Application of SEM in analyzing student satisfaction with administrative services

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Abstract. Satisfaction (y), the most basic and latest standard in improving services quality, is influenced by five variables, namely tangibles (x1), reliability (x2), responsibility (x3), assurance (x4), and empathy (x5). In this study, analyzing the satisfaction of Industrial Engineering students at the Sumbawa University of Technology with the administrative services provided by the administration division of the Faculty of Engineering. The analysis is processed using the Structural Equation Model (SEM). From the analysis, we obtained that the variables that can be used to analyze the satisfaction of Industrial Engineering students consist of three variables, namely tangible, reliability, and empathy. Those three variables are simultaneously able to explain the satisfaction variable.

1. Introduction

In the current era of globalization, the community's need for formal education is increasing, namely higher education being the frontline in producing qualified human resources. The current state of competition that is quite competitive among universities requires educational institutions to pay attention to the quality of education in the institution, so they are able to compete and win the competition. In this case, the tertiary institution must plan anticipatory steps to face the competition and be responsible for improving all aspects of the services they owned. It is because services owned by a particular institution will be an illustration of the quality of the institution. An institution can be said to be good if the services provided to consumers are good. On the other hand, if the services of an institution are bad, the institution is also said to be bad, including services in an educational institution.

Universities, as service providers, must provide quality service (service quality) to students. One of these characteristics is intangible. Evaluating intangible services, consumers generally use the following attributes: 1) tangibles, including physical facilities, equipment, employees, and means of communication; 2) reliability, providing services accurately, promptly, and satisfactorily; 3) responsiveness, including the desire to help and deliver responsive services; 4) assurance, namely the trustworthiness of the staff, free from danger, risk or doubt; and 5) empathy, namely understanding the needs of consumers [1].

In the aspect of facilities and infrastructure, Industrial Engineering study program, students have the right to receive administrative services, both administration services from the study program and the faculty. Therefore the admin who provides services must be able to provide the best servants so that the evaluation results provided by students regarding the service system are following the expected quality. Based on our observations, we obtained that some respondents were not satisfied with the services given by the administration's officers.
We found that there was a lack of service efficiency, the lack of an administrator's attitude, and sometimes, the administrators were not at work. Also, there are some opinions that there are no complaints about the service system at the Faculty of Engineering.

Based on the problems described above, the researcher wants to examine the satisfaction of students of the Industrial Engineering study program with administrative services at the Faculty of Engineering, the Sumbawa University of Technology, which consists of five independent variables, namely Tangibles, Reliability, Responsibility, Assurance, and Empathy. In contrast, the dependent variable is the satisfaction variable. The problems in this study were solved using Structural Equation Modeling (SEM) and LISREL for Windows to analyze and compile multiple regression models. SEM is a combination of factor analysis, multiple regression analysis, and correlation [2][3]. Besides using LISREL for Windows, we can also use PLS in analyzing the Analysis of Factors that affect Fix pay customer satisfaction [4]. Analyzing customer satisfaction using multiple linear regression and SPSS analyzing the effect of service quality on customer satisfaction at PT PLN Rayon Selatan Makassar [5]. The regression method is also used for forecasting [6]. The regression method is used in predicting water requirements for land preparation and in predicting diesel's demand [6][7].

2. Methods

2.1. Types of research
In this research, the type of research is quantitative research [8]. We describe the characteristics of a situation to find out how high the Industrial Engineering student's satisfaction is with the Academic Administrative Service of the Faculty of Engineering, Sumbawa University of Technology.

2.2. Scope of problem
In this study, the variables used are endogenous latent variables (dependent variables) and exogenous latent variables (independent variables) [9]. Tangibles, reliability, responsibility, assurance, empathy are used as exogenous latent variables, while endogenous latent variables are satisfaction. The population in this study was students of Industrial Engineering, the Sumbawa University of Technology, consisting of 121 students. So by using the Slovin formula, the required sample is at least 54 students using an error rate of 10% [10].

2.3. Data collection technique
In the data collection phase, it is necessary to have data or information both from within and outside the company. Researchers obtained data related to observations. The data obtained in this study were primary, which was conducted by distributing questionnaires to Industrial Engineering Students of the Faculty of Engineering. The purpose of spreading the questionnaire is to find out how much the level of satisfaction of Industrial Engineering Students with the administrative services of the Faculty of Engineering. In filling out the questionnaire measured using a Likert scale [11]. Four assessments were consisting of strongly agree, agree, disagree, and significantly disagree. If the Industrial Engineering student chooses Strongly Agree (SS) then it is given a weight of 4, the Agree (S) answer is given a weight of 3, and the Disagree (TS) answer is given a weight of 2 while the Strongly Disagree (STS) answer is given a weight of 1 [12].

2.4. Instrument testing
We did the instrument testing by testing the validity of a questionnaire. It is valid if all indicators in the study have a number above 0.30 [13]. Then, the reliability test was carried out using the Alpha Cronbach technique, and it could be said to be reliable if it had an $\alpha$ coefficient of 0.5 or more [14]. Furthermore, the reliability test is carried out, there are the results of the questionnaire using the Alpha Cronbach technique, and it can be said to be reliable if it has a coefficient $\alpha \geq 0.5$ [15].
2.5. Variable Identification
There are two types of variables used, namely latent variables and indicator variables, which are presented in table 1 [5].

| Latent Variables | Indicator Variables |
|------------------|---------------------|
| Tangibles        | 1. The appearance of the admin staff of the Faculty of Engineering is neat and professional.  
                     2. Modern equipment, equipment, and facilities.  
                     3. The workplace has comfortable and clean conditions.  
                     4. The administrative staff of the Faculty of Engineering who serve always wear a clear identification regarding the name, position, authority, and responsibility. |
| Reliability      | 1. Student services according to a predetermined time  
                     2. Complaint service is fast and reliable.  
                     3. Provide academic information according to student needs.  
                     4. If an error occurs, the service will be checked again as soon as possible |
| Responsibility   | 1. The readiness of Engineering Faculty admin staff in serving students  
                     2. There is a willingness to help students.  
                     3. Complaint service from students is fast and reliable.  
                     4. The administrative staff of the Faculty of Engineering provides information that is clear and easily understood by students. |
| Assurance        | 1. The admin staff of the Faculty of Engineering can instill trust in students.  
                     2. The administrative staff of the Faculty of Engineering can answer every student question.  
                     3. Students feel comfortable and safe in carrying out services and transactions.  
                     4. The Engineering Faculty admin has a positive image in the eyes of the public. |
| Empathy          | 1. Faculty of the Engineering admin staff can understand the specific needs of students.  
                     2. The admin staff of the Faculty of Engineering treats students with great care  
                     3. The admin staff of the Faculty of Engineering are easily contacted by students and prioritize student interests.  
                     4. Service to students does not differentiate social status. |
| Satisfaction      | 1. The Faculty of Engineering provides satisfying services as expected.  
                     2. The Engineering Faculty admin has a relatively vast and affordable network.  
                     3. The Engineering Faculty admin always responds to complaints quickly and precisely.  
                     4. Admin of the Engineering Faculty has a positive and good image. |

2.6. Coefficient of determination ($R^2$)
The coefficient of determination ($R^2$) is used to determine the influence of the variable $x$ on $y$. The coefficient of determination ($R^2$), which is close to one means that the independent variable explains almost all the information needed to predict the dependent variable [16]. If the determinant value ($R^2$) obtained is close to one, it can be said the stronger the influence of the independent variable on the dependent variable. Conversely, if the determinant value ($R^2$) gets closer to zero, then the weaker effect of the independent variable on the dependent variable. The coefficient of determination was used, namely Adjusted R Square.
2.7. **Structural Equation Modeling (SEM)**

The Structural Equations Model (SEM) determines the dependency relationship of independent variables using linear equation integration [17]. There are two types of equations in this study, namely the endogenous construct equation and the exogenous construct equation presented in table 2 [18].

| Table 2. Endogenous and Exogenous Construct Equations |
|---------------------------------------------------|
| **Endogenous constructs** | **Exogenous constructs** |
| $Y_1 = \lambda_1 y + \varepsilon_{11}$ | $X_1 = \lambda_1 x_1 + \delta_{11}$ |
| $Y_2 = \lambda_2 y + \varepsilon_{12}$ | $X_2 = \lambda_2 x_1 + \delta_{12}$ |
| $Y_3 = \lambda_3 y + \varepsilon_{13}$ | $X_3 = \lambda_3 x_1 + \delta_{13}$ |
| $Y_4 = \lambda_4 y + \varepsilon_{14}$ | $X_4 = \lambda_4 x_1 + \delta_{14}$ |
| $Y_5 = \lambda_5 y + \varepsilon_{15}$ | $X_5 = \lambda_5 x_2 + \delta_{15}$ |
| $Y_6 = \lambda_6 y + \varepsilon_{16}$ | $X_6 = \lambda_6 x_2 + \delta_{16}$ |
| $Y_7 = \lambda_7 y + \varepsilon_{17}$ | $X_7 = \lambda_7 x_3 + \delta_{17}$ |
| $Y_8 = \lambda_8 y + \varepsilon_{18}$ | $X_8 = \lambda_8 x_3 + \delta_{18}$ |
| $Y_9 = \lambda_9 y + \varepsilon_{19}$ | $X_9 = \lambda_9 x_4 + \delta_{19}$ |
| $Y_{10} = \lambda_{10} y + \varepsilon_{20}$ | $X_{20} = \lambda_{10} x_5 + \delta_{20}$ |

The structural equation for the effect of satisfaction is given in equation (1).

$$y = \gamma_1 x_1 + \gamma_2 x_2 + \gamma_3 x_3 + \gamma_4 x_4 + \gamma_5 x_5 + \varepsilon$$  \hspace{1cm} (1)

3. **Result and Discussion**

3.1. **Classic Assumption Test**

From the results of the questionnaire conducted on Industrial Engineering students for administrative services at the Faculty of Engineering, Sumbawa University of Technology, the data obtained from the questionnaire are presented in figure 1.

| Figure 1. Questionnaire results data. |
|--------------------------------------|

| Table 3. Multicollinearity test results. |
|-----------------------------------------|
| **Variable**   | **Tolerance** | **VIF** |
|----------------|--------------|--------|
| Tangible       | 0.348        | 2.876  |
| Reliability    | 0.252        | 3.972  |
| Responsiveness | 0.153        | 6.534  |
| Assurance      | 0.140        | 7.154  |
| Emphaty        | 0.248        | 4.036  |
Furthermore, the data in figure 1 determined the results of the validity test using SPSS for each question indicator on each variable showing results greater than 0.3, so it can be said that all are valid and from the reliability test the results obtained for each variable are greater than 0.5, so it can be said to be reliable [19][20]. While the multicollinearity test results can be seen in table 3.

So there is no multicollinearity symptom in the data of this study because the tolerance value > 0.100 and the VIF value < 10 are found in table 3 [21].

3.2. Multiple regression

We use SEM and LISREL 8.8 to determine the level of satisfaction of students of the Industrial Engineering study program, Sumbawa University of Technology, towards administrative services at the Faculty of Engineering [22]. The first step that must be taken is to determine the appropriate variables and indicators for the path diagram modeling. From the results of the analysis, the fit model for each indicator and variable can be seen in figure 2.

Based on figure 2, it can be seen that the resulting model is good because it has met the eligibility criteria of the model, namely the loading factor value of each indicator-variable and variable-variable whose value is more significant than 0.5, the chi-square value is 38.78 less of 53.388 (chi-square table), and the df (degree of freedom) value is 38 less than 0, the P-value is 0.43453 greater than 5% while the RMSEA value is 0.019 less than 5% [23]. Therefore, tangible variables, reliability, empathy, and satisfaction can be used to construct multiple regression models.

The results of the output coefficient values in the multiple regression models for the standardized solution after running can be seen in figure 3.

Based on equation (1), figure 4 and figure 5, the results of the multiple regression equation models are obtained as in equation (2).

\[ y = 0.55x_1 - 0.96x_2 + 1.40x_3 + 0.035 \]  

(2)

Where:
\[ y = \text{satisfaction}, \]
\[ x_1 = \text{tangible}, \]
\[ x_2 = \text{reliability}, \text{and} \]
\[ x_3 = \text{empathy}. \]

In the Structural Equation output, you can also see the value of R Square \( (R^2) \) of 0.96. This means that 96\% of Industrial Engineering student satisfaction is influenced by Tangible, Reliability, and Empathy variables, while the remaining 4\% is influenced by other variables that are not researched [24].

Results The output coefficient values on the multiple regression models for T-values after running can be seen in figure 4.

\[ \text{Ch1-Square}=38.78, \text{df}=38, \text{P-value}=0.03453, \text{RMSEA}=0.019 \]

**Figure 3.** Path model of multiple regression results (standardized solution).

And the results of the Structural Equation output can be seen in figure 5.

**Structural Equations**

\[
\text{SATISFAC} = 0.58*\text{EMPATHY} - 0.96*\text{REABILIT} + 1.40*\text{TANGIBLE}, \text{Errorvar.} = 0.035, R^2 = 0.96 \\
(0.45) \quad (2.46) \quad (2.29) \quad (0.39) \\
1.29 \quad -0.39 \quad 0.61 \quad 0.11
\]

**Figure 4.** Output structural equation.

It can be seen in Figure 5 that the T-value Tangible, Reliability, and Empathy on student satisfaction are 0.61, -0.39, and 1.29, respectively. This shows that the three variables do not significantly influence the satisfaction of Industrial Engineering students in the administrative services of the Engineering Faculty, Sumbawa University of Technology because the T-value is less than 1.967 [25].
4. Conclusion

Five variables affect satisfaction. Whereas in the study, only three variables can be used to analyze the satisfaction of Industrial Engineering students with administrative services, namely tangible, reliability, empathy variables [1]. However, these three variables do not have a significant effect. From the multiple regression equations, it is obtained that the tangible and empathy variables provide a positive relationship to the satisfaction variable while the reliability variable has a negative relationship. While the determinant coefficient value of the model is 0.96, this shows that the three variables can explain the satisfaction variable by 96%, other variables explain the remaining 4%.

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Figure 5. Multiple regression result model path (T-values).
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