Measurement of student satisfaction and loyalty using service quality model for higher education (HedQual) at industrial engineering department University of Pelita Harapan

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Abstract. The Department of Industrial Engineering (IE) at Pelita Harapan University (UPH) strives to continually improve the quality of its services. Previous studies were conducted in 2010 and 2015 using service quality model from Parasuraman. IE UPH wants to increase their student satisfaction; therefore, IE UPH needs to measure it with a customized model because of the distinctive nature of the service. This study develops the ServQual Model for IE UPH, which is named HedQual. The HedQual is predicted to have a positive influence on the students’ satisfaction and loyalty. The most important construct of service quality for IE UPH Students was also measured using consensus. Data collection was done using a questionnaire and distributed to all IE UPH students. The model was tested using PLS-SEM (Partial Least Square – Structural Equation Modeling). The final model shows that HedQual consists of Academic and Non-academic. HedQual, Reputation and Learning Outcome have a significant and positive effect on Student Satisfaction. Student Satisfaction has a significant and positive effect on Student Loyalty. The most important service quality for IE student from the consensus calculation is the attitudes and sincere interests of lecturers in helping the students.

1. Introduction
University of Pelita Harapan (UPH) is a private university in Indonesia that adheres to Christianity principles. By providing good and complete facilities, UPH tries to provide the best education for the students. Industrial Engineering (IE) is one of the study programs offered by UPH Karawaci, Tangerang which always want to improve its service quality.

IE UPH conducted research to assess its service quality (ServQual) in 2010 and 2015 to improve the service quality provided for the students. The research in 2010 used general ServQual model that consists of 5 dimensions as follows: Tangible, Reliability, Responsiveness, Assurance, and Empathy. The results shows that student expectations were higher than perceived levels of service quality provided by IE UPH [1]. Those studies only measure the gap or the difference between expectations and perceptions. Another research combined ServQual and Kano models into Quality Function Deployment (QFD) to improve the service quality of IE UPH [2]. Both of these studies used general ServQual model. Studies to improve the service quality should be tailor made because of the uniqueness of service, which differs between providers.
Research by Hartono (2008) concerns with the development of a service quality measurement model (ServQual) developed specifically for high school called HisQual with 7 dimensions, namely Tangibility, Reliability, Responsiveness, Assurance, Empathy, Learning Outcomes, and Personality Development [3]. Hartono et al. in 2017 also conducted research on important factors that influence students in choosing Industrial Engineering and the continuation of this research is needed [4]. Therefore, this study continues the research of Hartono et al. This study aims to create a ServQual model for IE UPH called HedQual, to test the predictive relationship between constructs in the HedQual, Student Satisfaction and Loyalty and to find out the most important part of the service for IE students based on the model.

2. Methodology

Service Quality was first introduced by Parasuraman in 1988 and has gained popularity until now for its generic ability to assess the quality of service. In this paper, ServQual that was introduced by Parasuraman is called general ServQual model that uses 5 dimensions (Tangibility, Reliability, Responsiveness, Assurance, and Empathy) because of researcher around the world use this ServQual model to assess a different kind of service. However, the service itself has specific characteristics and it is not always appropriate to use general ServQual model. Several researchers have modified the general ServQual model to assess service in education. Table 1 shows the position of this research compared with other ServQual model in education with the addition of two well-known ServQual models from Parasuraman and Grönroos [3,4,5,6,7,8,9,10,11,12,13,14].

| Researcher and year | Instrument | Research area | Data source | Note |
|---------------------|------------|---------------|-------------|------|
| Parasuraman et al. (1988) | ServQual with 5 dimension: Reliability, Empathy, Tangibles, Assurance, Responsiveness | General Service | Published | |
| Owlia dan Aspinwall (1998) | 4 dimension: Academic Resources, Competence, Attitude, Content | Higher Education (Engineering) in England | College student | Published |
| Grönroos (2000) | 7 dimension: Professionalism and skills, attitude and behavior, accessibility and flexibility, reliability and trustworthiness, service recovery, serviscapes, reputation and credibility | General | Published | |
| Munaf F (2002) | Integration Servqual (general model) with QFD | Higher Education (Engineering) | College student | Published |
| Abdullah (2005) | Development of ServQual Model for Higher Education | Higher Education in Malaysia | College student | Unpublished |
| Hartono J (2005) | Model ServQual Parasuraman et al. (general model) | Highschool in Bandung, Indonesia | Highschool student | Unpublished |
| Mahapatra and Khan (2007) | 5 dimension: Learning Outcomes, Responsiveness, Physical Facilities, Personality Development, Academics | Higher Education (Engineering) in India | Student, Alumini, Parent, Employer | Published |
| Hartono N (2008) | Integration ServQual, Kano and QFD (development of ServQual Model) | Highschool in Bandung, Indonesia | Student, Parent, Teacher | Published |
| Anandadev & Bellamkonda (2012) | Development of ServQual Model, HedQual | Higher Education in India | College student | Published |
| Gupta & Kaushik (2018) | ServQual Dimension Comparison in Higher Education | Higher Education | College student | Published |
| Hartono N and Laurence (2017) | ServQual (development ServQual model) | Higher Education (Engineering) in Indonesia | College student | Unpublished |
| Verma & Prasad (2017) | Development of ServQual Model (MeQual) | Higher Education (Management) | College student | Published |
| Mattah, Kwokteng, and Mensah (2018) | Development of ServQual Model | Higher Education in Ghana | College student | Published |

This research

Development of ServQual Model for Industrial Engineering University of Pelita Harapan, called HedQual | Higher Education (Engineering) in Indonesia | College student | Published |

The steps in developing HedQual compare service quality dimension in education as presented in table 1. The items in the questionnaire were developed from those previous studies and added with several items from interview to IE UPH students. The final item was 63 with HedQual 55 item, Student Satisfaction 4 item and Student Loyalty 4 item. HedQual results in 5 dimension: Reputation, Tangibility, Academics, Non-academic Aspect, Learning Outcomes. The respondents are from the population of IE UPH active students, in which from 130 students, there were only 57 usable filled questionnaires.

The validity test using the Pearson correlation shows that all items are valid because all Pearson Correlation values are > r table value (0.2609). R table value is obtained from the degree of freedom
(df) which is 55 and the level of significance 0.05 is 0.2609. The reliability test result which is 0.976 shows good reliability. The data shows that the population is 70.18% male and 29.82% female. The class of 2015 is the biggest percentage of response, shown by 38.6% followed by class of 2018, class of 2016, class of 2017 and 2014 which are 26.3%, 17.54%, 14%, and 3.5% respectively.

The initial conceptual HedQual model consists of Reputation (R), Tangibility (T), Academics (A), Non-academic (N) and Learning Outcome (L) which form a second order construct for HedQual. HedQual is an independent variable, while Student Satisfaction (SS) and Student Loyalty (SL) are dependent variables. The initial model is shown in figure 1. In this initial model, there are 8 hypotheses to be tested as follows:

H1: Academics is a dimension (second-order construct) of HedQual
H2: Learning Outcome is a dimension (second-order construct) of HedQual
H3: Non-academic is a dimension (second-order construct) of HedQual
H4: Reputation is a dimension (second-order construct) of HedQual
H5: Tangibility is a dimension (second-order construct) of HedQual
H6: HedQual has a significant and positive influence on Student Loyalty
H7: HedQual has a significant and positive influence on Student Satisfaction
H8: Student Satisfaction has a significant and positive influence on Student Loyalty

The PLS-SEM has been a subject of debates whether to use or not to use PLS [15]. The PLS path modeling is a full-fledged SEM method that can handle both factor models and composite models for constructing measurement, estimating recursive and non-recursive structural models, and conducting tests of model fit [16]. Sarstedt Hair points out that researchers have to clarify the difference between a conceptual measurement approach and statistical estimation perspective to choose specific SEM method and its appropriateness [15]. The PLS has advantages for exploratory research and important statistical tool for management, organizational research and other social sciences disciplines [17]. This research uses the PLS-SEM because developing a model using exploratory research that fits with IE UPH and not for generalization of the model.

The steps in PLS-SEM include importing data in the form of CSV file and constructing Path diagram. The model then evaluates after determining the number of bootstraps samples, in this research using 1000 as the number of bootstraps sample. Evaluation of the initial model consists of 2 stages: evaluation of measurement model (outer model) and structural model (inner model).

3. Results
The results of output outer loading show that several indicators have a value below 0.7 in the factor loading and have to be eliminated from the model. Results of PLS shows the indicators that must be eliminated are A1, A2, A3, A4, A5, A6, A7, A8, N1, N2, N4, and N13. All indicators in the construct of Reputation (code R), Tangibility (code T), and Learning Outcome (code L) are also eliminated.

After re-testing, it can be seen that all construct indicators have a value of loading factor > 0.7. The AVE value of all constructs is > 0.5, thus meet the convergent validity requirements. Based on the values of Cronbach's Alpha and Composite Reliability, all constructs have value > 0.7 that shows good reliability. Result of construct validity and reliability depicted in Table 2 shows that the evaluation of the outer model is good. Evaluation of the inner model (structural model) is from the R-square value and significance test. Table 2 also shows the R-square for the initial model which shows that the
prediction of the structural model is moderate to high. The significance test with significance level 0.05 shows that construct indicator with t-statistics > 1.96 model is valid. The hypothesis test results are in table 3.

Table 2. Construct validity, reliability and R square of initial model after deletion.

| Variable       | Average Variance Extracted (AVE) | Cronbach’s Alpha | Composite Reliability | R Square Adjusted |
|----------------|----------------------------------|-------------------|------------------------|-------------------|
| Academics      | 0.662                            | 0.927             | 0.940                  | 0.873             |
| HedQual        | 0.657                            | 0.971             | 0.973                  |                   |
| Non-academic   | 0.751                            | 0.966             | 0.971                  | 0.949             |
| Student Loyalty| 0.817                            | 0.925             | 0.947                  | 0.617             |
| Student Satisfaction | 0.765                      | 0.896             | 0.928                  | 0.619             |

Table 3. Hypothesis test result.

| Hypothesis | t-statistics | Note     | Hypothesis | t-statistics | Note     |
|------------|--------------|----------|------------|--------------|----------|
| H1         | 47.827       | Proven   | H5         | -            | Not proven |
| H2         | -            | Not proven | H6         | 0.275        | Not proven |
| H3         | 131.005      | Proven   | H7         | 14.919       | Proven   |
| H4         | -            | Not proven | H8         | 7.134        | Proven   |

4. Discussion
Based on the results of the initial model evaluation, the model needs to be modified. The modification is based on other research and exclude the variables that are not proven in the hypothesis test. The initial model is modified by pulling out Reputation and Learning Outcome from HedQual. The Reputation construct is connected with Student Satisfaction and Student Loyalty, while the Learning Outcome is connected with Student Satisfaction. Research by Eryilmaz (2016) said that students' intentions for collaboration in the future are influenced by the reputation and image of universities [18]. This finding is supported by research conducted by Barusman (2014) which states that perceptions of reputation and image of higher education have a positive and significant influence on student satisfaction and loyalty [19].

Tangibility construct is retained as a second-order HedQual construct to see whether this construct affects HedQual after the Reputation and Learning Outcome are eliminated from HedQual. In addition, the relationship between the construct HedQual and Student Loyalty is removed because the initial model hypothesis test shows that the relationship between the two constructs is not proven. These findings lead to the formation of the following hypothesis:

H1: Academics is a dimension (second-order construct) of HedQual
H2: Non-academic is a dimension (second-order construct) of HedQual
H3: Tangibility is a dimension (second-order construct) of HedQual
H4: HedQual
H5: Learning Outcome has a significant and positive influence on Student Satisfaction
H6: Reputation has a significant and positive influence on Student Loyalty
H7: Reputation has a significant and positive influence on Student Satisfaction
H8: Student Satisfaction has a significant and positive influence on Student Loyalty

Figure 2 shows the modification model. The steps of PLS-SEM is the same as the previous steps.
The final modification model shows that all indicators of constructs have a loading factor > 0.7 and AVE > 0.5 that shows that the convergent validity requirement is met. Based on the values of Cronbach's Alpha and Composite Reliability, all constructs have value >0.8 that shows good reliability. The outer model evaluation is in good category that is shown from composite reliability and Cronbach’s Alpha > 0.8 is depicted in table 4. Table 4 also shows the R-square and the hypotheses test results are in table 5.

| Variable             | Average Variance Extracted (AVE) | Cronbach's Alpha | Composite Reliability | R Square Adjusted |
|----------------------|----------------------------------|------------------|-----------------------|-------------------|
| Academics            | 0.662                            | 0.927            | 0.940                 | 0.873             |
| HedQual              | 0.657                            | 0.971            | 0.973                 |                   |
| Learning Outcome     | 0.644                            | 0.815            | 0.878                 |                   |
| Non-academic         | 0.751                            | 0.966            | 0.971                 | 0.949             |
| Reputation           | 0.666                            | 0.875            | 0.909                 |                   |
| Student Loyalty      | 0.817                            | 0.925            | 0.947                 | 0.630             |
| Student Satisfaction | 0.764                            | 0.896            | 0.928                 | 0.795             |

| Hypothesis | t-statistics | Note | Hypothesis | t-statistics | Note |
|------------|--------------|------|------------|--------------|------|
| H1         | 51,881       | Proven | H5         | 4,575        | Proven |
| H2         | 134,539      | Proven | H6         | 1,384        | Not proven |
| H3         | -            | Not proven | H7         | 2,146        | Proven |
| H4         | 3,706        | Proven | H8         | 8,160        | Proven |

Based on the results of the R-Square, it can be seen that the constructs of Academics, Non-academic, and Student Satisfaction have values that fall into the strong category in predicting, while Student Loyalty which is included in the moderate category in predicting. This shows that most variations in the construct of Student Loyalty are explained by 37% factors not included in the model. The next stage is the significance test using the significance level of 5% using the bootstrapping procedure where t-value > 1.96 states that the hypothesis is proven.

The modification model results outperform the initial model. The interesting part is that tangibility is deleted both in initial and modification model because all indicators of tangibility have a loading factor < 0.7. Thus, it can be said that IE UPH students do not consider the Tangibility construct such as the appearance of buildings, facilities, and the university environment as a factor that influences the quality of services. In addition, the overall value of R-Square in the modification model tends to be the same or higher than the initial model. Thus, the evaluation results in the modification model show that the model predicts constructs better than the initial model. The final model shows that HedQual which consists of Academic and Non-academic, HedQual together with Reputation and Learning Outcome has a significant and positive effect on Student Satisfaction, and Student Satisfaction has a significant and positive effect on Student Loyalty.

The consensus is carried out to know what the most important factor in service quality is for IE UPH students. The consensus is a general agreement from the respondents and calculated using the equation from Tastle and Wierman [20]. The consensus ranges between 0-1 where the number closest to one shows the highest level of agreement of the respondents. The calculation results for the item based on the Level of Importance from the questionnaire are listed in Table 6 for the top five highest scores.

5. Conclusion
IE UPH service quality is valued by its students from Academic and Non-academic qualities. HedQual, Reputation and Learning Outcome affect positively to Student Satisfaction and thus also affect positively to Student Loyalty. The consensus shows that IE UPH students consider lecturers as the most important part in service quality, shown by the positions of A15, A10, A9, A16, A14 in the
first, second, fifth, sixth and ninth in level of importance. The most important service quality for IE student from the consensus calculation is the attitudes and sincere interests of lecturers in helping the students. The reputation is also considered important, as shown by R2, R1 and R4 at the fourth, seventh and eight positions in the level of importance. Lecturers and Reputation should become major concerns to improve for IE Department to give the best service quality for their students.

Table 6. Consensus-based on level of importance.

| No | Code | Questions | Consensus |
|----|------|-----------|-----------|
| 1  | A15  | When students have a problem, the lecturer shows genuine interest in helping to solve it | 0.7650 |
| 2  | A10  | The lecturer showed a positive attitude towards students | 0.7648 |
| 3  | L3   | Students get the skills to use software (statistics & techniques) | 0.7582 |
| 4  | R2   | IE UPH has a high reputation | 0.7530 |
| 5  | A9   | The lecturer handles students in a caring and polite manner | 0.7497 |
| 6  | A16  | Availability of lecturer for guidance and advice | 0.7485 |
| 7  | R1   | IE UPH has a professional image | 0.7473 |
| 8  | R4   | IE UPH has good accreditation | 0.7467 |
| 9  | A14  | Lecturers understand the academic needs of students | 0.7459 |
| 10 | N12  | Students was treated equally and respectfully by staff | 0.7431 |

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