

## Webqual 4.0 and ISO/IEC 9126 Method for website quality evaluation of higher education

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**Abstract.** The paper is the development of a model from previous research on the quality of student website services or academic portals from user perceptions. The purpose of this study is to determine the quality of website services in Higher Education towards user satisfaction and website performance, conducting a service quality analysis of the 2 quality measurement approach models used. Development Method using the ISO/IEC 9126 model and Webqual 4.0 method to measure user satisfaction. Quality variables used are usability, information quality, service interaction quality, reliability quality, and efficiency quality. Additional testing of web performance is also carried out to support the results of quality evaluations of user perceptions and website performance.

### 1. Introduction

#### 1.1. Research background

Higher Education, as one of the institutions that focus on the field of education service providers are required to be optimal in the quality of services to users, in this case are students. Various forms of method approach are used, and service models are provided to students. One of which is the utilization of information and communication technology in the management of student academic administration, as an effort towards Good University Governance (GUG) for Excellent Service [1]. Excellent service is a service that not only meets customer expectations but also exceeds the expectations of customers. Excellent service can be a capital to increase student confidence in Higher Education. This supports Nurcahyani's study [2], which explains that the practice of the principles of good corporate governance is consistent and sustainable, generating public trust.

Utilization of information and communication technology, one of which is an academic information and management system, this system consists of several service management sub-systems, such as student study plan services, student assessment information services, practical work services and real student work, student competency test services, student career services, tracer study services, and other student management administration services. Utilization of information systems and academic management is provided by higher education institutions, aimed for optimizing services effectively and efficiently, which provides quality and satisfaction to students.

### 1.2. Motivation

The importance of service quality and satisfaction to students greatly affects the image of the Higher Education, competition in fighting over the student market is quite heavy. Based on the database of Higher Education in [3], that the number of Higher Education in Indonesia reached 4,603. From the total number of Higher Education, 4,481 or 97.35% are private institutions, while state institutions only amount to 122 or 2.65%. In the midst of heavy competition, improving quality becomes inevitable in order to compete for public trust and continue to exist. Higher education is required to be able to provide the best service to the community and be oriented to the needs of the community. Academic services and supporting facilities are among the consideration of prospective students in choosing Higher education institutions to continue their education. So that, the quality of service is one indicator of the success of educational institutions as a public service organization.

### 1.3. Problems

This paper is the development of a model from previous research [4] about the Web Performance Optimization Techniques for Biodiversity Resource Portal, and the research [5], about QoE and QoS Evaluation for Academic Portal in Private Higher Education Institution. The purpose of this study is to measure the quality of website services in Higher Education towards user satisfaction and website performance, conducting a service quality analysis of the 2 quality measurement approach models used. Development Method using the ISO/IEC 9126 model and Webqual 4.0 method to measure user satisfaction. Quality variables used are usability, information quality, service interaction quality, reliability quality, and efficiency quality. Additional testing of web performance is also carried out to support the results of quality evaluations of user perceptions and website performance.

## 2. Methodology

### 2.1. Data sources and collection methods

Data sources are divided into primary data and secondary data. Primary data is data obtained directly by researchers through questionnaires and website services in Higher Education testing using simulation tools. Secondary data is data obtained by researchers from the international standard software quality documentation from ISO / IEC 9126.

### 2.2. Software quality: ISO / IEC 9126 model and Webqual 4.0 method.

The quality factor according to ISO/IEC 9126 [6], includes the following six quality characteristics:

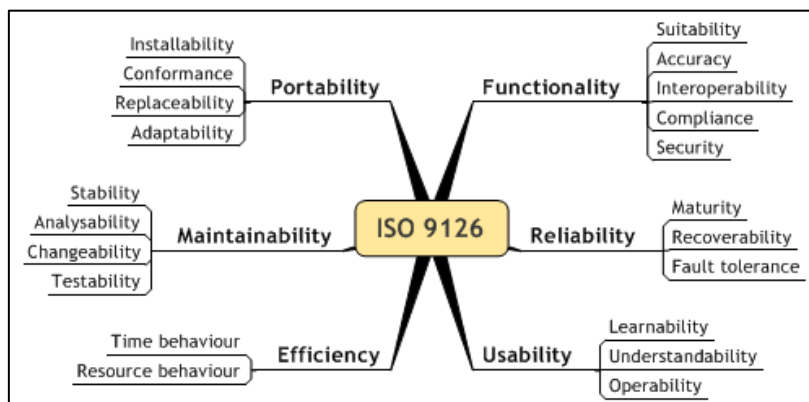
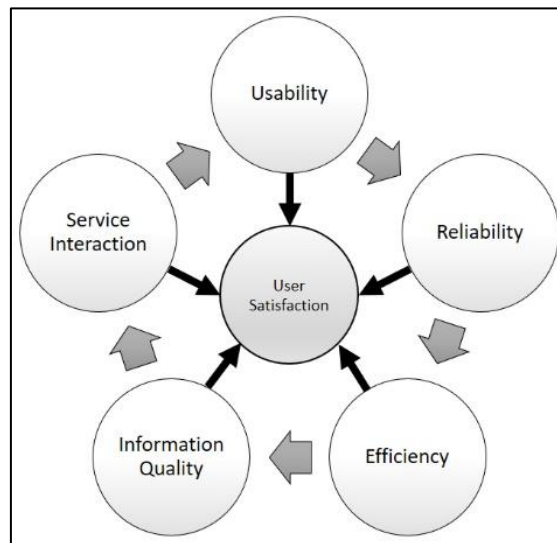


Figure 1. ISO/IEC 9126.

Measurement of the quality of service information systems and academic management of students using the ISO / IEC 9126 model based [6] on Figure 1, explains that there are 6 characteristics in measuring the quality of a website's services, i.e. Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability.

Webqual 4.0 is one of the methods of measuring the quality of services for customer satisfaction, such as management information systems service of students on higher education. And this paper characteristics of the ISO / IEC 9126 service quality model used are Reliability, and Efficiency refers to [5], [7], [8], [9].



**Figure 2.** Webqual 4.0 and ISO/IEC 9126.

The variable used (see: **Figure 2**) is an independent variable. These variables are explained based on the characteristics of the ISO 9126 model with the usability 10 Heuristic approach refers to [5], while the Webqual 4.0 quality variable (service interaction, information quality and functionality) refers to research [10]. the variable quality reliability and efficiency refers to [4], [11].

### 3. Results and Discussion

While the population in this study were all students who used Higher Education academic services throughout 2018. The population was 8261 users. The study sample using the Slovin formula [12], with an error tolerance level of 10%. Based on the results of sample calculations using the Slovin formula, a minimum sample of 98 samples was obtained from distributing the questionnaire to 104 respondents.

#### 3.1. Result: instrument test

Testing the questionnaire instrument using validity and reliability tests. Data validity testing uses a Pearson product-moment correlation coefficient [13]. The results of the validity test of 10 items on the questionnaire declared valid at a significance level of 0.05 with a sample size of 100 respondents. as well as the reliability test results of each variable with an Alpha Cronbach value for Usability of 0.768, information quality of 0.781, and service interaction quality of 0.773. This shows that the reliability test value is declared reliable because it is greater than the Cronbach Alpha value  $> 0.6$ .

#### 3.2. Result: webqual 4.0 method

The independent variable (X) of the research is Usability (X1), Information Quality (X2), Service Interaction Quality (X3), and the dependent variable is User Satisfaction (Y). Using the core quality indicators Webqual 4.0 which refers to Barnes and Vidgen research [14]. Reliability test results using Cronbach Alpha theory. If the Cronbach Alpha value is greater than 0.60 then the question items on

the questionnaire are declared to be reliable for use as research instruments. Furthermore, Based on the results of the Kolmogorov-Smirnov One-Sample test (using SPSS), the Asymp.Sig (2-tailed) significance value of 0.583 is greater than 0.05. Then according to the basis of decision making in the Kolmogorov-Smirnov normality test, it was stated that the data were normally distributed. Thus, the assumptions or normality requirements in the regression model have been accepted.

From the results of the reliability test based on Table 1, it shows that the value of sig. (Deviation from Linearity value) each variable is more than 0.60 and it can be concluded that the research variable is declared reliable, and is worthy of being used as a research instrument.

**Table 1.** ANOVA table reliability test.

	Sum of Squares	df	Mean Square	F	Sig.
User_Satisfaction * Usability	91.500	13	7.038	.820	.638
User_Satisfaction * Information_Quality	105.507	14	7.536	.881	.682
User_Satisfaction * Service_Interaction	82.691	15	5.513	.612	.856

Furthermore, the results of the Assumption test for multi-collinearity are seen in Table 2. To detect the presence or absence of multi-collinearity symptoms in the regression model, it can be done in several ways, i.e.: See the correlation value between independent variables, see the condition index and eigenvalue values, and see the value of tolerance and variance inflating factor (VIF). In this paper, we examine multi-collinearity by looking at tolerance values and VIF using the SPSS program.

**Table 2.** Assumption test for multi-collinearity.

Model		Coefficients <sup>a</sup>						
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.799	1.302		1.435	.194		
	Usability	.433	.094	.485	3.832	.000	.416	2.576
	Information_Quality	.354	.095	.334	2.968	.005	.534	1.874
	Service_Interaction	.257	.095	.397	3.225	.003	.423	3.632

a. Dependent Variable: User\_Satisfaction

Based on Table 2 "Coefficients" in the "Collinearity Statistics" section, the Tolerance value for the Usability (X1) variable is 0.416, Information Quality (X2) is 0.534 and Service Interaction (X3) is 0.423. These 3 variables are greater than 0.10. And the VIF value for the Usability (X1) variable is 2.576, information quality (X2) is 1,874 and service interaction (X3) is 3.632 <10.00. Then referring to the basis of decision making in the multi-collinearity test it can be concluded that there were no symptoms of multicollinearity in the regression model.

**Table 3.** ANOVA<sup>a</sup> - Linear regression test.

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	516.434	3	172.145	57.468	.000 <sup>b</sup>
Residual	287.566	96	2.995		
Total	804.000	99			

a. Dependent Variable: User\_Satisfaction

b. Predictors: (Constant), Service\_Interaction, Information\_Quality, Usability

Linear regression test is used to measure how much influence the independent variable X has on the dependent variable Y. Multiple linear regression is based on functional or causal relationships (cause and effect). The results of the analysis are in Table 3. Table 3 ANOVA - Linear regression test, provides information about the simultaneous (together) use of usability, information quality and service interaction on user satisfaction based on the significance value (Sig.) of Anova, the Sig value is 0,000. Because of the value of Sig.  $0.000 < 0.05$ , so according to the basis of decision making in the F test it can be concluded that the hypothesis is accepted or the usability (X1), information quality (X2) and service interaction (X3) simultaneously affect user satisfaction (Y).

To measure how much (%) the effect of the quality of usability (X1), information quality (X2) and service interaction (X3) simultaneously (together) on user satisfaction (Y), referring to the value of R square contained in Table 4.

**Table 4.** Model summary<sup>b</sup> – linear regression test.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.801 <sup>a</sup>	.642	.631	1.73074

a. Predictors: (Constant), Service\_Interaction, Information\_Quality, Usability

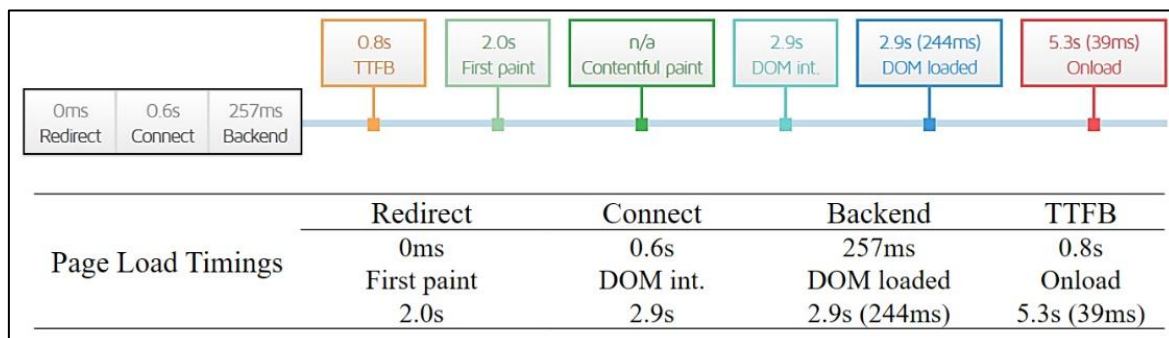
b. Dependent Variable: User\_Satisfaction

Based on Table 4, it is known that the coefficient of determination or R Square is 0.642. R Square value of 0.631 is derived from the square of the correlation coefficient @, which is  $0.801 \times 0.801 = 0.642$ . The magnitude of the coefficient of determination (R Square) is 0.642 or equal to 64.2%. This value implies that the quality of Usability (X1), Information Quality (X2) and Service Interaction (X3) simultaneously (together) to user satisfaction (Y), amounted to 64.2%. While the rest ( $100\% - 64.2\% = 35.8\%$ ) is influenced by other variables.

Based on the results of research in measuring the quality of management information systems services of students on higher education based on the User Satisfaction using the Webqual 4.0 method, the results of testing on 3 variables showed a significance value of 0,000. This shows that the quality of usability, quality of information, quality of service interaction has a positive and significant impact on user satisfaction.

### 3.3. Result: ISO/IEC 9126 formula

The characteristics of ISO / IEC 9126 as measured in the paper are the quality of reliability and efficiency, especially in the performance of internal resources in the student academic management system of Higher Education. Measuring the quality of service (reliability) resource system using the GTMetrix performance measurement tool of the website [15]. The results of performance measurements of reliability quality are shown in Figure 3. The Executive Summary report on the results of measuring the quality of reliability performance is shown in [16], Figure 3.



**Figure 3.** The executive summary report of the website performance.

Figure 3 at performance report [16], explains that the time spent redirecting the URL before the last HTML page loads is 0 ms. This time is the total of all this time spent diverting, the value of which is 0ms (no redirects occurred). The time spent connecting to the server to make requests to the page is 0.6s. Once the connection is complete and the request is made, the server needs to generate a response for the page. The time it takes to generate the response is known as the Backend duration of 257 ms, with the total amount of time spent to receive the first byte of the response once it has been requested or Time to First Byte (TTFB) of 0.9 s. The time spent browser sort and rendering on the page (First paint time) is 2.0s, the Document Object Model (DOM) interactive time is 2.9s and DOM loaded is 244ms. Onload time needed for page processing is complete and all resources on the page are 5.3 s (39 ms).

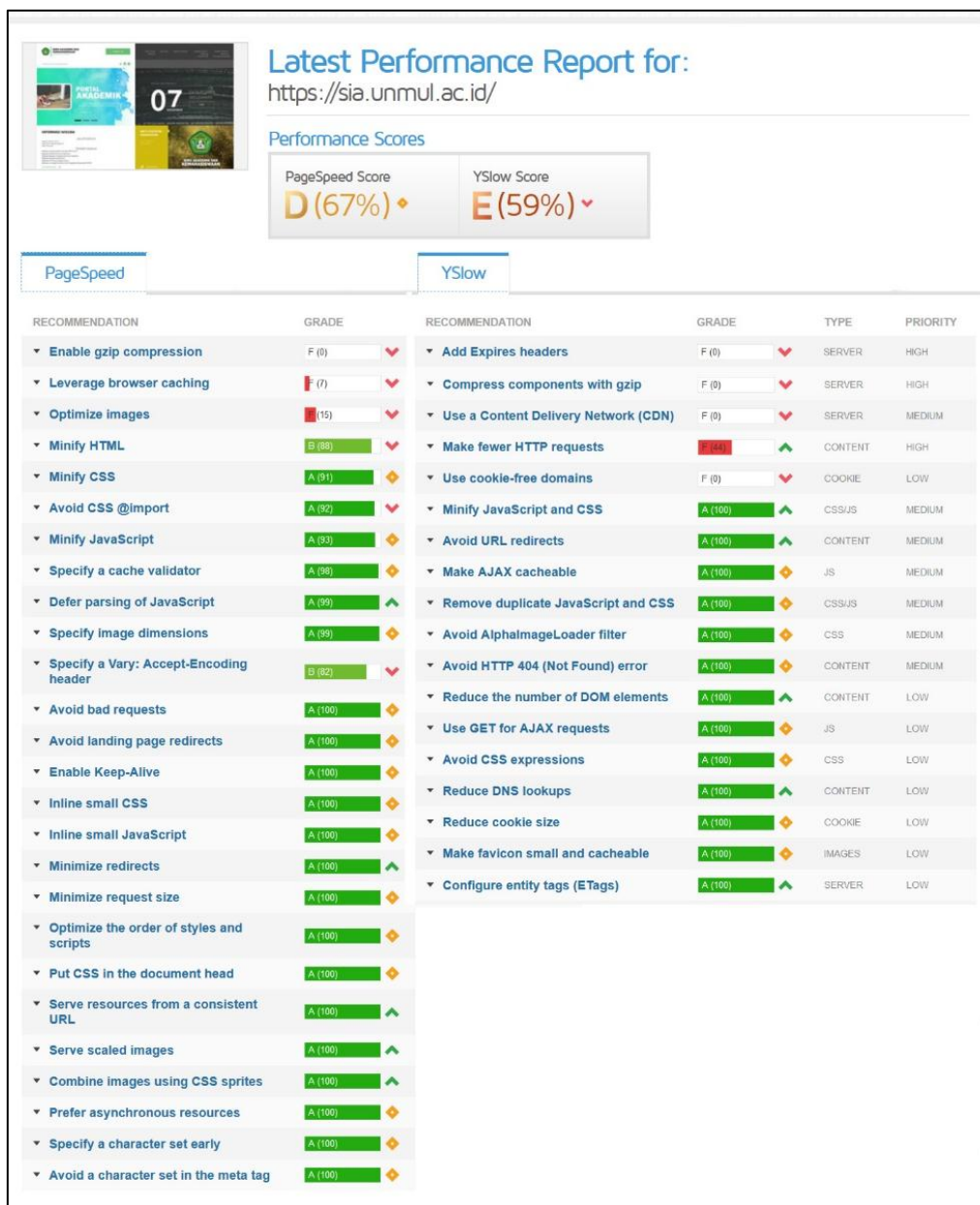


Figure 4. The performance recommendation from Google's PageSpeed and Yahoo's YSlow.

The results of measuring for quality of efficiency of service system resources using a combination of the performance recommendation parameters from Google's PageSpeed and Yahoo's YSlow [16-18]

shown in Figure 4. Based on the results of the measurement of the quality of the efficiency presented in Figure 4 shows that the performance of the website resources Academic management system students get a PageSpeed score (67 %) category D and YSlow Score (59 %) in the E category. This explains that the low score quality website resource efficiency caused by some parameters PageSpeed recommendations get grade F (0) such as Enable gzip compression, Leverage browser caching, and Optimize images, and YSlow recommendations, such as Add Expires headers, Compress components with gzip, Use a Content Delivery Network (CDN), Make fewer HTTP requests and Use cookie-free domains.

#### 4. Conclusion

Research measuring the quality of student academic services at tertiary institutions based on the perception of users (User Satisfaction), using the WebQual 4.0 method involves usability quality, information quality, and interaction service quality, it is concluded that shows significance and has a positive influence on user satisfaction. If the quality of usability, quality of information, and quality of service interaction increase, user satisfaction will also increase. Whereas the measurement of the quality of reliability and efficiency using the formula approach ISO / IEC 9126 shows that the quality of reliability based on the evaluation of the GTmetrix web performance measuring tool obtained a Fully Loaded Time value of 5.3 s (onload) with 1.24MB total page size of 33 Requests. This is due to the resource parameter in Optimize images recommendation in grade F, this parameter greatly influences the high page load time.

These recommendations for improving the quality of reliability can be through file size reduction by loading images of the right size based on where the images will be displayed, saving files in the appropriate format depending on usage, and save time and bandwidth by compressing resources. So that the results of this reliability quality measure significantly affect the quality of efficiency, which shows the performance of the Academic Management System website for students obtaining a PageSpeed D score (67 %) and YSlow Score E (59 %).

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