Structural Equation Modelling of Teaching Quality on Students' Satisfaction

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Abstract. Students are the main, vital, and central customers that must be served in a college. The college success is characterized by the quality of services provided, and service quality can be identified through student satisfaction. Therefore, knowledge is needed related to variables that affect student satisfaction, especially in the learning process. This study suspects that the knowledge and teaching methods used by educators in the learning process, the depth of material delivered, the implementation of the learning process, the clarity of the assessment of learning outcomes, and the affective interactions of lecturers and students affect the level of student satisfaction. This study uses the Structural Equation Modeling-Partial Least Square (SEM-PLS) with the Bootstrap parameter estimation method. The results showed that all the indicators forming the six latent variables used in this study were significant, so the models met the fit category. The results showed there was a positive and significant effect of the quality of teaching on the level of student satisfaction in the learning process by 19%. However, based on the five variables forming the quality of teaching, only the variable knowledge and teaching methods of lecturers have a significant effect on the level of student satisfaction.

1. Introduction
The Higher Education Quality Assurance System and the National Higher Education Standards in Indonesia are regulated in Law No. 12/2012 in Article 52 paragraph (3). National Higher Education Standards include national education standards, research standards, and community service standards [1]. The education quality assurance system is certainly used to support long-term education development plans for 2005-2025 in Indonesia. Furthermore, it was elaborated into four themes of educational development, namely capacity building and modernization (2005-2009), strengthening services (2010-2015), strengthening regional competitiveness (2015-2020) and strengthening international competitiveness (2020-2025). This development plan has implications for all education stakeholders so that the development of national education aims to improve the quality of education services which will have an impact on increasing the academic satisfaction of all users of education services, especially students [2] including the higher education level [3].

The new paradigm of higher education management states that universities are service institutions [4]. Therefore, the teaching and learning process can not only be assumed as the relationship between students and educators, but also the relationship between recipients and service providers.

The quality of services provided characterizes the success of a college. One of the qualities of service can be identified through student satisfaction. This is because students are the main customers to be served and the main stakeholders in higher education. That is, their opinions are very important in
improving the quality of the reputation of higher education and the university's image. [2,4]. In addition, higher education can also benefit from student satisfaction, for example, students who are satisfied tend to drop out of school more, and are more likely to achieve higher grades [4]. This commitment should be proven by the quality of academic services, such as the availability of lecturers who meet educational and professional qualifications that are able to create quality teaching, also learning facilities that meet the standards [2,5].

Quality teaching does not have a clear definition, but can be interpreted as the ability to provide teaching to different students with different abilities while combining learning objectives and assessing effective student learning styles [5,6]. Indicators of teaching quality include teacher professionalism, teacher knowledge, teacher self-esteem, and teacher communication skills [5]. In detail, the quality components of teaching and learning include nine components, namely 1) courses, 2) lecturer motivation, 3) teaching design, 4) relationships between students, 5) relationships between students and lecturers, 6) assignments, 7) competencies lecturer, 8) challenges and obstacles, and 9) evaluation [7].

Satisfaction is defined as the response of consumer fulfillment because the theory of student satisfaction is developed from the theory of consumer satisfaction. Satisfaction is also interpreted as a student assessment of the services provided by institutions [5]. Learning satisfaction can be defined as a condition of feeling satisfied because the fulfillment of expectations from a learning activity experienced by students. Therefore, in line with the theory of consumer satisfaction, learning satisfaction theory views the position of students as a consumer who is able to respond to an activity (teaching and learning) based on the comparison between expectations and the reality they receive [8,9].

Student learning satisfaction is measured by the determinants of satisfaction itself, namely the degree of product quality, including service and professionalism of lecturers, as well as ease and comfort in the learning process [9]. In addition, several other studies also used different indicators of learning satisfaction, such as Ko and Chung [8] which revealed four indicators of learning satisfaction including satisfaction with instructional planning, satisfaction with arrangement of procedures, satisfaction with time arrangement, and satisfaction with curriculum design. Furthermore, Hofland and Patkar [7] suggested five items of student satisfaction consisting of quality of facilities, quality of learning processes, quality of services, quality of curriculum, and quality of teaching implementation. Gruber et al. mentioned indicators of student satisfaction include administrative services and student affairs, student atmosphere, course material, and lecturer support [10,11]. Butt and Rehman examined student satisfaction on four dimensions of Education, namely teaching skills, courses offered/material offered, learning environment, and classroom facilities [12]. Temizer and Turkyilmaz developed a model measuring student satisfaction from various aspects such as institutional image, expectations, perceived quality, perceived value, and loyalty [13]. Alam Malik also explores student satisfaction measurements based on teaching skills, courses/materials offered, learning environment, and facilities [14].

The teaching quality of lecturers has a positive relationship with student satisfaction. This implies that the quality of teaching is one of the factors that can affect student satisfaction [7]. Therefore, it is very important to understand the factors that determine student satisfaction with tertiary institutions, considering students as core stakeholders who have high ideals. In addition, student satisfaction data helps universities make their curriculum more responsive to dynamic market needs [5].

This research is modelling the level of student satisfaction in the learning process using the method of Structural Equation Modeling (SEM) based on variance or Partial Least Square (PLS) by involving several variables, such as 1) knowledge and teaching methods used by educators in the learning process; 2) depth of material delivered; 3) the implementation of the learning process; 4) clarity of assessment of learning outcomes; 5) good affective interaction from lecturers and students.

2. Method
This study uses two variables, the teaching quality and student satisfaction. Teaching quality variable indicators (X) include, 1) knowledge and teaching methods used by educators in the learning process (X1); 2) depth of material delivered (X2); 3) the implementation of the learning process (X3); 4) assessment clarity of learning outcomes (X4); 5) affective interactions among educators and students (X5). While the indicators of student satisfaction variable (Y), including: 1) lecturer teaching skills (Y1), 2) depth of material delivered in lectures (Y2), 3) comfort of the learning environment (Y3), and 4)
transparency learning evaluation \( (Y_4) \). The samples used in this study were 86 lecturers of Universitas Muhammadiyah Sukabumi who actively taught in odd semester in the academic year 2019/2020. Samples are taken randomly.

This study aims to see whether a particular model is valid or not rather than using it to find a particular model is suitable or not [15]. Therefore SEM-PLS analysis is used with SMART-PLS software which is as an analytical technique to confirm rather than explain. SEM-PLS is a powerful analysis method because it can be applied at all data scales, it does not require a lot of assumptions and the sample size does not have to be large. Besides, PLS can be used as a confirmation of theory can also be used to build relationships that do not yet have a basis for theory or for testing propositions. PLS can also be used for structural modeling with indicators that are reflective or formative. In addition, PLS does not require assumptions normality of data and the data used may be small (≥ 30).

The advantages of SEM-PLS include: 1) not affected by lack of data; 2) no problem with small samples. However, a larger sample size will increase the accuracy of PLS estimates; 3) does not require distribution assumptions (normality assumptions), because PLS is classified as a non-parametric statistic; 4) measurement scale can be in the form of metric scale data (ratios and intervals), metric scale data (ordinal), or binary (nominal); 5) easily combines reflective and formative measurement models; 6) handle complex models with many structural model relationships; 7) can be used for predictive purposes; 8) can be used as input for further analysis; and 9) has high statistical power [16].

Analysis with PLS-SEM uses two important stages, namely measurement model and structural model. Data in the measurement model is evaluated to determine its validity and reliability. Part of the measurement model consists of: 1) Individual loading of each question item; 2) Internal Composite Reliability (ICR); 3) Average Variance Extracted (AVE); and 4) Discriminant Validity. If the data meet the requirements in the measurement model, the next step is to evaluate the structural model. In the structural model the hypothesis is tested through the significance of 1) Path coefficient; 2) T-Statistic; and 3) R-square value.

### 2.1 Measurement Model Criteria (Outer Model Evaluation) on the Reflective Measurement Model

a. Convergent validity is to measure the magnitude of the correlation between constructs with latent variables. Convergent Validity can be seen through 1) Individual loading of each question item; 2) Internal Composite Reliability (ICR); 3) Average Variance Extracted (AVE). The criteria are as follows

1) Individual Item Reliability can be seen from the standardized loading factor value. The standardized loading factor illustrates the magnitude of the correlation between each measurement indicator and its construct. A loading factor value > 0.7 is said to be ideal, meaning that the indicator is said to be valid in measuring the construct. This value shows the percentage of constructs able to explain the variations that exist in the indicator.

2) Internal Consistency or Construct Reliability can be seen from the value of Composite Reliability (CR). The Composite Reliability (CR) interpretation is the same as Cronbach’s Alpha. Limit values > 0.7 are acceptable, and values > 0.8 are very satisfying.

3) Average Variance Extracted (AVE) describe the magnitude of variance or diversity of manifest variables that can be owned by latent constructs. Thus, the greater the variance or variety of manifest variables that can be contained by latent constructs, the greater the representation of manifest variables to their latent constructs. A minimum AVE value of 0.5 indicates a good measure of convergent validity. That is, latent variables can explain an average of more than half the variants of the indicators.

b. Discriminant Validity. The reflective model is evaluated through cross-loading, then compares the correlation between constructs with the roots of AVE. The root value of AVE must be higher than the correlation between constructs and other constructs or the value of AVE is higher than the square of correlation between constructs.

### 2.2 Structural Model Criteria Model (Inner Model Evaluation)

After evaluating the construct measurement model, the next stage is evaluating the structural model or inner model.
a. The first step in evaluating structural models is to look at the significance of the relationships between constructs/variables. This can be seen from the path coefficient which describes the strength of the relationship between constructs. Signs or directions in the path must be in accordance with the hypothesized theory, the significance can be seen in the t test or CR (critical ratio) obtained from the bootstrapping process (resampling method).

b. The second step is evaluating the value of $R^2$. Interpretation of the value of $R^2$ is the same as interpretation of linear regression $R^2$, that is the magnitude of the variability of endogenous variables that can be explained by exogenous variables. Criteria $R^2$ consists of three classifications, namely as substantial ($>0.67$), moderate ($>0.33$), and weak. Changes in the value of $R^2$ can be used to see whether the influence of exogenous latent variables on endogenous latent variables has substantive effects.

3. Result and Discussion

3.1 Measurement Model

Before testing hypotheses to predict relationships between latent variables in a structural model, an evaluation of the measurement model is first performed to verify the indicators and latent variables that can be tested subsequently. The path diagram with loading factor values is presented in Figure 1.

Based on Figure 1 above, the indicators of $X_{36}$, $X_{37}$, $X_{39}$, $X_{311}$, $X_{312}$, $X_{313}$, $X_{48}$, $X_{51}$, $X_{52}$, $X_{53}$, $X_{56}$, are eliminated from the model because they have a loading factor value below 0.7. So that the new diagram is produced in Figure 2.

Based on Figure 2, it can be seen that the latent variables knowledge and teaching method of the lecturers ($X_1$) can explain the variants of the nine indicators $X_{11}$ to $X_{19}$ more than 73%. The variant of $X_{21}$ can be explained by the latent variable depth of material presented by the lecturer ($X_2$) above 80%.
The implementation of the learning process variable \((X_1)\) is able to explain the variants of the eight indicators \(X_{31}, X_{32}, X_{33}, X_{34}, X_{35}, X_{38}, X_{310}, \) and \(X_{314}\), respectively more than 70%. Variable assessment clarity of learning outcomes \((X_2)\) is able to explain the variants of the seven indicators \(X_{41}, X_{42}, X_{43}, X_{44}, X_{45}, X_{46}, \) and \(X_{47}\) more than 79%. The affective interactions among educators and students \((X_3)\) is able to explain the variants of the five indicators \(X_{54}, X_{55}, X_{57}, X_{58}, \) and \(X_{59}\) more than 73%. While the latent variable Student satisfaction \((Y)\) as an endogenous latent variable is able to explain the four indicators, \(Y_1\) to \(Y_4\), above 90%. So, all of each latent variable has been able to explain the variance of each indicator that measures above 70%. The next criteria, namely composite reliability and convergent validity \((AVE)\) are presented in Table 1.

### Table 1. Composite Reliability and AVE value

| Variable | Composite Reliability | AVE   |
|----------|-----------------------|-------|
| X1       | 0.937                 | 0.624 |
| X2       | 1.000                 | 1.000 |
| X3       | 0.922                 | 0.597 |
| X4       | 0.948                 | 0.724 |
| X5       | 0.897                 | 0.635 |
| Y        | 0.977                 | 0.913 |

Based on the composite reliability values presented in Table 1, the six latent variables have composite reliability values above 0.6. That is, the established indicators have been able to measure each latent variable well or it can be said that the six measurement models have been reliable. Likewise the AVE value, the results show that the six latent variables have an AVE value above 0.5. So that, the size of convergent validity is good or can be said meets the convergent validity criteria.

The next criterion is discriminant validity, by comparing correlations between constructs with the roots of AVE. The root value of AVE must be higher than the correlation between constructs and other constructs or the value of AVE is higher than the square of correlation between constructs. The results are shown in the Table 2.

### Table 2. AVE root dan Discriminant Validity Value

| Variable | AVE root | Discriminant validity |
|----------|----------|-----------------------|
| X1       | 0.790    | good                  |
| X2       | 1.000    | good                  |
| X3       | 0.772    | good                  |
| X4       | 0.851    | good                  |
| X5       | 0.797    | good                  |
| Y        | 0.955    | good                  |

Based on testing the four criteria, it can be concluded that the measurement model used in this study is fit.

### 3.2. Structural Model

The structural model (inner model) is a model that describes the relationship between latent variables that are evaluated using the path coefficient. The results of the path coefficient and t-statistic values obtained through the bootstrapping process with a sample size for resampling of 86 and repetition of 5000 times are shown in table 3.

Based on the Table 3, it can be seen that among the five forming the Teaching quality variable, the latent variable Knowledge and the teaching method of lecturer \((X_1)\) significantly affect the Student Satisfaction \((Y)\).

### Table 3. Structural model coefficient

| Variable | T Statistics | P-Value |
|----------|--------------|---------|

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Next is the feasibility test of the model using the value $R^2$. $R^2$ for Student satisfaction (Y) is 0.190. This value explains that the variability of endogenous variables that can be explained by the variability of exogenous variables is 19%. The T value is 2.275 with a P-value of 0.023. This value is significant at the 5% level of testing. Based on these results it can be seen that there is a positive and significant effect of the Teaching Quality variable of 19% on the level of student satisfaction in the learning process at the Universitas Muhammadiyah Sukabumi.

3.3 Discussion

Based on the results of the study, it is known that there is a positive and significant effect of the Teaching quality variable of 19% on the level of student satisfaction in the learning process at the Universitas Muhammadiyah Sukabumi. The results also showed that among the five forming the Teaching quality Variable, only the latent variable Knowledge and the teaching method of lecturer (X1) significantly affected Student satisfaction (Y). This is in line with the results of Green's study, et al. [17] which said that in general the teaching variable tends to be more strongly related to student satisfaction because it is a logical target used to increase student satisfaction. High quality teaching, clear standards and assessment criteria, and fairness of assessment are very important to increase student satisfaction. Among these three aspects, indicators of teaching quality have a strong influence on student satisfaction, such as the knowledge and teaching style of educators, the material delivered, and the implementation of learning. Even the teacher's knowledge and teaching ability are more important predictors in measuring the level of quality and student satisfaction with learning than lecturers' interest and mastery of certain material [17]. In line with this, the results of other studies also reveal the same thing, namely the teaching methods used by educators have a significant major influence on the level of student satisfaction and academic achievement [4,18].

Although there is a significant influence of the quality of teaching on student satisfaction, but its influence is classified as a weak category. This is because there are too many other aspects that affect the quality of service in tertiary institutions that have not been measured in this study such as facilities (such as the convenience of lecture rooms, the convenience of discussion rooms, ease of internet access, complete library literature, toilet cleanliness, ease of parking vehicles, and employee friendliness) [6,18] and curriculum (such as the usefulness of the material provided, the suitability of the curriculum with the world of work, the availability of the desired study program, the balance of composition between theory and cases in the real world, and the variety of concentration/specialization courses, services careful academic and fast administrative services, or the readiness of lecturers and employees in handling complaints [19].

4. Conclusion

Based on the results of the study, it is known that among the five forming variables of Teaching Quality, only the Knowledge and Teaching Methods variable (X1) had a significant positive effect on Student Satisfaction (Y). That is, student satisfaction in the learning process will be better if the knowledge and teaching methods of lecturers that are applied in the classroom are improved. The results also showed that the teaching quality displayed by lecturers in the class affected the level of student satisfaction in the learning process at Universitas Muhammadiyah Sukabumi by 19%. For further research, it is better to use a larger number of samples, so that a better model is produced. In addition, there is a need for a deeper assessment of the indicators of all latent variables used in the study, as well as the need for a specific explanation of each question contained in the questionnaire, so that there are no differences of opinion in filling out the questionnaire.
5. Acknowledgements
This research was funded by the Mathematics Education Study Program and the Learning Development Unit of the Universitas Muhammadiyah Sukabumi in the 2019/2020. Therefore, we say many thanks because with this assistance, our research went well as targeted.

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