Usability Test Using the System Usability Scale in the Industrial Engineering Laboratory at Universitas X Indonesia

Saiful Rowi[1, a)], Fuad Achmadi[2, b)]

Author Affiliations
[1] *Master of Industrial Engineering Program, Institut Teknologi Adhi Tama Surabaya*
Jalan Arief Rahman Hakim No. 100 Surabaya, Indonesia, 60117
[2] *Master of Industrial Engineering Program, Institut Teknologi Nasional Malang*
Jalan Sigura - Gura No. 2 Malang, Indonesia, 65145

Author Emails
[a)] *saifulrowi150@gmail.com**
[b)] *fuadachmadi@gmail.com*

Abstract. In a quality education system, services are integral to delivering quality education. Providing excellent, effective, and efficient services to students is crucial for their success at the university, including laboratory services to support student practicum. However, the laboratory services in the Industrial Engineering Program Study at Universitas X in Indonesia seem to fall short of expectations and do not fully meet student needs. This study aims to assess the usability of the Industrial Engineering Laboratory services at Universitas X. The System Usability Scale (SUS) method is employed to gauge the service scale's effectiveness. The SUS score obtained in this study is 53, indicating that the services at the Industrial Engineering Laboratory Universitas X are categorized as acceptable but require improvement. Therefore, while the system created is deemed acceptable by its users, it needs enhancement to positively impact Industrial Engineering laboratory services.

Keywords: System usability scale, Services, Laboratory

1. Introduction

Educational institutions at both secondary and tertiary levels must possess quality and qualified human resources (HR). This includes not only teachers or lecturers but also competent educational staff to ensure maximum satisfaction among the stakeholders we serve. In higher education, stakeholders may include students, parents, or collaborating parties. However, since most activities in higher education revolve around students, excellent service must prioritize their needs. Miftah & Sari (2020) define service as the process of fulfilling needs directly through the activities of others.

It's crucial to realize that services to students should be executed excellently, efficiently, and in accordance with established procedures and quality standards. This ensures that the output of these services effectively addresses the problems faced by students on campus. Service quality, being the essence of service, must be evaluated based on the quality of the service itself. Abdullah Adzan (2022) identifies two factors influencing service quality: expected service and perceived

service. Balancing these factors is essential to ensure good service quality and alignment between expectations and perceived performance. Service quality, a crucial indicator of organizational effectiveness, must be integrated into services provided to students on campus (Maulana et al., 2023).

The significance of laboratory service quality in student satisfaction is supported by various studies. Susanto et al. (2021) found that good service quality positively impacts customer satisfaction, echoed by Shofa et al. (2019) who suggest that customer satisfaction predicts loyalty in the education sector. Mahapatra & Kiran (2018) emphasize the role of service quality in shaping students' perceptions of university quality and loyalty to the institution. Thus, Universitas X must prioritize the quality of its laboratory services to enhance student satisfaction, perceptions of the university, and loyalty to the institution (Girsang, 2019).

This study employs the System Usability Scale (SUS) analysis (Miftah & Sari, 2020) to assess the usability of the Industrial Engineering Laboratory at Universitas X. SUS is chosen for its effectiveness in evaluating usability, as supported by Welda et al. (2020), Kosim et al. (2022), Tuloli et al. (2022), and Kaban et al. (2020). It is particularly suitable for evaluating service systems like laboratory services, focusing on factors such as learnability, efficiency, memorability, errors, and satisfaction (Defriani et al., 2021). Additionally, SUS requires a relatively small sample size, reducing costs and time (Shofa et al., 2019). This approach aligns with the need for verification and validation testing to ensure that laboratory services meet their objectives. However, further exploration is needed to address the research gap in the specific application of usability testing for service systems like laboratory services.

2. Methods

The study employs the field research method for data collection, involving physical visits to the research location. This method encompasses interviews, discussions, observations, and distribution of questionnaires. The focus of this study is the Industrial Engineering Laboratory at Universitas X. Data collection utilizes a questionnaire comprising various aspects. Researchers extract diverse data corresponding to the questionnaire items. The research was conducted during January-February 2023.

This study utilized a questionnaire based on the System Usability Scale (SUS) method, comprising 10 items. The instrument was distributed through Google Forms. Each question in the questionnaire consists of a five-point scale: 1 for "strongly disagree," 2 for "disagree," 3 for "undecided," 4 for "agree," and 5 for "strongly agree."

Respondents in this study are Industrial Engineering students at Universitas X who have utilized the laboratory facilities. The study aims to involve 60 respondents, including 44 males and 16 females. Below is a table 1 displaying the translation of items in the SUS Questionnaire instrument:

Table 1 System Usability Scale (SUS) item translation results

Item	Question	Scale
1	I think that I would like to use the Industrial Engineering Lab more often for practicum.	1 – 5
2	In my opinion, access to the use of the Industrial Engineering Lab does not need to be complicated/complex for practicum.	1 – 5
3	In my opinion, the Industrial Engineering Lab is easy to use for practicum.	1 – 5
4	I need help from someone who is an expert/understands how to use the Industrial Engineering Lab for practicum.	1 – 5
5	In my opinion, the facilities available in the Industrial Engineering Lab are sufficient for practicum.	1 – 5
6	In my opinion, many of the facilities available in the Industrial Engineering Lab do not support practicum.	1 – 5
7	In my opinion, ordinary people will quickly understand and easily use the Industrial Engineering Lab for practicum.	1 – 5
8	In my opinion, the Industrial Engineering Lab is too difficult to use for	1 – 5

Item	Question	Scale
	practicum.	
9	I feel that there are no obstacles when practising in the Industrial Engineering Lab.	1 – 5
10	I need to adapt first before using the Industrial Engineering Lab for practicum.	1 – 5

The SUS analysis utilizes a rating scale from 1 to 5 (x), with each question assigned a weight from 0 to 4, based on 10 given questions. These questions are categorized into two types: positive questions (numbered 1, 3, 5, 7, and 9) and negative questions (numbered 2, 4, 6, 8, and 10). Scores for positive questions (1, 3, 5, 7, and 9) are calculated by subtracting 1 from the rating scale (x-1), while scores for negative questions (2, 4, 6, 8, and 10) are calculated by subtracting the rating scale from 5 (5 - x). The sum of these scores is then multiplied by 2.5 to determine the SUS value. The range of assessment results for this study will be interpreted using an adjective scale, as illustrated in Figure 1.
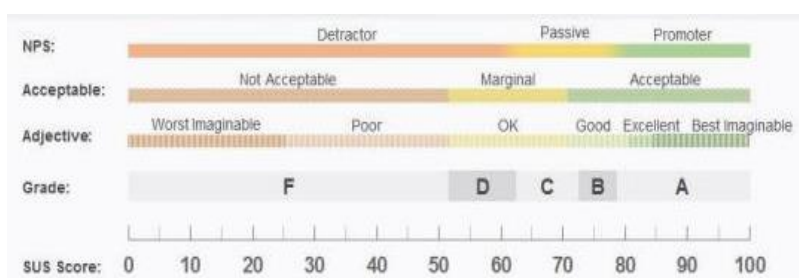

Figure 1 SUS Value Interpretation

3. Results and Discussion

In this study, the validity and reliability of the System Usability Scale (SUS) are determined using the two-tailed Pearson correlation test. This test is chosen to evaluate the relationship between the total scores of all questionnaire items and the desired validity measure. The two-tailed Pearson test offers insight into both the direction and strength of the relationship between the total questionnaire score and the validity measure. By analyzing the correlation value, this study ascertains the extent to which the questionnaire meets expected validity standards. Therefore, the decision to utilize the two-tailed Pearson test establishes a robust framework for assessing the validity of the SUS (table 2).

Table 2 Questionnaire Data Validity Test Results

	R_{count}	R_{table}	Description
Q1	0,324	0,2144	Valid
Q2	0,639	0,2144	Valid
Q3	0,434	0,2144	Valid
Q4	0,476	0,2144	Valid
Q5	0,546	0,2144	Valid
Q6	0,614	0,2144	Valid
Q7	0,561	0,2144	Valid
Q8	0,648	0,2144	Valid
Q9	0,551	0,2144	Valid
Q10	0,699	0,2144	Valid

This study conduct reliability testing on each question collectively using the Cronbach's Alpha (α) method. This selection is based on the necessity to gauge the internal consistency of the questionnaire items. The Cronbach's Alpha method specifically evaluates the level of consistency

or reliability of a measurement instrument consisting of multiple items or questions. Through this reliability test, researchers can ascertain the extent to which the questionnaire questions are consistent in measuring the same variable, thus ensuring the reliability and accuracy of the research findings.

Table 3 Reliability Test Results of Questionnaire Data (Reliability Statistics)

Method (a)	Item Number	Description
0.741	10	Reliable

The reliability test results (Table 3) yield a coefficient alpha of 0.741 for the 10 questionnaire statements, indicating a high level of reliability. Generally, when the alpha value exceeds 0.60, the questionnaire items are considered reliable.

Regarding the System Usability Scale assessment results, they are categorized as follows:
a. Grade
   This type of grading system for categorising SUS scores is in the A-F grade range. At grade A which indicates superior performance, grade B indicates excellent, grade C indicates average, grade D indicates poor, to F to indicate failed performance.
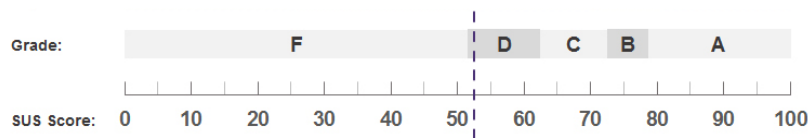

Figure 2 SUS Score in Grade Scale

With a SUS score of 53, correlating with a grade D on the scale (Figure 2), the findings suggest a low assessment of laboratory service quality. This indicates inadequate performance in areas such as equipment availability, staff effectiveness, and responsiveness to user needs. The link between this outcome and the questionnaire lies in users' evaluations of the usability and satisfaction regarding the provided laboratory services.

b. Adjectives
   The adjective scale includes adjectives such as good, OK, and poor to categorize users broadly based on the usability of a product. For instance, an SUS score above 85 is associated with the Excellent category.
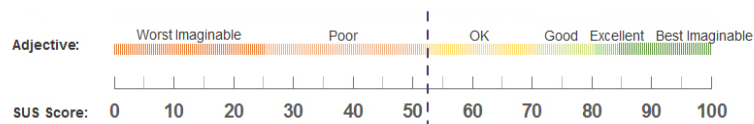

Figure 3 SUS Score in Adjectives Scale

In figure 3, with an SUS score of 53, the service at the Industrial Engineering Laboratory Universitas X is considered "OK" according to the adjective scale. However, respondents perceive a lack of utility, indicating that the service may not be deemed effective in achieving user goals. This could stem from inadequate equipment availability, complex procedures, or insufficient staff support. Improvements in these aspects may be necessary to enhance user perception of utility.

c. Acceptability
   Another way to describe SUS is through statements of acceptability or unacceptability. According to Bangor (2009), these terms are defined when the SUS score is well above

average or well below average. SUS scores above 70 (which is higher than the average SUS score of 68) are categorized as acceptable, while scores below 50 are deemed unacceptable (closely related to scores lower than 51.6 with an F value). Scores falling within the range of 50-70 are considered marginally acceptable or acceptable but in need of improvement.
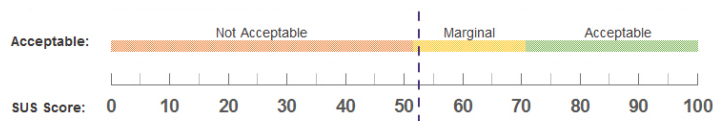

Figure 4 SUS Score in Acceptability Scale

In Figure 4, with a SUS score of 53, the services of the Industrial Engineering Laboratory Universitas X are categorized as marginally acceptable on the Acceptability scale, indicating the need for improvement. This suggests that although meeting minimum standards, the service quality does not fully satisfy users, resulting in hesitancy in recommending it. Critical areas for improvement include equipment availability and quality, staff competency and responsiveness, as well as the effectiveness of the communication and feedback system. Enhancements in these areas are expected to elevate user satisfaction and loyalty, while also enhancing the laboratory's image and reputation.

d. Net Promoter Score (NPS)

NPS classifies recommenders into three categories based on their responses to potential points (ranging from 0 to 100). Promoters are those scoring between 90 and 100, passives fall within the range of 70 to 80, and detractors score 60 or below. Promoters are highly likely to recommend the product/website/app/service to others, while passives find it acceptable but may not actively promote it, and detractors are inclined against recommending it.

The diagram in figure 5 illustrates the correlation between NPS and SUS scores. Achieving a promoter classification typically necessitates an average SUS score close to 81. On the other hand, a detractors classification aligns with an average SUS score of 53 or lower, while passive falls in between with an average score of approximately 70.
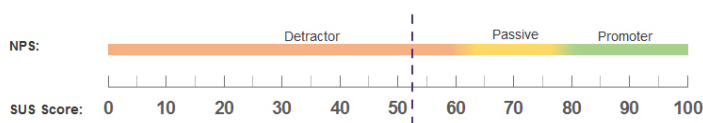
Figure 5 SUS Score in NPS Scale

The SUS score in this study is 53, indicating placement in the detractor category according to NPS. Respondents generally refrain from recommending Universitas X's Industrial Engineering Laboratory services. To address this issue, proposed solutions include enhancing equipment quality and availability, instituting regular staff training, and improving communication and responsiveness to user feedback. Implementation strategies may involve upgrades to equipment, more effective inventory management, comprehensive training programs, and the establishment of a transparent feedback mechanism. The responsibility for these improvements should be assigned to the lab management, with support from the industrial engineering department and the university's quality assurance unit, ensuring cohesive coordination and continuous enhancement.

4.   Conclusions

This research contributes to the general improvement of laboratory services by identifying areas in need of enhancement using the SUS (System Usability Scale) method. With a SUS score falling in the D range and categorized as "OK," along with a classification on the acceptability scale as "marginal" and acceptable, the study reveals that while laboratory services meet minimum standards, there remains significant room for improvement. Correlating these results with the NPS (Net Promoter Score) classification in the detractor category emphasizes the necessity of enhancing services to elevate user satisfaction levels. These findings hold relevance not only for the industrial engineering laboratory at Universitas X but also offer valuable guidance to other laboratories seeking to enhance their service quality and achieve optimal user satisfaction.

Acknowledgements

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