Measurement at Student Service Satisfaction Using Fuzzy Service Quality Method at Indramayu State Polytechnic

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Abstract. Providing satisfaction to students and preventing students from all campus facilities services is very important to improve the quality of higher education. Therefore, this study aims to build a system to measure student satisfaction with campus services using the fuzzy servqual method. The number of samples is 100 students. The measuring instrument used in the study was declared valid with a significance level of 5% or a 95% confidence level. The reliability test with the result of 0.746 means that the measuring instrument used has high mobility. Data processing is done by calculating the value of fuzzification, defuzzification, and calculating the value of GAP between students' perceptions and expectations. From the results of the fuzzy servqual gap ranking with 5 variables, it shows that empathy gets to level 1 with the smallest value of -0.74. Level 2 is an assurance with a value of -0.85; then level 3 is reliability with a gap value of -0.89, the 4th position is the reaction force with a gap value of -0.97, and the 5th position is real with a value of -1.27. The results obtained can help the Indramayu State Polytechnic in improving the performance and quality of service.

1 Introduction

An important factor in increasing progress in every aspect of the world is one of them, which is education [1]. In Indonesia, education is divided into several levels, and college is the final level of education based on Law Number 12 of 2012 on higher education. At present, the number of universities in Indonesia reaches 4,574.

Higher education as a community service institution in education has an important role as a vehicle to develop and shape its students into high-quality graduates ready in the face of competition in this modern era. Therefore, the quality of higher education needs to be observed to produce quality graduates. Higher education's internal quality assurance system is the plan, implementation, control, and development of high-quality standards consistently

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and continuously to obtain stakeholder satisfaction and graduate quality assurance following assigned competencies [2,3].

One of the ways to compete, every college is required to be able to develop and improve its quality. Improving the quality is the right strategy to achieve an international scale college or a World Class University. Higher education services can be rated good and quality based on the good achievements of teaching staff, administrative staff and existing facilities. To provide a level of satisfaction to the number of students with the services provided and in accordance with what students expect to improve the quality of campus services.

The problem is the choice of the university to provide services for students such as adequate internet access, good computer labs, a comfortable library and a complete collection of books, comfortable and safe vehicles and other services, in order to provide something profitable for the campus, in this case providing satisfaction for students as well as free student dissatisfaction on all campus facility services [4]. Measuring the level of student satisfaction with the service becomes important and must be done by the university.

Satisfaction level analysis has been done by several researchers the world, one of the successes is to measure the satisfaction level of e-learning services using fuzzy servqual at Universiti Pendidikan Indonesia with 21 respondents obtained a gap value of -1.584 with a perceived value of 7.695 and an expectation of 9.277 [5]. Analysis of the quality level of outpatients in PUSKESMAS Baktiya using the fuzzy-servqual method has been successfully done with a value of 5.5. The results of defuzzification can be seen from the expected value of the quality of outpatient services [6]. Fuzzy Service Quality has been implemented to measure student service satisfaction at Universiti Dian Nuswantoro Semarang. The results of the overall gap calculation show a negative gap value with the meaning that the perception or service that users do not meet student expectations [1].

The success and success of fuzzy servqual in solving the satisfaction with the service are very appropriate if implemented at the Indramayu State Polytechnic. Indramayu State Polytechnic is the only polytechnic in region III of Cirebon. The number of students of 1,229 in the academic year 2019/2020 is based on the emergence of questions about the quality of campus services provided by the campus is in line with what is promised to students.

2 Materials and Methods

2.1 Materials

The research took place at Indramayu State Polytechnic, West Java, Indonesia. The study material used a web-based information system. Development system on a virtual private server with the domain http://kpm.polindra.ac.id. With web-based technologies that can be reached to all networks, the data collection process becomes faster and more effective. Measuring material in the form of a questionnaire for Indramayu state polytechnic students.

Data collection using sampling techniques to students from 3 (three) departments at Indramayu State Polytechnic. Sampling in empirical research is defined as the process of selecting or determining a sample (samples). Conventionally, the concept of a sample refers to a section of the population. The number of respondents of the study used was 100 students from 3 majors. The following are the measuring instruments used in the questionnaire:
Table 2. Questionnaire Measurement Tool.

| No. | Question Attributes                                                                 |
|-----|--------------------------------------------------------------------------------------|
| 1   | Comfort, cleanliness and safety of the college board                                  |
| 2   | Completeness, comfort, maximum cleanliness                                           |
| 3   | Completeness, comfort, cleanliness of the library                                     |
| 4   | Completeness, comfort, cleanliness and ease of exercise                               |
| 5   | Comfort, cleanliness and availability of a train location                             |
| 6   | Comfort, cleanliness, completeness and safety of the Student Activity Unit cubicles   |
| 7   | Hotspot broadband availability                                                       |
| 8   | Comfort, cleanliness and safety of the prayer room (mosque)                           |
| 9   | The comfort, completeness, cleanliness and safety of the room await during class breaks|
| 10  | Availability of Green Areas                                                          |
| 11  | Comfort, completeness, and safety of campus operating vehicles                       |
| 12  | Comfort, completeness and cleanliness of the Tandas-WC room                           |
| 13  | Curriculum and learning process                                                      |
| 14  | Quality and eligibility Lecturer                                                     |
| 15  | Lecture and practicum atmosphere                                                     |
| 16  | The material presented by the penyarah was clear and pleased to be understood        |
| 17  | Alumni quality                                                                       |
| 18  | Respect and appropriateness in reverence                                             |
| 19  | The overall quality of service in supporting the smooth running of college activities |
| 20  | Conformity, Accuracy and Accuracy of SIAKAD Period (Academic Information System)     |
| 21  | Knowledge and skills acquired after college                                          |
| 22  | Mastery of the field of work                                                         |
| 23  | Campus safety                                                                        |
| 24  | Initiative in helping                                                                 |
| 25  | Hospitality, courtesy and attitude in serving                                        |
| 26  | Good communication between students and positions is established                     |

The instrument used to measure service quality was a written questionnaire or list of questions (statements) distributed to users, using a Likert scale. There are usually several types of Likert scales used, namely:

Table 3. Likert scale.

| Scale | Perception     | Expectation     |
|-------|----------------|-----------------|
| 1     | Very Dissatisfied | Very unimportant |
| 2     | Dissatisfied     | Not too important |
| 3     | Quite satisfied  | Quite important  |
| 4     | Satisfied        | Important        |
| 5     | Very satisfied   | Very important   |
The Likert perception scale provides information on the respondents’ state of satisfaction with the measured questions. Meanwhile, the Likert expectation scale provides information on respondents’ satisfaction expectations with the measured questions.

### 2.2 Methods

#### 2.2.1 Service Quality (Servqual)

Service quality can be interpreted as a comparison between customer trust and service perception. The SERVQUAL model developed by Parasuraman et al. (1985) is one of the most widely used service quality measurement models to identify the gap between customers and service providers. In the SERVQUAL model, there are five dimensions of service quality that include aspects of tangibles, reliability, responsiveness, assurance, and empathy. An explanation of the five dimensions can be seen in table 4.

| Dimension   | Explanation of dimensions                        |
|-------------|-------------------------------------------------|
| Tangible    | The ability to display physical facilities and infrastructure |
| Reliability | The ability to provide services as promised accurately and reliably |
| Responsiveness | Willingness to help and provide fast and appropriate service to customers |
| Assurance   | The ability of service providers to grow the trust of customers |
| Empathy     | Give personal attention and understand the desires of customers |

#### 2.2.2 Fuzzy

Fuzzy set theory is a mathematical framework used to represent uncertainty, ambiguity, uncertainty, lack of information, and partial truth. Lack of information in problem-solving is often found in various areas of life. Discussions about ambiguity have been going on since 1937, when a philosopher named Max Black put forward his opinion on ambiguity.

Convert the scale value to a fuzzy number from the input variable for each attribute as in table 3. Here are the steps to solve the servqual fuzzy algorithm:[9,10]

**Step 1: Determine the fuzzy set for the linguistic variables and measurement scale.**

In this step, each value given by the respondent in the questionnaire for each attribute will be calculated. Calculations are made on perceptions and expectations. The calculation is done using the following equation:

\[
A_1 + A_2 = (a_1 + a_2, b_1 + b_2, c_1 + c_2)
\]

**Step 2: Determine the fuzzy set for the linguistic variables and measurement scale**

In identifying user perceptions and expectations, linguistic variables are used. The measurement scale used is as shown in table 5.

| TFN   | Perception      | Expectation       |
|-------|-----------------|-------------------|
| 1,1,2 | Very Dissatisfied | Very unimportant |
| 1,2,3 | Dissatisfied     | Not too important |
| 2,3,4 | Quite satisfied  | Quite important   |
| 3,4,5 | Satisfied        | Important         |
| 4,6,6 | Very satisfied   | Very important    |
Step 3: Establishment of TFN value perceptions and value of user expectations
The fuzzy calculation process is performed to form the TFN of the perceived value and the expected value of the user. Calculation to get the average weight of all users using the arithmetic mean with the following equation:

\[ a_m = \frac{a_{m1} + a_{m2} + a_{m3} + \ldots a_{mi}}{N} \]  

\[ b_m = \frac{b_{m1} + b_{m2} + b_{m3} + \ldots b_{mi}}{N} \]  

\[ c_m = \frac{c + c_{m2} + c_{m3} + \ldots c_{mi}}{N} \]

Step 4: Get a single value from the average weight of each variable
The next step confirms the fuzzification value obtained using the defuzzification calculation. The result of defuzzification will be the single value of the average weight of each variable. The defuzzification stage uses the following equation:

\[ X = \frac{a_m + b_m + c_m}{3} \]

Step 5: Calculate the gap for each attribute
The role of each attribute gap will show how important these attributes are in providing improved service quality. After getting the defuzzification value for perception and defuzzification for expectation, the gap for each attribute can be calculated using the following equation.

\[ Gap_i = MA_{pi} - MA_{ei} \]

3 Implementation
The fuzzy servqual application to determine student satisfaction with campus services was performed by testing questionnaires with validity and reliability tests. The total number of respondents was 100 students with table r-0.195. Table R is a table of numbers commonly used to test the test results of the validity of study instruments.

|        | Perception | Expectation |
|--------|------------|-------------|
|        | r-table 0.195 | r-table 0.195 |
| P1     | 0.606     | Valid       | H1    | 0.386  | Valid   |
| P2     | 0.570     | Valid       | H2    | 0.396  | Valid   |
| P3     | 0.492     | Valid       | H3    | 0.405  | Valid   |
| P4     | 0.510     | Valid       | H4    | 0.353  | Valid   |
| P5     | 0.519     | Valid       | H5    | 0.421  | Valid   |
| P6     | 0.615     | Valid       | H6    | 0.440  | Valid   |
| P7     | 0.577     | Valid       | H7    | 0.335  | Valid   |
| P8     | 0.464     | Valid       | H8    | 0.492  | Valid   |
| P9     | 0.671     | Valid       | H9    | 0.449  | Valid   |
| P10    | 0.581     | Valid       | H10   | 0.333  | Valid   |
| P11    | 0.560     | Valid       | H11   | 0.359  | Valid   |
| P12    | 0.534     | Valid       | H12   | 0.474  | Valid   |
If we look at the diagram, at $df$ or N 100 with a significance level of 5%, the value of $r$ is 0.195. If the calculated value of $r$ is $> r$ table value, then the item on the question instrument is said to be valid or there is a correlation between the linked variables. However, if the calculated value of $r$ is $< r$ table value, then the item on the instrument is invalid or this means that there is no relationship between the linked variables. This $R$ count was obtained from the test results with SPSS. The next step is a reliability test with results as shown in Table 7.

| Perception | Expectation |
|------------|-------------|
| $r$-table 0.195 | $r$-table 0.195 |
| P13 0.650 Valid | H13 0.493 Valid |
| P14 0.564 Valid | H14 0.536 Valid |
| P15 0.708 Valid | H15 0.535 Valid |
| P16 0.639 Valid | H16 0.524 Valid |
| P17 0.368 Valid | H17 0.389 Valid |
| P18 0.674 Valid | H18 0.481 Valid |
| P19 0.640 Valid | H19 0.495 Valid |
| P20 0.670 Valid | H20 0.624 Valid |
| P21 0.604 Valid | H21 0.531 Valid |
| P22 0.511 Valid | H22 0.479 Valid |
| P23 0.495 Valid | H23 0.497 Valid |
| P24 0.432 Valid | H24 0.582 Valid |
| P25 0.704 Valid | H25 0.471 Valid |
| P26 0.524 Valid | H26 0.501 Valid |

Table 7. Case Processing Summary.

| Cases | N | % |
|-------|---|---|
| Valid | 100 | 100.0 |
| Excluded | 0 | 0.0 |
| Total | 100 | 100.0 |

Table 8. Reliability Statistics.

| Cronbach. Alpha | N of Items |
|-----------------|------------|
| 0.746 | 53 |

Reliability testing refers to the understanding that the instruments used in research to obtain the information used are reliable as data collection tools and can reveal real information in the field. Reliability testing is also a tool for measuring questionnaires that are indicators of variables or constructs. A questionnaire is said to be reliable or trustworthy if a person’s answer to the statement is consistent or stable over time. The reliability test results of table 8 show that the measuring instrument used is of high reliability indicated by the value
of rxx 0.746 close to the number 1. In general, the reliability is considered satisfactory if $\geq 0.700$.

The characteristics of the respondents are Indramayu State Polytechnic students with a composition of 13 Departments of Informatics Engineering, 17 Departments of Mechanical Engineering and 70 Departments of Air Conditioning and Air Conditioning Engineering as shown in Figure 1.

![Characteristics of respondents in 2021](image)

**Fig. 1.** Characteristics of Respondents.

The next step is to calculate the number of answers on the respondents' Likert scale based on equation 1. The results of the calculation of perceptions and expectations are shown in Table 9.

**Table 9.** Number of respondents based on Likert scale.

| No. | Question                                                                 | Perception | | | | | | | | Expectation |
|-----|--------------------------------------------------------------------------|------------|---|---|---|---|---|---|---|---|
| 1   | Comfort, cleanliness and safety of the college board                     | 2          | 26 | 26 | 39 | 7  | 1  | 0  | 8  | 23 | 68 |
| 2   | Completeness, comfort, maximum cleanliness                              | 1          | 27 | 26 | 34 | 12 | 0  | 0  | 10 | 17 | 73 |
| 3   | Completeness, comfort, cleanliness of the library                       | 0          | 8  | 31 | 45 | 16 | 0  | 1  | 13 | 25 | 61 |
| 4   | Completeness, comfort, cleanliness and ease of exercise                 | 25         | 30 | 20 | 21 | 4  | 1  | 2  | 15 | 35 | 47 |
| 5   | Comfort, cleanliness and availability of a train location               | 8          | 32 | 22 | 28 | 10 | 0  | 0  | 11 | 27 | 62 |
| 6   | Comfort, cleanliness, completeness and safety of the Student Activity Unit cubicles | 11         | 26 | 26 | 32 | 5  | 0  | 0  | 13 | 24 | 63 |
| 7   | Hotspot broadband availability                                         | 8          | 36 | 22 | 26 | 8  | 0  | 0  | 9  | 12 | 79 |
| 8   | Comfort, cleanliness and safety of the prayer room (mosque)             | 1          | 16 | 19 | 49 | 15 | 0  | 0  | 6  | 17 | 77 |
| 9   | The comfort, completeness, cleanliness and safety of the room await during class breaks | 13         | 30 | 24 | 28 | 5  | 0  | 0  | 13 | 28 | 59 |
| 10  | Availability of Green Areas                                            | 18         | 37 | 19 | 20 | 6  | 0  | 1  | 10 | 18 | 71 |
| 11  | Comfort, completeness, and safety of campus operating vehicles          | 14         | 25 | 22 | 33 | 6  | 0  | 1  | 13 | 31 | 55 |
| 12  | Comfort, completeness and cleanliness of the Tandas-WC room              | 12         | 26 | 29 | 25 | 8  | 0  | 0  | 14 | 19 | 67 |
| 13  | Curriculum and learning process                                        | 2          | 17 | 21 | 54 | 6  | 0  | 0  | 7  | 20 | 73 |
| 14  | Quality and eligibility Lecturer                                       | 0          | 10 | 29 | 52 | 9  | 0  | 0  | 8  | 18 | 74 |
| 15  | Lecture and practicum atmosphere                                       | 1          | 13 | 27 | 47 | 12 | 0  | 0  | 10 | 19 | 71 |
| 16  | The material presented by the penyarah was clear and pleased to be understood | 0          | 16 | 38 | 38 | 8  | 0  | 0  | 9  | 16 | 75 |
| 17  | Alumni quality                                                          | 2          | 11 | 34 | 43 | 10 | 1  | 1  | 17 | 21 | 60 |
| 18  | Respect and appropriateness in reverence                               | 7          | 22 | 24 | 38 | 9  | 0  | 0  | 9  | 29 | 62 |
Table 9 provides information that question number 1 respondents answered the perception of Likert scale 1, which is 11 students, Likert scale 2 is 26 students, Likert scale 3 is 26 students, Likert scale 4 is 32 students and Likert scale 5 is 5 students. While question number 1, respondents answered the expectation of Likert scale 1, which is 0 students, Likert scale 2 is 0 students, Likert scale 3 is 13 students, Likert scale 4 is 24 students and Likert scale 5 is 63 students.

Table 10. Student Satisfaction Defuzzification.
After knowing the result of the respondent's Likert scale, the next step is to calculate the fuzzy by applying equations 2 and 3 so as to produce the value of deflux education perception ($X_p$) and defluxification perception ($\Delta p$), as shown in Figure 2. value $a$ is a low fuzzy number, $b$ is the medium fuzzy number, and $c$ is the upper fuzzy number. The defuFuation value of each perception and expectation will then calculate the performance gap through equation 5 and produce figure 2.

Fig. 2. GAP Student Satisfaction Against Services in 2021.

The results of the application of gap performance analysis provide information by means of graphic pictures in accordance with the ranking obtained through equation 5. Position 1 (first) with the smallest gap value shows in question number 3, which is -0.63. In comparison, the largest gap value is question number 10, which is -1.72. The values obtained from the respondents are all reduced, indicating that each student's satisfaction with the campus services is still beyond expectations, with measures necessary to improve management for the total number of gaps that occur between students and campus.

Fig. 3. Analysis of Student Satisfaction Variables Against Services in 2021.

The fuzzy servqual gap level with 5 variables indicates that emphaty gets position 1 with the smallest value, i.e. -0.74, then the 2nd level is assurance with a value of -0.85, then the 3rd level is reliability with a gap value of -0.89, the 3rd level is 4 is responsive with a gap value of -0.97 and the 5th stage is real with a value of -1.27 The detailed position can be seen in table 11.
Table 11. Table Ranking of Student Satisfaction Variables Against Service in 2021.

| Rank | Variable      | Perception | Expectation | GAP   | Explanation      |
|------|---------------|------------|-------------|-------|------------------|
| 1    | Empathy       | 3.60       | 4.34        | -0.74 | Needs improvement|
| 2    | Assurance     | 3.54       | 4.40        | -0.85 | Needs improvement|
| 3    | Reliability   | 3.47       | 4.36        | -0.89 | Needs improvement|
| 4    | Responsiveness| 3.32       | 4.29        | -0.97 | Needs improvement|
| 5    | Tangible      | 3.04       | 4.31        | -1.27 | Needs improvement|

The stage provides information that the management of Indramayu State Polytechnic must improve management so that there is no minus value. Especially for a real variable that gets a gap value of -1.27.

4 Result and Discussion

The questionnaire as a measuring tool used in the study was declared valid with a significance level of 5% or a confidence level of 95%. In addition, the questionnaire was tested for its reliability with a result of 0.746, and thus the measuring instrument used had high mobility as it was above 0.700.

The analysis of student satisfaction with the service using the fuzzy servqual method obtained the value of the minus gap until the management of the Indramayu State Polytechnic campus is treated with better management improvement. By obtaining the value of the gap from this study, management can read the state of campus services to students to facilitate decision-making.

The fuzzy servqual gap level with 5 variables indicates that empathy gets position 1 with the smallest value, i.e. -0.74, then the 2nd level is an assurance with a value of -0.85. The 3rd level is reliability with a gap value of -0.89; the 3rd level is 4 is the reaction force with a gap value of -0.97, and the 5th stage is real with a value of -1.27.

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