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Perceived Service Quality in the Era of Sustainable Higher Education: Evidence from Teacher Training Institutions in Indonesia

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Abstract: Despite the growing popularity of sustainability practices in higher education institutions (HEIs), the specific factors influencing Perceived Service Quality (PSQ) in this context remain unclear. This study addresses this gap by examining the Sustainable Higher Education Service Quality (SHE-SQ) framework to identify drivers of PSQ. This investigation focused on Teacher Education Institutions (LPTK) in Indonesia. The research design used a quantitative cross-sectional approach. Data were collected through convenience sampling, yielding a sample of 320 respondents. Data analysis used Partial Least Squares Structural Equation Modeling with 5000 subsample bootstrapping runs to assess path outcomes. The results revealed a significant shift in student expectations. Job Quality and Student Skills Development had a positive and significant impact on PSQ. Meanwhile, Lecturer Profile, Curriculum, Infrastructure and Facilities, Management and Support Staff, and Safety and Security did not have a significant impact. The unexpected results of this study directly challenge the traditional paradigm of educational service quality. This study recommends that LPTK managers align their institutions' strategic focus on fostering graduate innovation in a dynamic labor market through industry collaborations, integrated internships, and competency certification. The study, the first to combine General Systems Theory with UI GreenMetric parameters, revealed that LPTK students place greater value on HEIs' services that foster personal growth through experiences and future career readiness.

Keywords: Construct Validation, Educational Management, Employability Readiness, Student Perception, Sustainability Metrics.

1. Introduction

Higher Education Institutions (HEIs) have faced intense global competition in recent years. HEIs' managers consider service quality a top strategic priority due to the internationalization of programs, increasing stakeholder demands, and the push for program diversification (Peters, 2021; Quintal *et al.,* 2012). General marketing literature states that superior service quality is a key factor for business success (Chen & Fu, 2015; Setyawati, 2022). Similarly, in the HEIs context, improving service quality aims to increase student appeal (Suranta & Rahmawati, 2024). Measuring HEIs' service quality based on student perceptions is essential. Students are direct consumers and daily evaluators of the services provided by HEIs (Ahmad, 2015; Clarke *et al.,* 2007). This situation underscores the urgency of conducting research to identify appropriate measurement tools to assess students' perceptions of HEIs' service quality (Abbas, 2020; Asnawi & Setyaningsih, 2020).

Contemporary academics have empirically demonstrated that traditional models such as SERVQUAL are no longer suitable for measuring Perceived Service Quality (PSQ) in HEIs (Abbas, 2020; Brochado, 2009; Silva *et al.,* 2017). However, the reality on the ground shows that most HEIs in Indonesia still use SERVQUAL to measure students' perceptions of service quality (Raharjo *et al.,* 2023; Abbas, 2020) developed HEISQUAL, a PSQ measurement tool believed to be more appropriate for the context of HEIs. However, this latest model still does not integrate sustainability values. The neglect of environmental and social values is a major setback in the current educational landscape. Institutional accountability and environmental awareness have become key determinants of students' enrollment and loyalty to HEIs (Munim & Noor, 2020).

Sustainable higher education is a concept that requires HEIs to play a role in reducing the negative environmental, economic, social, and health impacts arising from resource use in learning, research, and community service activities (Ozdemir *et al.,* 2020; Velazquez *et al.,* 2006). The number of HEIs in Indonesia participating in the UI GreenMetric World University Rankings has increased steadily over the past decade. This participation demonstrates HEIs' commitment to implementing their sustainability mission while simultaneously enhancing their institutional image among students. Although sustainability values are a crucial factor in shaping student satisfaction (Morgeson *et al.,* 2023), the specific service quality dimensions that align with these sustainability measures remain a major unanswered question in current research (Liu *et al.,* 2022).

This study aims to propose a measurement framework for PSQ that integrates the principles of sustainable higher education. This framework is called the Sustainable Student Service Quality (SHE-SQ) model. Therefore, there are two main questions examined in this study, namely: (a) How appropriate is the SHE-SQ framework in the sustainable higher education sector in Indonesia from the perspective of students? Moreover, (b) Which specific dimensions of the SHE-SQ model have the greatest influence on overall PSQ in Indonesia?.

This study has two main contributions to contemporary academic literature. First, it develops a new measurement scale to assess SHE-SQ by integrating the HEISQUAL framework with environmental and operational indicators from UI GreenMetric (Universitas Indonesia, 2019). Previous research has relied on adaptations of the traditional SERVQUAL model, which does not encompass sustainability factors essential for developing a sustainable higher education ecosystem (Hajrasouliha, 2017; Nejati & Nejati, 2013; Ozdemir *et al.,* 2020). Second, this study clearly links the SHE-SQ dimensions to General Systems Theory (GST) (Hofkirchner & Schafranek, 2011) to go beyond a simple list of predictors. Within the GST framework, HEIs operate as open and dynamic systems composed of interdependent subsystems that deliver overall service quality. These dimensions are not considered separate variables but are categorized into seven SHE-SQ constructs within two distinct systemic groups. The elements of faculty profile (LP), curriculum (C), infrastructure and facilities (IF), management and support staff (MSS), and safety and security (SS) are grouped as structural and procedural subsystems, representing the system's inputs and outputs. On the other hand, employment quality (EQ) and student skill development (SSD) act as outcome subsystems, representing the system's outputs and direct outcomes. This study builds a solid theoretical framework by applying GST. In addition to explaining the interactions among dimensions that influence PSQ, this study provides important guidance for predicting and identifying students' perceptions of system inputs and outputs.

2. Methods

This study is a cross-sectional quantitative investigation (Zangirolami-Raimundo *et al.,* 2018) that uses a survey design (Creswell & Creswell, 2018). The proposal of a new measurement framework was conducted through a rigorous multi-stage scale development process. The initial stage involved brainstorming based on the HEISQUAL model (Abbas, 2020) and the UI GreenMetric sustainability indicators. Individual statement items were developed and tailored to reflect specific details of sustainable service quality in HEIs. This phase resulted in a preliminary item bank containing 87 items across the underlying factors.

Three experts reviewed the initial item pool to ensure strong content validity. The evaluators rated the 87 items based on their relevance to theory, clarity of meaning, and applicability to HEIs in Indonesia. Items that were redundant, unclear, or inconsistent with the core concepts of sustainability and service quality were revised or removed based on expert consensus. A pilot study was then conducted to refine the instrument. The initial item pool was carefully reduced through data screening and internal consistency assessments to improve measurement quality and theoretical simplicity. Items that did not clearly represent the concept or showed weak correlations with other items were removed. This continuous refinement process resulted in a unified seven-dimensional SHE-SQ structure for the main study. The validated scale comprises 65 items across 17 dimensions.

Data were collected through a structured online survey of students at Indonesian Teacher Training Institutions (LPTK) participating in the UI GreenMetric World University Rankings. There are two main reasons for selecting this group of units of analysis in this study. Focusing on a specific type of institution yields more consistent data from a research perspective, thereby mitigating the risk of outliers and sampling error (Venema *et al.*, 2012). Furthermore, LPTK play a crucial role in the education system. As primary training venues for prospective teachers,

they are key hubs for disseminating sustainability values. Students' views and understanding of the quality of sustainable services at LPTK will impact future teaching practices and create a domino effect for sustainability education. Therefore, it is crucial to understand the future of sustainable higher education in Indonesia through a study limited to the LPTK segment.

The questionnaire was structured into two main sections. The first section collected information on participant demographics, while the second section measured the external SHE-SQ dimension and the internal PSQ construct. The PSQ is defined as a discrete, multi-item, reflective latent construct to ensure robust SEM specification and claim validity. Respondents rated the PSQ using a set of specific indicators to capture a comprehensive view of the institution's overall service quality and alignment with student expectations. All measurement items used a five-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). This structured scaling method follows the measurement framework developed by Alhassan *et al.* (2022), which is an established standard for collecting perceptual and behavioral data in educational settings.

Determining the sample size used the Krejcie and Morgan formula (1970), which obtained an initial sample size of 384 respondents. Individuals were selected using convenience sampling, a non-probability method that focuses on easy access rather than strict population representation (Zulvia *et al.,* 2022). A thorough data screening process is conducted after data collection. 64 respondents were excluded due to incomplete or unresponsive data. The final data set included 320 respondents, who were used for all subsequent statistical analyses.

The collected data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) assisted by SmartPLS 4. The selection of this analysis technique was aligned with the research focus of predicting and estimating complex latent-variable relationships. A general two-stage analytical process was followed based on PLS-SEM guidelines, which includes assessment of the measurement and structural models (Hair *et al.,* 2018). First, the measurement model was tested to evaluate the psychometric properties of all operationalized constructs. Internal consistency reliability was examined using Cronbach's Alpha criteria, and Composite Reliability (CR) must be greater than 0.700. Convergent validity was established through loading factors with the criterion of Average Variance Extracted (AVE) greater than 0.500. Discriminant validity was also examined to ensure that each construct is empirically different from the others in the model. After validating the measurement model, the next step was to evaluate the structural model to assess the significance of the proposed structural paths. It uses a nonparametric bootstrap resampling procedure with 5,000 subsamples to estimate standard errors, exact p-values, and t-statistics for the proposed hypothesis test (Hair *et al.,* 2018; Shmueli *et al.,* 2025).

Table 1. Respondent Demographics

Variable	Categories	Frequency	(%)
Gender	Male	126	39.38
	Female	194	60.62
Student Age	<20	5	1.56
	20	163	50.94
	21	112	35.00
	22	23	7.19
	>23	17	5.31
Educational Tier	Bachelor	230	71.87
	Master	75	23.44
	Doctor	15	4.69
Year of Study	1	52	16.25
	2	134	41.88
	3	84	26.25
	4	32	10.00
	5	18	5.62

3. Results and Discussion

3.1 Result

3.1.1 Respondent Description

The demographic distribution of respondents (N=320) presented in Table 1 is classified by gender, age, educational level, and study period.

In terms of gender, respondents in this study were more female (60.62%) than male (39.38%). The majority of respondents were 20 years old (50.94%), while the fewest were under 20 years old (1.56%). Based on educational level, the majority of respondents were enrolled in a Bachelor's degree program (71.87%), followed by Master's students (23.44%) and Doctoral students (4.69%). The respondents' study period was mostly in the second year (41.88%).

3.1.2 Measurement Model Test Results

Three construct evaluation criteria are operationalized to establish strong convergent validity: individual assessment of item factor loadings, calculation of Average Variance Extracted (AVE), and assessment of Composite Reliability (CR) (Chin & Newsted, 1998; Hair *et al.,* 2018). As shown in Table 2, the proposed measurement model demonstrates excellent convergent validity. All constructs have CR values exceeding the threshold of 0.700 (Hair *et al.,* 2018). Furthermore, all item factor loadings exceed the acceptable threshold of 0.500 (Chin & Newsted, 1998). All latent variables also yield AVE values exceeding the strict criterion of 0.600 (Hair *et al.,* 2018; Morgeson *et al.,* 2023). A comprehensive assessment of the construct's discriminant validity used the Fornell-Larcker criterion, which states that the square root of each construct's AVE must be greater than its highest correlation with any other latent variable in the model (Morgeson *et al.,* 2023). As shown in Table 3, all diagonal values (representing the square root of the AVE) exceed the corresponding off-diagonal correlation values in their respective rows and columns.

Table 2. Construct Validation and Reliability Analysis

Construct	AVE	CR	Dimensional Indicator	Item	Loading Factor Range
LP	0.761	0.858	LP1	4	0.606 – 0.842
			LP2	4	0.623 – 0.743
			LP3	4	0.606 – 0.812
			LP4	5	0.652 – 0.826
C	0.658	0.829	C1	4	0.638 – 0.821
IF	0.742	0.852	IF1	4	0.754 – 0.868
			IF2	3	0.682 – 0.728
			IF3	3	0.605 – 0.776
MSS	0.684	0.837	MSS1	3	0.806 – 0.854
			MSS2	6	0.725 – 0.862
EQ	0.786	0.875	EQ1	3	0.825 – 0.878
			EQ2	4	0.792 – 0.852
SS	0.627	0.821	SS1	4	0.662 – 0.754
			SS2	3	0.628 – 0.724
SSD	0.757	0.849	SSD1	3	0.754 – 0.872
			SSD2	5	0.767 – 0.884
PSQ	0.687	0.874	PSQ1	3	0.798 – 0.825

Table 3. Discriminant Validity Analysis Findings

Construct	LP	C	IF	PSQ	MSS	EQ	SS	SSD
LP	0.872							
C	0.487	0.811						
IF	–0.192	0.140	0.861					
PSQ	0.401	0.336	0.484	0.829				
MSS	0.360	0.563	0.525	0.087	0.827			
EQ	0.464	0.410	0.207	0.339	0.388	0.887		
SS	0.093	0.162	–0.187	0.168	–0.077	0.523	0.792	
SSD	0.107	–0.041	0.448	–0.082	0.186	0.442	–0.122	0.870

3.1.3 Structural Model Results

The proposed conceptual framework was tested using a non-parametric bootstrapping resampling technique with 5,000 subsamples. The choice of a variance-based SEM approach was tailored to this study's objectives, effectively examining complex relationships among latent variables and clearly predicting their scores (Chin & Newsted, 1998). An evaluation of the structural model's predictive accuracy was conducted prior to hypothesis testing. The evaluation results indicated that the model had moderate ability (68.4%) to explain variance in the PSQ ($R^2 = 0.684$). The results of testing the seven hypotheses in the structural model are illustrated visually in Figure 1 and presented statistically in Table 4. Path significance was assessed based on the *t*-value, exact *p*-value, and 95% confidence interval (CI).

The path assessment results confirmed that only two hypotheses were accepted, namely H5 and H7. The analysis results showed that overall PSQ was positively and significantly influenced by EQ, with a strong effect (β = 0.362; t = 3.549; p < 0.001; 95% CI [0.162, 0.562]). SSD also had a significant positive impact (β = 0.226; t = 2.093; p = 0.036; 95% CI [0.014, 0.438]) on PSQ.

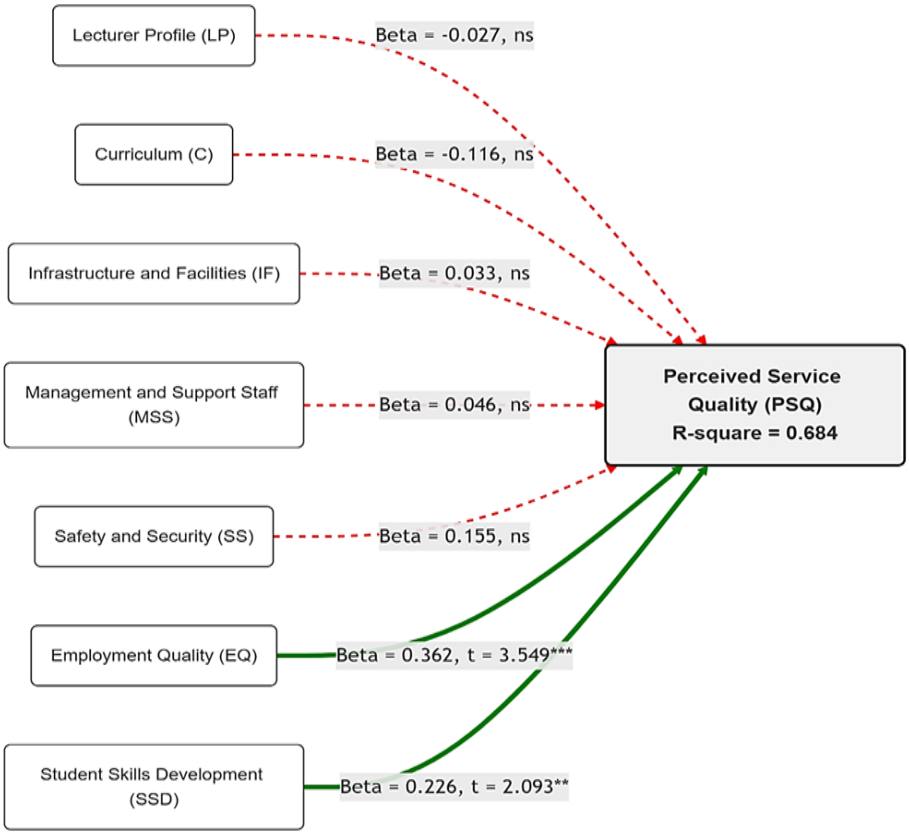

Figure 1. The PLS-SEM Structural Model Assessment

Table 4. Results of Hypotheses Evaluation

Hyp.	Structural Path	Original Sample	Standard Error	t-value	Exact p-value	95% CI [LLCI,ULCI]	Conclusion
H1	LP → PSQ	–0.027	0.109	0.248	0.804	[–0.241, 0.187]	Rejected
H2	C → PSQ	–0.116	0.119	0.975	0.330	[–0.349, 0.117]	Rejected
H3	IF → PSQ	0,033	0.139	0.237	0.813	[–0.239, 0.305]	Rejected
H4	MSS → PSQ	0.046	0.106	0.434	0.664	[–0.162, 0.254]	Rejected
H5	EQ → PSQ	0.362	0.102	3.549	< 0.001	[0.162, 0.562]	Accepted
H6	SS → PSQ	0.155	0.109	1.422	0.155	[–0.059, 0.369]	Rejected
H7	SSD → PSQ	0.226	0.108	2.093	0.036	[0.014, 0.438]	Accepted

The confidence interval scores that did not cross zero further confirmed the significance of these two hypotheses. Meanwhile, the other five hypotheses, H1 through H4 and H6, were empirically rejected. The p-values were above the standard threshold of 0.05 and their confidence intervals encompassed zero, statistically proving the absence of the expected positive effects of LP, C, IF, MSS, and SS on PSQ.

3.2 Discussion

The empirical findings in this study indicate substantial empirical differences regarding the study of the influence of structural and procedural subsystems on PSQ. Specifically, the dimensions of lecturer profile, curriculum, infrastructure and facilities, management and support staff, and safety and security did not positively influence PSQ. This finding contradicts existing literature, which positions these fundamental subsystems as the primary determinants of student satisfaction with the quality of service provided by HEIs (Fiel'ardh *et al.,* 2023; Ismailova *et al.,* 2025; Schiaroli *et al.,* 2024). The unique characteristics of LPTK may explain the differences in empirical results in this study. Traditional service quality attributes and academic curricula in LPTK are largely determined by national policies centrally regulated by the government (Lorente-Echeverría *et al.,* 2022). This condition leads students to perceive these important service attributes as basic needs (hygiene factors) that HEIs should fulfill, rather than as valuable differentiating factors.

Furthermore, sustainability initiatives in most Indonesian HEIs are still in their infancy (Jusuf *et al.,* 2020). Many institutions primarily focus on meeting UI GreenMetric administrative requirements (such as basic campus greening and energy efficiency) rather than making more substantial and pedagogically valuable improvements (Ankareddy *et al.,* 2025; Fiel'ardh *et al.,* 2023). This phenomenon has resulted in these core subsystems no longer being a focus of attention for current students and not significantly improving students' overall impressions of HEIs' service quality (Seitova *et al.,* 2024).

Furthermore, this study's findings indicate that the outcomes subsystem within the SHE-SQ framework has a strong positive influence on PSQ. EQ and SSD have been shown to significantly impact sustainability practices in current HEIs (Bui *et al.,* 2024; Khatri *et al.,* 2024; Latif *et al.,* 2024) while highlighting a clear shift in student perceptions. Students at LPTK are now competent in distinguishing between standard educational services and the tangible benefits of the higher education experience, perceived in terms of employability (Fang *et al.,* 2025). Student perceptions are more focused on services that directly impact teaching skills and career flexibility. These skills are essential for students facing intense competition in the national labor market for educators (Fleck *et al.,* 2025). EQ and SSD are key requirements for LPTK students to minimize the gap between theoretical classroom learning and the practical demands of long-term career sustainability (Fang *et al.,* 2025; Humburg *et al.,* 2013). Students perceive the ability to integrate sustainability values and promote independent growth through hands-on practice as essential advantages for securing current job opportunities (Brusoni & Grifoll, 2014; Žalėnienė & Pereira, 2021). These findings confirm that the quality of LPTK services is no longer evaluated solely based on their physical facilities or traditional services, but rather on their ability to provide clear career paths and develop skills that prepare students to adapt to job demands.

4. Conclusion

The results of this investigation have fulfilled the objectives of this study: confirming the SHE-SQ framework and identifying the specific dimensions driving PSQ in the context of LPTK in Indonesia. The findings of this study indicate a significant shift in perspective in the study of educational service quality. The outcome subsystem, specifically EQ and SSD, has a positive and significant effect on PSQ. In contrast, traditional aspects such as LP, C, IF, MSS, and SS were not proven to have a significant impact on PSQ. The findings of this study confirm that LPTK students prioritize practical workforce-readiness and self-development through experience-based self-development over conventional forms of service.

The practical implications of these findings underscore the urgent need for LPTK administrators to realign their service priorities to students. Institutional management should focus on strengthening industry collaborations, expanding integrated internship programs, and offering flexible competency certifications that meet the demands of a dynamic labor market. While basic service structural elements remain necessary for institutional compliance, empirical evidence suggests they are no longer the primary strategic focus for distinguishing sustainable service quality.

5. Limitations and Future Research

Although this study implemented rigorous methodological protocols, several limitations need to be critically acknowledged. First, the sampling frame was limited to students enrolled in LPTK actively participating in UI GreenMetric. While this target group provides valuable insights into the contemporary perceptions of educators and prospective educators, the findings cannot be generalized to all higher education institutions, particularly polytechnics or non-teaching universities, which have different institutional missions than LPTK. Second, the cross-sectoral survey design limited the collection of student perceptions at a single point in time. Consequently, this method does not allow for the establishment of clear, long-term causal relationships between SHE-SQ dimensions.

The results of this study, which rejected five hypotheses, highlight the limitations of research that relies solely on a quantitative approach. The specific social and educational contexts at LPTK significantly influence students' perceptions of traditional service attributes. Future research should address this issue by expanding the sample to include a wider range of HEIs across diverse fields and cultural backgrounds. Furthermore, qualitative methods are highly recommended for future studies. By integrating focus group discussions or in-depth interviews, mixed-methods research can better uncover the social factors that explain why traditional service attributes are not currently a priority for students.

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Author Contribution Statement

Teguh Hardi Raharjo: Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Funding acquisition. Nina Oktarina: Validation, Writing - Review & Editing, Supervision. Dian Fithra Permana: Data Curation, Visualization, Project administration. All the authors have read and agreed to the published version of the manuscript.

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Conflict of Interest

The authors have no conflicts of interest to declare. There is also no financial interest to report. The author certifies that the submission is original work and is not under review at any other publication.

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