



Analysis of Student Satisfaction Levels Against Services Campus STMIK Pelita Nusantara Medan using Fuzzy Servqual Method

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ABSTRACT

STMIK Pelita Nusantara Medan is a private university located in the city of Medan, North Sumatra Province. At STMIK Pelita Nusantara, there are problems that occur, namely the lack of services provided by the campus, especially in responding to student complaints, causing dissatisfaction (disappointment) and causing a sense of discomfort. Then there are no methods and systems that can support student uncertainty about campus services, so a method is needed to be able to solve this problem properly, namely the Servqual method. To overcome this, a study was conducted on the Analysis of Student Satisfaction Levels on Campus Services at STMIK Pelita Nusantara using the Fuzzy Servqual Method. The Servqual method is a method that can be used to analyze problems with a service. In the Servqual method there are 5 dimensions as a measuring tool for the level of satisfaction, namely responsiveness with 4 statements, reliability with 8 statements, assurance with 4 statements, empathy (attention) with 4 statements, and tangible (physical evidence) with 10 statements. Thus, this criterion is a criterion that many students complain about so that it needs to be corrected immediately. While the criteria that rank lowest is the dimension of Responsiveness (responsiveness) and close to the satisfaction score for students.

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1. INTRODUCTION

Higher education is a higher education that prepares and equips students to develop their potential so that they become skilled human beings. The current rapid development of technology and the presence of technology can facilitate all human activities and activities, both in everyday life and in an educational environment. In an environment of education, technology and information is needed to facilitate activities between teachers and academic activities. Education is considered important and becomes everyone's need, therefore many people continue their education to a higher level. Therefore, a university must have an information system that is complete, clear and easily accessible to all within the scope of a university, as well as people from outside. Service quality is a level of excellence that is expected to fulfill student desires. Quality starts from the needs of students and ends with the perceptions of students, not from the perceptions of universities. Students'

perceptions of service quality are a total assessment of the excellence given to higher education. STMIK

Pelita Nusantara Medan is a private university located in the city of Medan, North Sumatra Province. Since its inception, STMIK Pelita Nusantara has been a place of learning for young people who come from various regions in North Sumatra with their respective local cultures and languages. This college also provides various facilities for student needs such as a library, wifi, computer lab, and so on. The services provided are very important for the smooth and accurate completion of student studies in the college. Based on pre-research conducted in the form of interviews with STMIK Pelita Nusantara students, there are problems that occur, namely the lack of services provided by the campus, especially in responding to student complaints, causing dissatisfaction (disappointment) and causing a sense of discomfort. Then there are no methods and systems that can support student uncertainty about campus services, so a method is needed to be able to solve this problem properly, namely the Servqual method.

2. RESEARCH METHOD

2.1. Fuzzy

Fuzzy logic is one of the building blocks of soft computing[1]. Fuzzy logic was first introduced by Prof. Lotfi A. Zadeh in 1965[2], [3]. The basis of fuzzy logic is the theory of fuzzy sets[4]. In fuzzy set theory, the role of the degree of membership as a determinant of the existence of elements in a set is very important[5]. The value of membership or the degree of membership or membership function is the main feature of reasoning with this fuzzy logic[6].

2.2. Fuzzy Servqual

Fuzzy Servqual is a fuzzy set theory that is used as a means of presenting uncertainty and is a tool for modeling uncertainty related to obscurity, uncertainty and deficiencies regarding information related to certain elements and the problems faced to measure the value of the perception and expectation gap[7][8].

The Servqual method consists of 5 dimensions of service quality, namely[9]–[11]:

1. Tangibles or physical evidence: namely in relation to the attractiveness of physical facilities, equipment and materials used by the company and the appearance of employees.
2. Reliability: which relates to the company's ability to provide accurate service from the first time without making any mistakes and delivering its services according to the agreed / promised time promptly and satisfactorily.
3. Responsiveness: which refers to the willingness and ability of employees to help customers and respond to their requests, as well as informing when services will be provided and then providing services quickly and responsively.
4. Assurance: the behavior of employees is able to foster customer trust in the company and the company can create a sense of security for its customers. Assurance also means that employees are always courteous and have the knowledge and skills needed to handle any customer question or problem.
5. Emphaty or empathy: which means that the company understands the problems of its customers and acts in the interests of customers, as well as giving personal attention to customers and having comfortable operating hours.

3. RESULTS AND DISCUSSION

Analysis is a problem-solving technique by breaking the system into components with the aim of studying these components work and interacting to complete their goals. Data Analysis At this stage, data analysis and system requirements will be made. At this stage there will also be an application design analysis of the level of student satisfaction with the STMIK Pelita Nusantara campus services using the fuzzy Servqual method.

| No Pert | Dimensi Servqual | Variabel Pertanyaan Kualitas Pelayanan |
|---------|----------------------------|---|
| P1 | Bentuk fisik (Tangible) | Penampilan pegawai terlihat rapi dan sopan |
| P2 | | Lokasi Gedung yang Strategis |
| P3 | | Kualitas Layanan Perpustakaan |
| P4 | | Kondisi Kelas terlihat nyaman, bersih dan rapi |
| P5 | | Kelengkapan fasilitas Kampus yang memadai (AC, Lift, dll) |
| P6 | | Tersedianya area parkir kendaraan yang aman dan nyaman |
| P7 | | Ketersediaan alat yang mendukung kegiatan pembelajaran (Projektor, Papan Tulis, Dll). |
| P8 | | Kondisi dan kelengkapan komputer lab |
| P9 | | Tersedianya Mushola yang nyaman dan bersih |
| P10 | | Tersedianya kantin untuk melayani kebutuhan makanan dan minuman. |

Figure 1. Criteria

Application of the Fuzzy Servqual Method

Determination of the fuzzy set is done to determine the score that should be given by respondents for each criterion proposed in the questionnaire. The method of determination is shown in Figure 2 below:

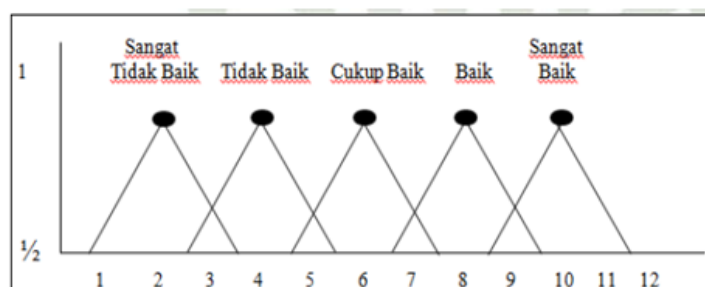


Figure 2. Fuzzy set determination

Thus, the value used in determining the weight (score) that we use to determine the level of service quality from the calculation of the fuzzification value is as follows:

- Category 1 = very bad with a score of 1,2,3,4 (covering the answers to the Perception / Hope questionnaire, namely Strongly Disagree / Strongly Not Expected).
- Category 2 = Not Good with a score of 3,4,5,6 (covering the answers to the Perception / Expectations questionnaire, namely Disagree / Not Expected).
- Category 3 = Good Enough with a score of 5,6,7,8 (covering the answers to the Perception / Expectations questionnaire, namely Agree / Fairly Expected).
- Category 4 = Good with a score of 7,8,9,10 (includes answers to the Perception / Hope questionnaire, namely Agree / Fairly Expected).
- Category 5 = Very Good with a score of 9,10,11,12 (includes answers to the Perception / Hope questionnaire, namely Strongly Agree / Highly Expected)

1. Fuzzyfication

At this stage, fuzzification calculations are carried out to obtain the lower limit (c), middle limit (a), and upper limit (b) which are the values of the Triangular Fuzzy Number (TFN). To calculate the fuzzification value, it can be done with the following formula:

Lower limit value (c_i):

$$c_i = \frac{b_{i1*n_1} + b_{i1*n_2} + b_{i2*n_3} + \dots + b_{i(k-1)*n_k}}{n_1 + n_2 + \dots + n_k}$$

Middle limit value (a_i):

$$a_i = \frac{b_{i1*n_1} + b_{i2*n_2} + b_{i3*n_3} + \dots + b_{ik*n_k}}{n_1 + n_2 + \dots + n_k}$$

Upper limit value (b_i):

$$b_i = \frac{b_{i2} \cdot n_1 + b_{i3} \cdot n_2 + \dots + b_{ik} \cdot n_{i(k-1)} + b_{ik} \cdot n_k}{n_1 + n_2 + \dots + n_k}$$

Information

b_i = average value of interest level fuzzy set

n = number of respondents with importance level

| Kode Pertanyaan | TFN | | |
|--------------------|------|------|------|
| | C | A | B |
| P1 | 7 | 8,5 | 10 |
| P2 | 6,84 | 8,34 | 9,84 |
| P3 | 6,48 | 7,98 | 9,48 |
| P4 | 6,04 | 7,54 | 9,04 |
| P5 | 6,8 | 8,3 | 9,8 |

Figure 1. The results of perceptual fuzzyfication

| Kode Pertanyaan | TFN | | |
|--------------------|------|------|-------|
| | C | A | B |
| 1 | 7,92 | 9,42 | 10,92 |
| P2 | 7,88 | 9,38 | 10,88 |
| P3 | 7,8 | 9,3 | 10,8 |
| P4 | 7,96 | 9,46 | 10,96 |
| P5 | 7,84 | 9,34 | 10,84 |

Figure 2. Expected fuzzyfication results

2. Defuzzification

The next step is to calculate the defuzzification value from the perceptions and expectations. This defuzzification is carried out to obtain a single, representative value. The following is the defuzzification calculation for the level of perception in the P1 statement variable for further calculations carried out with the same calculation using the Arithmetic Mean formula, namely:

$$\mu A \cap B = (\mu A[x] + \mu B[y])/2$$

| NO | Kode Pertanyaan | TFN | | | DEFUZYFIKASI | RANK |
|----|--------------------|------|------|------|--------------|------|
| | | C | A | B | | |
| 1 | P1 | 7 | 8,5 | 10 | 9,25 | 8 |
| 2 | P2 | 6,84 | 8,34 | 9,84 | 9,09 | 16 |
| 3 | P3 | 6,48 | 7,98 | 9,48 | 8,73 | 26 |
| 4 | P4 | 6,04 | 7,54 | 9,04 | 8,29 | 30 |
| 5 | P5 | 6,8 | 8,3 | 9,8 | 9,05 | 20 |

Figure 3. The result of perceptual defuzzification

| NO | Kode Pertanyaan | TFN | | | DEFUZYFIKASI | RANK |
|----|--------------------|------|------|-------|--------------|------|
| | | C | A | B | | |
| 1 | P1 | 7,92 | 9,42 | 10,92 | 10,17 | 5 |
| 2 | P2 | 7,88 | 9,38 | 10,88 | 10,13 | 6 |
| 3 | P3 | 7,8 | 9,3 | 10,8 | 10,05 | 10 |
| 4 | P4 | 7,96 | 9,46 | 10,96 | 10,21 | 4 |
| 5 | P5 | 7,84 | 9,34 | 10,84 | 10,09 | 8 |

Figure 4. Expectation defuzzyfication results

3. Gap Value Determination

Calculation Results of Gap Value per Statement Variable. The gap value per statement variable is obtained based on the difference between the perceived value and the expected value. It is used to determine the quality of service at the STMIK Pelita Nusantara Medan campus. To see the results of the calculation of the gap value per statement variable can be seen in the figure below:

| Dimensi | Kode Pertanyaan | Defuzzyfikasi | Defuzzyfikasi | Gap | RANK |
|-----------|--------------------|---------------|---------------|-------|------|
| | | Persepsi | Harapan | | |
| Tangibles | P1 | 9,25 | 10,17 | -0,92 | 15 |
| | P2 | 9,09 | 10,13 | -1,04 | 8 |
| | P3 | 8,73 | 10,05 | -1,32 | 4 |
| | P4 | 8,29 | 10,21 | -1,92 | 1 |
| | P5 | 9,05 | 10,09 | -1,04 | 9 |

Figure 5. Gap results per statement variable

| Dimensi Servqual | Persepsi | Harapan | Gap | Rank |
|-----------------------|----------|---------|---------|------|
| <i>Tangibles</i> | 8,934 | 10,05 | -1,116 | 5 |
| <i>Reliability</i> | 9,115 | 9,9675 | -0,8525 | 4 |
| <i>Responsiveness</i> | 9,23 | 9,9 | -0.67 | 1 |
| <i>Assurance</i> | 9.2 | 9.91 | -0.71 | 2 |
| <i>Empahty</i> | 9.24 | 9,9725 | -0.7325 | 3 |

Figure 6. Five Dimensional Servqual Gap Results

After processing data on each dimension, from the table above it can be seen that all dimensions are prioritized for improvement. But from these results the dimension of Responsiveness is almost close to the satisfaction score for students and is followed by the dimensions of Assurance and Empathy, Realibility and Tangibles in other words, this dimension is very far from student expectations.

4. Implementation

The implementation of the interface is an interface design that will be used as an intermediary for the user and the software used. The interface implementation of the satisfaction level analysis application design is as follows:

a. Login page

The login page, the admin ensures that the username and password are validated into the database, entering the application must be absolutely guaranteed safe from irresponsible hands or persons. So that the data collected is guaranteed to be true. The implementation of the login form design of the satisfaction level analysis application design using the Unified Modeling Language (UML) method.

The login form aims for the username and password to enter the main menu. The submit button functions for admin to enter the main menu of the system.

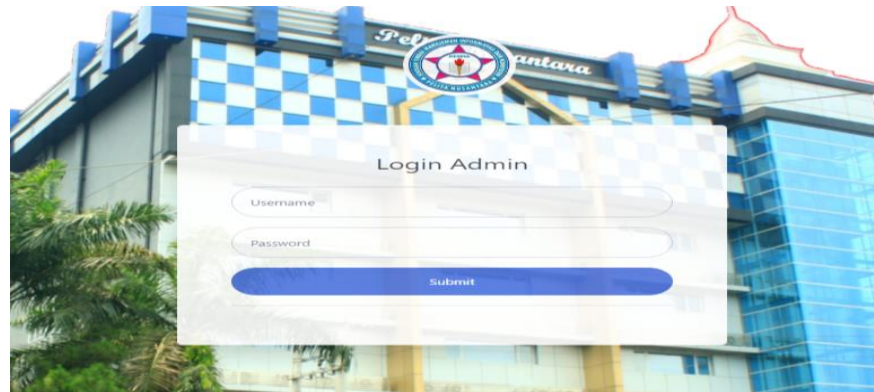


Figure 7. Display Login Form

b. Admin Home Page

This main menu form is created to call other menu forms, such as Defuzzification, Gaps, Results and questions.

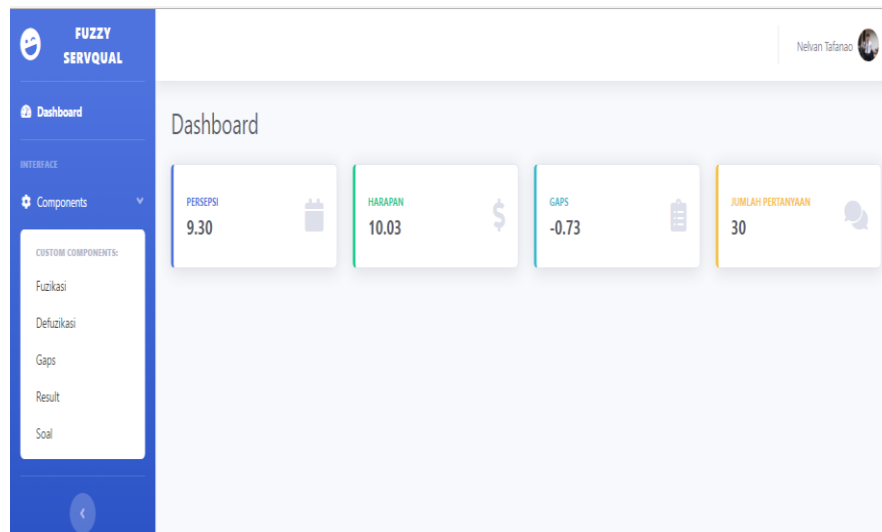


Figure 8. Admin Homepage

c. Questionnaire page

The questionnaire data form is data in the form of questions asked to students who will go through the process of analyzing the level of student satisfaction with campus services.

1. The Physical Display, Responsiveness, Reliability, Assurance and Empathy buttons function to see and fill in some of the questions filled in by students.
2. The Save button functions to store a new data input into the system.



| No | Pertanyaan | Persepsi | | | | | Harapan | | | | |
|----|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | | STS | TS | KS | S | SS | STP | TP | KP | P | SP |
| 1 | Penampilan pegawai terlihat rapi dan sopan | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2 | Lokasi Gedung yang Strategis | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3 | Kualitas Layanan Perpustakaan | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4 | Kondisi Kelas terlihat nyaman, bersih dan rapi | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5 | Kelengkapan fasilitas Kampus yang memadai (AC, Lift, dll) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6 | Tersedianya area parkir kendaraan yang aman dan nyaman | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7 | Ketersediaan alat yang mendukung kegiatan pembelajaran (Projektor, Papan Tulis, dll) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 8 | Kondisi dan kelengkapan komputer lab | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 9 | Tersedianya Mushola yang nyaman dan bersih | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 10 | Tersedianya kantin untuk melayani kebutuhan makanan dan minuman | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Figure 9. Display of the Questionnaire Page Form

d. Fuzzyfication Process page

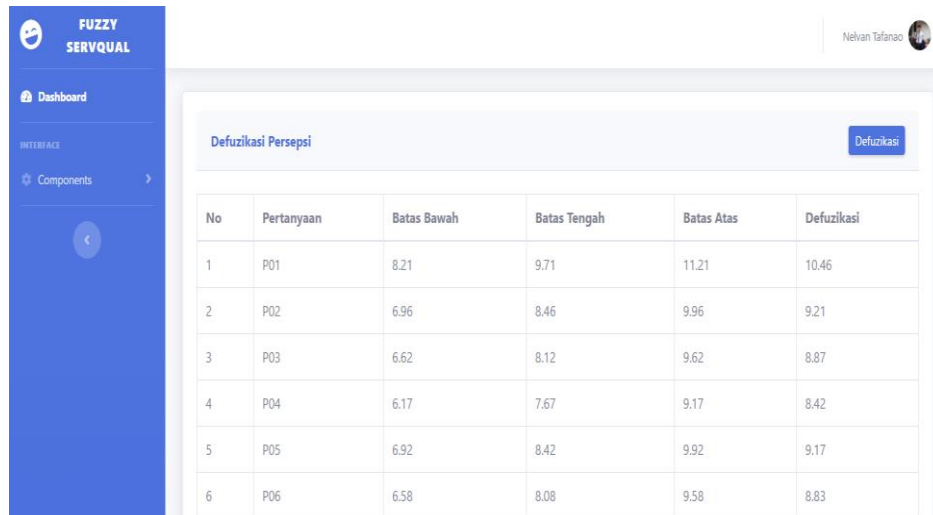
Fuzzyfication page to find the lower, middle and upper limit values.

| No | Pertanyaan | Batas Bawah | Batas Tengah | Batas Atas |
|----|------------|-------------|--------------|------------|
| 1 | P01 | 8.21 | 9.71 | 11.21 |
| 2 | P02 | 6.96 | 8.46 | 9.96 |
| 3 | P03 | 6.62 | 8.12 | 9.62 |
| 4 | P04 | 6.17 | 7.67 | 9.17 |
| 5 | P05 | 6.92 | 8.42 | 9.92 |
| 6 | P06 | 6.58 | 8.08 | 9.58 |

Figure 10. Display of Fuzzyfication Process Page Form

e. Defuzzyfication Process page

Defuzzyfication page is the result of calculation of fuzzy set data obtained from the perception and expectation values based on the lower, middle and upper limit values. The Defuzzyfication button functions to calculate the value of perceptions and expectations.

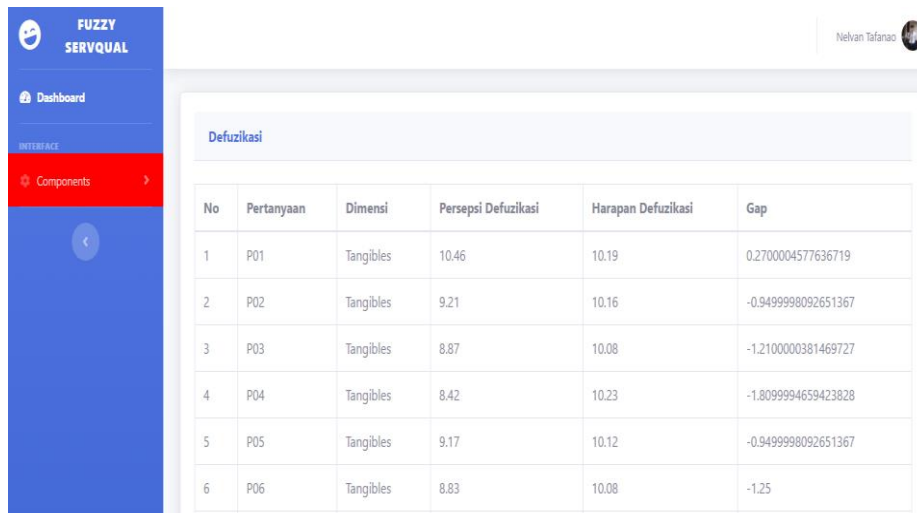


| No | Pertanyaan | Batas Bawah | Batas Tengah | Batas Atas | Defuzzikasi |
|----|------------|-------------|--------------|------------|-------------|
| 1 | P01 | 8.21 | 9.71 | 11.21 | 10.46 |
| 2 | P02 | 6.96 | 8.46 | 9.96 | 9.21 |
| 3 | P03 | 6.62 | 8.12 | 9.62 | 8.87 |
| 4 | P04 | 6.17 | 7.67 | 9.17 | 8.42 |
| 5 | P05 | 6.92 | 8.42 | 9.92 | 9.17 |
| 6 | P06 | 6.58 | 8.08 | 9.58 | 8.83 |

Figure 11. Display of Deffuzification Process Form

f. Gap Value page

Implementation of the Gap Value Form aims to determine the value of the gap between Perceptions and Expectations.



| No | Pertanyaan | Dimensi | Persepsi Defuzzikasi | Harapan Defuzzikasi | Gap |
|----|------------|-----------|----------------------|---------------------|---------------------|
| 1 | P01 | Tangibles | 10.46 | 10.19 | 0.2700004577636719 |
| 2 | P02 | Tangibles | 9.21 | 10.16 | -0.9499998092651367 |
| 3 | P03 | Tangibles | 8.87 | 10.08 | -1.2100000381469727 |
| 4 | P04 | Tangibles | 8.42 | 10.23 | -1.8099994659423828 |
| 5 | P05 | Tangibles | 9.17 | 10.12 | -0.9499998092651367 |
| 6 | P06 | Tangibles | 8.83 | 10.08 | -1.25 |

Figure 12. Display Gap Value Form

4. CONCLUSION

Design and manufacture of analysis system applications for the level of student satisfaction with the campus services of STMIK Pelita Nusantara Medan using UML (Unified Method language), namely use case diagrams, activity diagrams, class diagrams. Php programming language, Mysql Database, and Servqual (Service Quality) method as a method in making a student satisfaction level analysis system. Based on the processing and analysis of fuzzy servqual data per criteria, it can be seen that the level of service quality at the STMIK Pelita Nusantara Medan campus as a whole has a negative value. So that students are not satisfied with the services provided. The criterion that has the highest gap value is the Tangibels dimension value. Thus this criterion is a criterion that many students complain about so that it needs to be corrected immediately. While the criterion that ranks the lowest is the value of the Responsiveness dimension and approaches the value of satisfaction for students.

REFERENCES

- [1] L. A. Zadeh and R. A. Aliev, "Introduction to Fuzzy Logic Control," in *Fuzzy Logic Theory and*

- Applications*, 2018.
- [2] P. Melin and O. Castillo, "A review on the applications of type-2 fuzzy logic in classification and pattern recognition," *Expert Systems with Applications*. 2013, doi: 10.1016/j.eswa.2013.03.020.
 - [3] O. Castillo, L. Amador-Angulo, J. R. Castro, and M. Garcia-Valdez, "A comparative study of type-1 fuzzy logic systems, interval type-2 fuzzy logic systems and generalized type-2 fuzzy logic systems in control problems," *Inf. Sci. (Ny)*, 2016, doi: 10.1016/j.ins.2016.03.026.
 - [4] V. Yasin, M. Zarlis, and M. K. M. Nasution, "Filsafat Logika Dan Ontologi Ilmu Komputer," *J. Inf. Syst. Applied, Manag. Account. Res.*, 2018.
 - [5] A. R. Wardani, Y. N. Nasution, and F. D. T. Amijaya, "Aplikasi Logika Fuzzy Dalam Mengoptimalkan Produksi Minyak Kelapa Sawit Di PT. Waru Kaltim Plantation Menggunakan Metode Mamdani," *Inform. Mulawarman J. Ilm. Ilmu Komput.*, 2017, doi: 10.30872/jim.v12i2.651.
 - [6] Handi, H. Fitriyah, and G. E. Setyawan, "Sistem Pemantauan Menggunakan Blynk dan Pengendalian Penyiraman Tanaman Jamur Dengan Metode Logika Fuzzy," *J. Pengemb. Teknol. Inf. dan Ilmu Komput.*, 2019.
 - [7] P. S. Putra, "Analisis Kualitas Pelayanan Dengan Menggunakan Pendekatan Metode Fuzzy Service Quality (Fuzzy SERVQUAL)," *Progr. Stud. Tek. Ind. Univ. Islam Indones. Yogyakarta*, 2017.
 - [8] S. Behdioğlu, E. Acar, and H. A. Burhan, "Evaluating service quality by fuzzy SERVQUAL: a case study in a physiotherapy and rehabilitation hospital," *Total Qual. Manag. Bus. Excell.*, 2019, doi: 10.1080/14783363.2017.1302796.
 - [9] E. Sutinah and O. R. Simamora, "Metode Fuzzy Servqual Dalam Mengukur Kepuasan Pasien Terhadap Kualitas Layanan BPJS Kesehatan," *J. Inform.*, 2018, doi: 10.31311/ji.v5i1.2944.
 - [10] G. P. Subagya, "Penerapan Metode Fuzzy Service Quality untuk Melihat Kepuasan Nasabah terhadap Pelayanan PT . Bank," *PENERAPAN Metod. FUZZY Serv. Qual. UNTUK MELIHAT KEPUASAN NASABAH TERHADAP PELAYANAN PT. BANK MANDIRI KCP MEDAN CITRA Gard.*, 2018.
 - [11] S. Pendidikan *et al.*, "METODE FUZZY SERVQUAL DI BENGKEL HYUNDAI WIYUNG SURABAYA Raniya Nur Ningsih Dyah Riandadari Abstrak," *Anal. Kualitas Pelayanan Terhadap Jasa Serv. Berk. Berbas. Metod. Fuzzy Servqual Di Bengkel Hyundai Wiyung Surabaya*, 2019.