92.25	98.75	67.25	86.08
19	Assurance 3	91.75	98.75	66.75	85.75
20	Assurance 4	91.5	98.5	66.5	85.50
21	Empathy 1	89	97.25	64	83.42
22	Empathy 2	90.25	97.5	65.25	84.33
23	Empathy 3	89.25	96.75	64.25	83.42

Table 6. The results of recap values for services received (perception) and defuzzification

No	Attribute	TFN			Defuzzification
		a_{x_i}	b_{x_i}	c_{x_i}	
1	Tangible 1	61.5	83.75	37.25	60.83
2	Tangible 2	75	93	50.5	72.83
3	Tangible 3	72	91	47.5	70.17
4	Tangible 4	64	84.75	40	62.92
5	Tangible 5	68.5	89.25	43.75	67.17
6	Tangible 6	53	74.5	30.5	52.67
7	Tangible 7	65	84.75	40.75	63.50
8	Tangible 8	72.25	88.5	48.75	69.83
9	Reliability 1	71	89	47	69.00
10	Reliability 2	66	86	42	64.67
11	Reliability 3	63.5	83.25	39.75	62.17
12	Reliability 4	57	78.5	33	56.17
13	Responsiveness 1	61.75	83.25	37.75	60.92
14	Responsiveness 2	69	89.75	45	67.92
15	Responsiveness 3	70.5	90.25	46.25	69.00
16	Responsiveness 4	67.5	87.25	43.5	66.08
17	Assurance 1	67	84.5	43.5	65.00
18	Assurance 2	68.5	87.5	44.5	66.83
19	Assurance 3	68.75	87.75	44.5	67.00
20	Assurance 4	69	88.75	44.75	67.50
21	Empathy 1	61.75	82	37.75	60.50
22	Empathy 2	64.5	84.75	40.75	63.33
23	Empathy 3	62	83.25	38.5	61.25

GAP VALUE CALCULATION SERVICE QUALITY

The value of the service quality gap is the difference between perceptions and expectations. It aims to measure the extent to which the library has provided services according to the wishes of students. Gap plays a role in providing an evaluation of how far these attributes provide satisfaction in providing services.

1. For manual calculation of gap values per attribute, namely:

    Gap = Perception – Hope

= 60.83 − 82.42

= −21.58

For further calculations calculated using Microsoft Excel. The results are obtained as in the table.

Table 7. Gap values per attribute

No	Attribute	Hope	Preception	Gap	Rank
1	Tangible 1	82.42	60.83	−21.58	17
2	Tangible 2	86.67	72.83	−13.83	1
3	Tangible 3	85.83	70.17	−15.67	5
4	Tangible 4	86.17	62.92	−23.25	21
5	Tangible 5	85.33	67.17	−18.17	9
6	Tangible 6	86.08	52.67	−33.42	23
7	Tangible 7	86.42	63.50	−22.92	19
8	Tangible 8	87.00	69.83	−17.17	7
9	Reliability 1	83.33	69.00	−14.33	2
10	Reliability 2	84.83	64.67	−20.17	13
11	Reliability 3	78.75	62.17	−16.58	6
12	Reliability 4	81.17	56.17	−25.00	22
13	Responsiveness 1	81.25	60.92	−20.33	14
14	Responsiveness 2	83.42	67.92	−15.50	4
15	Responsiveness 3	83.83	69.00	−14.83	3
16	Responsiveness 4	84.83	66.08	−18.75	10
17	Assurance 1	85.92	65.00	−20.92	15
18	Assurance 2	86.08	66.83	−19.25	12
19	Assurance 3	85.75	67.00	−18.75	10
20	Assurance 4	85.50	67.50	−18.00	8
21	Empathy 1	83.42	60.50	−22.92	19
22	Empathy 2	84.33	63.33	−21.00	16
23	Empathy 3	83.42	61.25	−22.17	18

2. For manual calculation of gap values per dimension, namely:

Gap = Perception − Hope

= 64.99 − 85.75

= −20.75

For further calculations calculated using Microsoft Excel. The results obtained are as in the table below.

Table 8. Gap values per attribute

Attribute	Hope	Preception	Gap	Rank
Tangible	85,74	64,99	−20,75	4
Reliability	82,02	63,00	−19,02	2
Responsiveness	83,33	65,98	−17,35	1
Assurance	85,81	66,58	−19,23	3
Empathy	83,72	61,69	−22,03	5

CONCLUSION

Based on the results of the research and discussion in this thesis, it can be concluded that in general it shows that each question attribute has a negative gap value, so the service is said to be of poor quality and unsatisfactory. This shows that the quality of services provided by the library needs to be improved, one of which is the Physical (Tangible) 6 attribute with questions about the availability and ease of internet access. On the value of the gap per dimension, the dimension that the USU Library needs to prioritize for improvement is the Empathy dimension.

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