Evaluating Satuva Academic Portal Service Quality Using Webqual 4.0 Toward User Satisfaction And Academic Effectiveness

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Abstract

Extending prior End-User Computing Satisfaction (EUCS) findings, this study evaluates the website service quality of the Integrated Academic System of Universitas Al Washliyah Medan (SATUVA) and its empirical impact on user satisfaction and academic effectiveness using the WebQual 4.0 framework. A quantitative explanatory survey was conducted among 101 active users comprising students (75.2%), lecturers (17.8%), and administrative staff (6.9%). Nineteen questionnaire indicators were mapped across Usability Quality, Information Quality, and Service Interaction Quality, and analyzed via WebQual Index (WQI%), mean satisfaction scoring (RK), and multiple linear regression. Results show SATUVA achieved a satisfied rating with an aggregate mean of 3.77/5.00 (WQI = 75.32%), led by Service Interaction Quality (3.87; 77.33%) and Usability Quality (3.84; 76.86%), while Information Quality scored lowest (3.65; 72.97%) due to data output errors (IQ6 = 2.34). Regression confirms all three dimensions significantly drive User Satisfaction and Effectiveness ($F = 479.65$, $R^2 = 0.937$, $p < 0.01$), highlighting priorities in geofencing expansion, billing automation, and schedule synchronization.

Keywords: SATUVA, WebQual 4.0, Usability Quality, Information Quality, Service Interaction Quality, User Satisfaction.

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Introduction

Digital transformation in higher education institutions has fundamentally shifted academic administration from manual record-keeping toward integrated web-based service ecosystems [1], [2]. Modern academic portals function not merely as grade repositories, but as the operational backbone connecting students, lecturers, and administrative personnel within a unified real-time information architecture [3], [4]. The operational success of an institutional information system depends heavily on balancing software engineering reliability, intuitive user interface design, and accurate decision-support capabilities [5], [6]. At Universitas Al Washliyah (UNIVA) Medan, the institutional commitment to realizing Good University Governance through digitalization is embodied in the Integrated Academic System of Universitas Al Washliyah, known as SATUVA [1].

Although the SATUVA portal serves as the primary digital platform for course registration, geolocation-based lecture attendance, learning material distribution, and academic reporting, field observations reveal persistent gaps between functional availability and end-user service experience [1]. In an earlier study conducted by Manao et al. [1], the evaluation of SATUVA was approached using the End-User Computing Satisfaction (EUCS) model focusing on five internal computing dimensions: content, accuracy, format, ease of use, and timeliness. While that baseline investigation reported an aggregate satisfaction mean of 3.77, it exposed critical vulnerabilities regarding data accuracy [1]. However, the EUCS framework has inherent structural limitations when applied to web portals: it does not explicitly separate web service interaction quality from interface usability quality, nor did the prior descriptive analysis statistically quantify the causal regression weights of each web quality dimension on user satisfaction and academic effectiveness.

Recent information systems research conducted within the Master of Information Technology program at Universitas Pembangunan Panca Budi emphasizes that structured web architecture, user-centered design, and data-driven analytics are vital for minimizing data recapitulation errors and enhancing organizational productivity [2], [7], [8]. Hafiz and Hariyanto [3] demonstrated the necessity of rigorous usability assessment in evaluating administrative information systems, while Parlindungan et al. [4] and Wahyuni et al. [9] highlighted that well-engineered web databases significantly improve reporting transparency and operational accuracy. To evaluate web-based academic portals comprehensively, the WebQual 4.0 framework developed by Barnes and Vidgen provides a robust three-pillar diagnostic structure comprising Usability Quality, Information Quality, and Service Interaction Quality [12], [13].

The scientific novelty of this proceeding article lies in transforming and extending the evaluation of the SATUVA portal from a purely descriptive EUCS assessment [1] into an explanatory quantitative modeling study based on WebQual 4.0, coupled with multiple linear regression testing and thematic synthesis of qualitative user feedback. Specifically, this study addresses three research questions: (1) how is the service quality profile of the SATUVA academic portal characterized across the Usability Quality, Information Quality, and Service Interaction Quality dimensions of WebQual 4.0; (2) to what extent do the three WebQual 4.0 dimensions partially and simultaneously influence user satisfaction and academic effectiveness; and (3) what specific operational bottlenecks are experienced by academic stakeholders based on empirical open-ended feedback. The findings provide an evidence-

based technical and managerial roadmap for optimizing SATUVA at Universitas Al Washliyah Medan.

Literature Review

2.1 Integrated Academic Information System Portal (SATUVA)

Web-based academic information systems are integrated digital platforms designed to automate the academic lifecycle, encompassing student enrollment, course scheduling, attendance tracking, grade processing, and institutional reporting [1], [12]. Hariyanto et al. [2] along with Pratiwi and Iqbal [10] emphasize that effective web-based management systems must guarantee input validation, relational database integrity, and seamless report accessibility for both administrators and end users. At Universitas Al Washliyah Medan, the SATUVA portal (https://satuva.univamedan.ac.id) operates as a centralized web platform serving three primary stakeholder groups: students, lecturers, and administrative staff [1]. The main landing interface of the SATUVA portal is displayed in Figure 1.

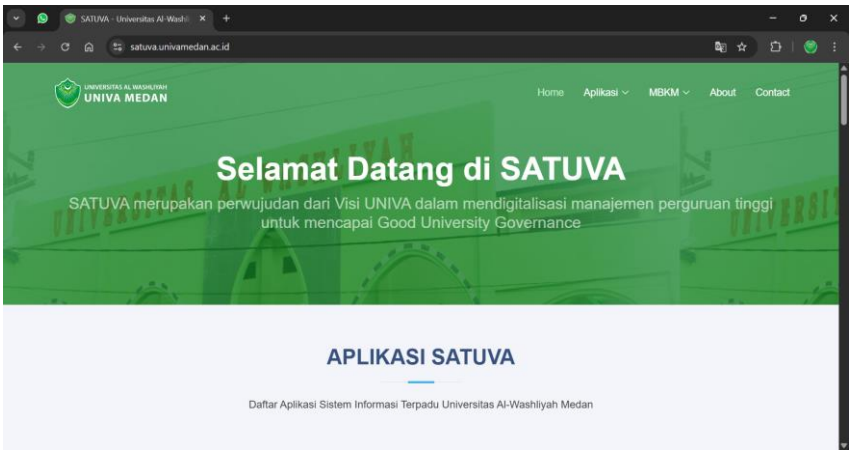


Figure 1. Main Interface of the SATUVA Integrated Academic Portal at Universitas Al Washliyah Medan [1]

2.2 WebQual 4.0 Evaluation Framework

WebQual 4.0 is a widely validated instrument for measuring website quality grounded in end-user perceptions (voice of the customer) and Quality Function Deployment (QFD) principles [12], [14]. Unlike purely functional software verification such as Black Box Testing [2], [6] or single-construct usability scales such as the System Usability Scale (SUS) [3], WebQual 4.0 decomposes web portal quality into three complementary structural dimensions [15], [16]:

1) Usability Quality: Evaluates human-computer interaction and interface design quality, including visual attractiveness, screen layout neatness, modern aesthetic appeal, ease of navigation, and cross-device responsiveness on mobile smartphones [7], [12], [17].
2) Information Quality: Measures the substantive fitness of portal content and data outputs, covering completeness of academic information, clarity without ambiguity, task distribution effectiveness, and error-free data accuracy [1], [4], [13].
3) Service Interaction Quality: Assesses the quality of service delivery and transactional interaction experienced by users, reflected in uninterrupted system availability, timely access to lecture schedules, punctual availability of academic management features, and administrative processing support [8], [11], [14].

2.3 User Satisfaction and Academic Effectiveness

User satisfaction represents the cognitive and affective evaluation formed when users compare their service expectations against the actual performance delivered by an information system [1], [15]. Empirical investigations by Pakpahan et al. [12] and Syah et al. [14] on Indonesian higher education portals confirm that all three WebQual 4.0 dimensions positively and significantly drive user satisfaction and continuance intention. Beyond psychological satisfaction, superior portal quality directly enhances lecture effectiveness and administrative workflow efficiency for faculty and staff [5], [11]. The conceptual model proposed in this study is illustrated in Figure 2.

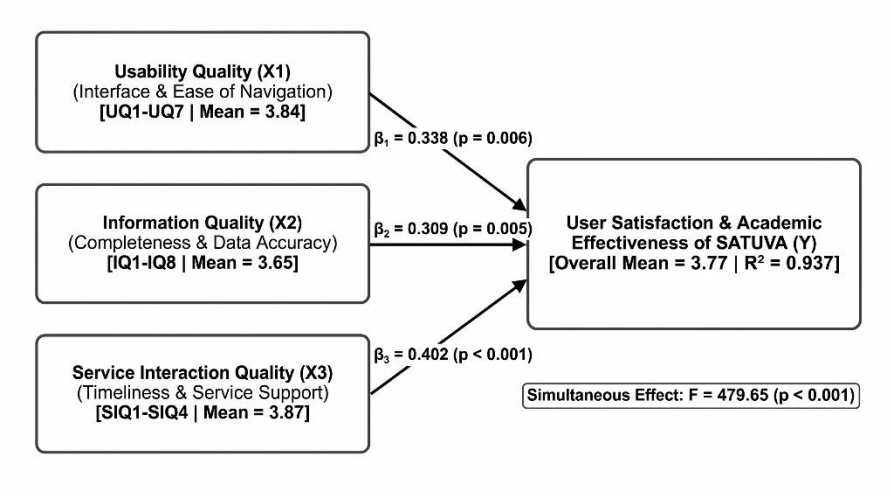


Figure 2. Conceptual Model of SATUVA Academic Portal Evaluation Based on the WebQual 4.0 Framework

Research Methodology

3.1 Research Workflow and Stages

This study employs an explanatory quantitative approach with a cross-sectional survey design, complemented by thematic qualitative analysis of open-ended respondent feedback. The research execution workflow is structured into eight sequential stages grouped across two core phases: Phase I (Research Planning, Data Acquisition, and Instrument Validation) and Phase II (WebQual 4.0 Algorithmic Computation, OLS Regression Hypothesis Testing, and System Recommendations), as illustrated in Figure 3.

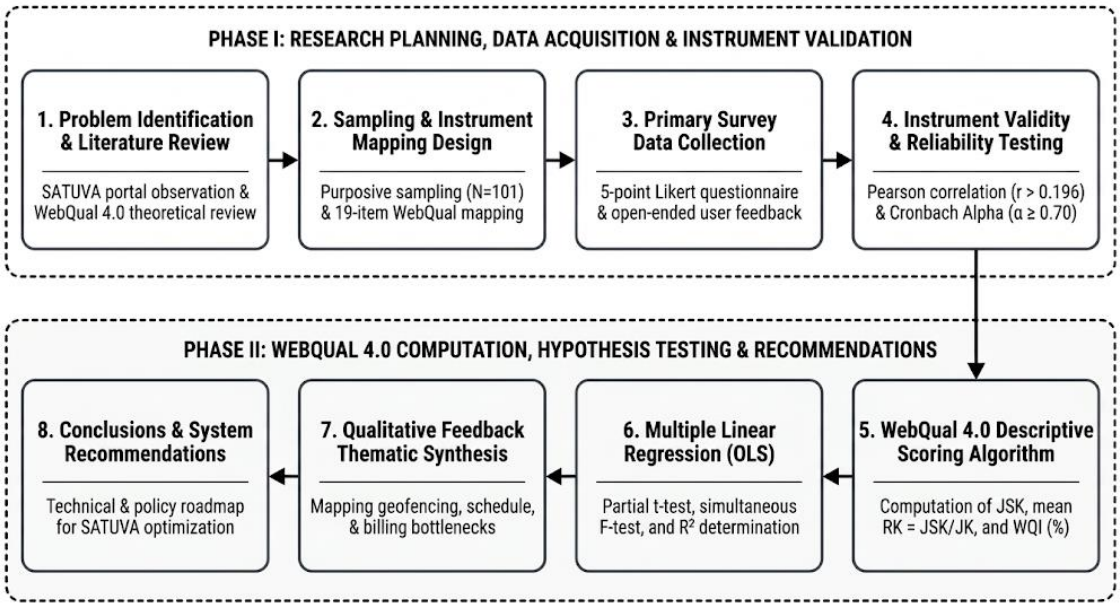


Figure 3. Research Workflow for Evaluating the SATUVA Academic Portal Using the WebQual 4.0 Framework

Referring to Figure 3, the operational procedures across the eight research stages are defined as follows:

1) Problem Identification and Literature Review: Conducting preliminary observations of operational issues within the SATUVA portal at Universitas Al Washliyah Medan and reviewing recent literature on transitioning from EUCS [1] to WebQual 4.0 [12]–[17].

2) Sampling and Instrument Mapping Design: Defining the active user population (±1,000 users), selecting 101 respondents via purposive sampling, and mapping the 19 questionnaire indicators into WebQual 4.0 constructs.

3) Primary Survey Data Collection: Distributing the 5-point Likert questionnaire and open-ended feedback prompt online via Google Forms from November 29, 2025, to January 6, 2026.

4) Instrument Validity and Reliability Testing: Evaluating indicator validity using Pearson Product Moment correlation and verifying internal consistency reliability via Cronbach's Alpha [18].

5) WebQual 4.0 Descriptive Scoring Algorithm: Computing Total Questionnaire Score (JSK), Mean Satisfaction Score (RK), Ideal Maximum Score (Smax), and WebQual Index percentage (WQI%) for each indicator and dimension.

6) Multiple Linear Regression (OLS): Estimating regression parameters to test partial effects (t-test), simultaneous effects (F-test), and the coefficient of determination (R^2) of the three WebQual 4.0 dimensions on user satisfaction and effectiveness.

7) Qualitative Feedback Thematic Synthesis: Categorizing open-ended respondent complaints and suggestions into technical and administrative themes.

8) Conclusions and System Recommendations: Formulating an evidence-based engineering and policy roadmap for SATUVA portal optimization.

3.2 Population, Sample, and WebQual 4.0 Instrument Mapping

The target population comprises approximately 1,000 active SATUVA users at Universitas Al Washliyah Medan. Purposive sampling was applied using three inclusion criteria: (1) active status as a student, lecturer, or administrative staff member at UNIVA Medan; (2) minimum system usage experience of six months; and (3) routine utilization of at least three core SATUVA features per week, yielding 101 valid respondents. The research instrument comprises 19 statement items measured on a five-point Likert scale: 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), and 5 = Strongly Agree (SA) [12], [18]. The mapping of the 19 indicators into WebQual 4.0 dimensions and model roles is detailed in Table 1.

Table 1. Mapping of SATUVA Survey Indicators into WebQual 4.0 Constructs

WebQual 4.0 Dimension	Code	Orig.	Questionnaire Indicator Statement	Model Role
Usability Quality	UQ1	C31	The SATUVA user interface (UI) is visually attractive	Predictor (X1)
Usability Quality	UQ2	C32	Information on the screen is neatly arranged and not confusing	Predictor (X1)
Usability Quality	UQ3	C33	The visual appearance of the SATUVA portal is modern	Predictor (X1)
Usability Quality	UQ4	C34	Users feel comfortable because the layout is neat and easy to understand	Predictor (X1)
Usability Quality	UQ5	C41	The SATUVA portal is easy to operate (user-friendly)	Predictor (X1)
Usability Quality	UQ6	C42	The SATUVA portal is easily accessible via smartphone devices	Predictor (X1)
Usability / Loyalty	UQ7/US3	C43	Intend to continue using SATUVA due to anytime ease of access	Dependent (Y)
Information Quality	IQ1	C11	Information facilities in SATUVA support user academic needs	Predictor (X2)
Information Quality	IQ2	C12	Academic information presented on SATUVA is always complete	Predictor (X2)
Information Quality	IQ3	C13	Information obtained on SATUVA is clear and unambiguous	Predictor (X2)
Information Quality	IQ4	C14	Assignment and important academic announcements are effectively delivered	Predictor (X2)
Information Quality	IQ5	C21	Academic information obtained through SATUVA is consistently accurate	Predictor (X2)
Information Quality	IQ6	C22	Data outputs generated by SATUVA are free from errors	Predictor (X2)
Info / Satisfaction	IQ7/US1	C23	Satisfied with the accuracy of services and information in SATUVA	Dependent (Y)
Info / Effectiveness	IQ8/US2	C24	SATUVA provides information needed to make lectures more effective	Dependent (Y)
Service Interaction	SIQ1	C51	SATUVA services can be accessed at any time without technical disruption	Predictor (X3)
Service Interaction	SIQ2	C52	SATUVA helps users access lecture schedules in a timely manner	Predictor (X3)

WebQual 4.0 Dimension	Code	Orig.	Questionnaire Indicator Statement	Model Role
Service Interaction	SIQ3	C53	System features are available on time to support academic management	Predictor (X3)
Service Interaction	SIQ4	C54	SATUVA services facilitate academic administrative processing	Predictor (X3)

3.3 Mathematical Formulas and WebQual 4.0 Computation Algorithm

The mathematical equations and algorithmic computation steps governing the WebQual 4.0 evaluation are formally defined as follows:

1) Validity Testing Formula (Pearson Product Moment Correlation): The empirical validity of each indicator i relative to the total construct score (Y_tot) across n respondents is computed using Equation (1) [12], [18]:

$$r_{xy} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

where r_xy is the item-total correlation coefficient, X_i is the score of indicator i, Y_tot is the total construct score, and n = 101 is the sample size. An indicator is declared valid if r_calculated > r_table (0.1956 at α = 0.05).

2) Reliability Testing Formula (Cronbach's Alpha): The internal consistency across k indicators within a construct is evaluated using Equation (2) [18]:

$$\alpha = \left[\frac{k}{(k-1)}\right] \times \left[1 - \frac{\Sigma\sigma_{b^2}}{\sigma_{t^2}}\right] \quad (2)$$

where α is Cronbach's Alpha coefficient, k is the number of items, Σσ_b² is the sum of individual item variances, and σ_t² is the variance of total construct scores. A construct is reliable if α ≥ 0.70.

3) Total Score (JSK), Mean Satisfaction Score (RK), and WebQual Index (WQI%) Formulas: For each WebQual 4.0 dimension d comprising m_d indicators and n respondents, Total Responses (JK_d), Total Score (JSK_d), Mean Score (RK_d), and WebQual Index Percentage (WQI_d%) are computed via Equations (3)–(6) [1], [12], [15]:

$$JK_d = m_d \times n \quad (3)$$

$$JSK_d = (1 \times f_{SD}) + (2 \times f_D) + (3 \times f_N) + (4 \times f_N) + (5 \times f_{SA}) \quad (4)$$

$$RK_d = \frac{JSK_d}{JK_d} \quad (5)$$

$$WQI_d\,(\%) = \left(\frac{JSK_d}{S_{max,d}}\right) \times 100\% = \left(\frac{RK_d}{5.00}\right) \times 100\% \quad (6)$$

where f_SD, f_D, f_N, f_A, and f_SA denote response frequencies for Likert weights 1 to 5, and S_max,d = 5 × JK_d represents the ideal maximum score. The scale interval width (I) for categorizing RK is determined via Equation (7) [12]:

$$I = (\text{Highest Score} - \text{Lowest Score}) / \text{Number of Classes} = (5 - 1) / 5 = 0.80 \quad (7)$$

Based on the class interval I = 0.80 and standard WebQual 4.0 and Kaplan-Norton evaluation criteria [1], [12], the interpretation thresholds for RK and WQI (%) are presented in Table 2.

Table 2. Interpretation Criteria for Mean Satisfaction Score (RK) and WebQual Index Percentage (WQI%)

RK Score Range	WQI (%) Range	WebQual 4.0 Quality Rating	User Satisfaction Category
1.00 – 1.79	20.00% – 35.99%	Very Poor	Very Dissatisfied
1.80 – 2.59	36.00% – 51.99%	Poor	Dissatisfied
2.60 – 3.39	52.00% – 67.99%	Fair	Moderately Satisfied
3.40 – 4.19 (or up to 4.91)	68.00% – 83.99%	Good	Satisfied
4.20 – 5.00 (or 4.92 – 5.00)	84.00% – 100.00%	Excellent	Very Satisfied

Results

4.1 Respondent Demographic Profile

Analysis of the 101 valid respondents reveals a balanced gender distribution comprising 54 male users (53.47%) and 47 female users (46.53%). By institutional role, students constitute the majority at 76 respondents (75.25%), followed by lecturers at 18 respondents (17.82%), and administrative staff at 7 respondents (6.93%). Across eleven participating study programs, the largest representation originates from Islamic Religious Education with 62 respondents (61.39%), Management with 16 respondents (15.84%), Development Economics with 6 respondents (5.94%), Law with 5 respondents (4.95%), Agrotechnology with 3 respondents (2.97%), and six other programs accounting for 9 respondents (8.91%). The demographic breakdown is illustrated in Figure 4.

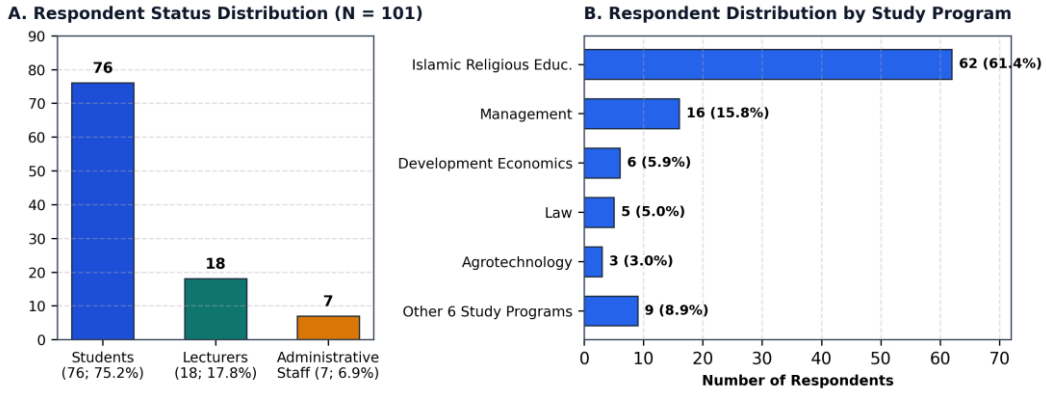


Figure 4. Demographic Distribution of SATUVA Respondents by Institutional Role and Study Program (N = 101)

4.2 Instrument Validity and Reliability Results

Pearson Product Moment validity testing via Equation (1) across the full sample (N = 101; critical r-table = 0.1956 at $\alpha = 0.05$) confirms that 18 of the 19 indicators exhibit strong positive correlations ranging between 0.870 and 0.963 ($p < 0.001$). One indicator within Information Quality, IQ6/C22 ('Data outputs generated by SATUVA are free from errors'), yielded an inverse correlation of $r = -0.067$ ($p = 0.506$) because 57.4% of respondents rated it low (SD = 35; D = 23) despite expressing high satisfaction on other items. As summarized in Table 4, reliability computation via Equation (2) confirms that all WebQual 4.0 constructs achieve Cronbach's Alpha values exceeding 0.890 (well above the 0.70 benchmark), confirming excellent internal consistency [12], [18].

Table 4. Validity Correlation Ranges and Construct Reliability of the WebQual 4.0 Instrument (N = 101)

WebQual 4.0 Construct	No. of Items	Valid r-Range	Cronbach's Alpha	Reliability
Usability Quality (UQ)	7 Items (6 Predictor X1)	0.870 – 0.957	0.975 (X1 = 0.969)	Highly Reliable
Information Quality (IQ)	8 Items (6 Predictor X2)	0.935 – 0.961*	0.939 (Valid = 0.983)	Highly Reliable
Service Interaction Quality (SIQ)	4 Items (Predictor X3)	0.911 – 0.963	0.965	Highly Reliable
User Satisfaction & Effectiveness (Y)	3 Items (US1, US2, US3)	0.945 – 0.957	0.970	Highly Reliable
Total WebQual 4.0 SATUVA Instrument	**19 Items (18 Valid Items)**	**0.870 – 0.963**	**0.985 (Valid = 0.992)**	**Highly Reliable**

4.3 Descriptive Evaluation of WebQual 4.0 Dimensions

The complete results of executing Step 3 and Step 4 of the WebQual 4.0 algorithm (Equations (3)–(6)) across all 101 participants—including response frequencies (SD, D, N, A, SA), Total Score (JSK), Mean Satisfaction Score (RK), and WebQual Index Percentage (WQI%)—are presented in Table 5. Across all JK = 1,919 item responses (ideal maximum score S_max = 9,595), SATUVA recorded a total JSK of 7,227, yielding an overall aggregate mean score of RK = 3.77 or WQI = 75.32% (categorized as Satisfied/Good).

Table 5. Frequency Distribution, Mean Scores (RK), and WebQual Index (WQI%) for the SATUVA Portal (N = 101)

Code	WebQual 4.0 Dimension / Indicator Focus	SD	D	N	A	SA	JSK	RK	WQI%	Category
UQ1	Visual attractiveness of user interface (C31)	11	14	10	19	47	380	3.76	75.25%	Satisfied
UQ2	Neatness and clarity of screen layout (C32)	10	12	6	27	46	390	3.86	77.23%	Satisfied
UQ3	Modern visual design of SATUVA (C33)	10	10	9	29	43	388	3.84	76.83%	Satisfied
UQ4	Navigation comfort and layout clarity (C34)	11	8	10	28	44	389	3.85	77.03%	Satisfied
UQ5	Overall ease of operation / user-friendly (C41)	12	7	9	29	44	389	3.85	77.03%	Satisfied
UQ6	Ease of access via mobile smartphone (C42)	10	10	9	21	51	396	3.92	78.42%	Satisfied
UQ7	Continuance intention due to ease of access (C43)	13	6	12	26	44	385	3.81	76.24%	Satisfied
Sub-1	**Subtotal Usability Quality (7 Items; JK=707)**	**77**	**67**	**65**	**179**	**319**	**2717**	**3.84**	**76.86%**	**Satisfied**
IQ1	Information facilities support academic needs (C11)	13	9	9	20	50	388	3.84	76.83%	Satisfied
IQ2	Completeness of presented academic info (C12)	11	7	14	26	43	386	3.82	76.44%	Satisfied
IQ3	Unambiguous clarity of portal information (C13)	11	11	10	27	42	381	3.77	75.45%	Satisfied

Code	WebQual 4.0 Dimension / Indicator Focus	SD	D	N	A	SA	JSK	RK	WQI%	Category
IQ4	Effective delivery of task & academic notices (C14)	8	10	15	26	42	387	3.83	76.63%	Satisfied
IQ5	Consistent accuracy of academic information (C21)	11	8	11	28	43	387	3.83	76.63%	Satisfied
IQ6*	Error-free system data outputs (C22)	35	23	23	14	6	236	2.34	46.73%	Dissatisfied
IQ7	Satisfaction with service & info accuracy (C23)	10	9	7	31	44	393	3.89	77.82%	Satisfied
IQ8	Information effectiveness for lectures (C24)	12	6	11	27	45	390	3.86	77.23%	Satisfied
Sub-2	**Subtotal Information Quality (8 Items; JK=808)**	**111**	**83**	**100**	**199**	**315**	**2948**	**3.65**	**72.97%**	**Satisfied**
SIQ1	Uninterrupted 24/7 service accessibility (C51)	13	10	7	27	44	382	3.78	75.64%	Satisfied
SIQ2	Timely access to lecture schedules (C52)	12	6	6	25	52	402	3.98	79.60%	Satisfied
SIQ3	Timely feature availability for management (C53)	12	11	4	28	46	388	3.84	76.83%	Satisfied
SIQ4	Facilitation of academic administration (C54)	11	6	12	29	43	390	3.86	77.23%	Satisfied
Sub-3	**Subtotal Service Interaction (4 Items; JK=404)**	**48**	**33**	**29**	**109**	**185**	**1562**	**3.87**	**77.33%**	**Satisfied**
Total	**Aggregate WebQual 4.0 Score (19 Items; JK=1919)**	**236**	**183**	**194**	**487**	**819**	**7227**	**3.77**	**75.32%**	**Satisfied**

As shown in Table 5 and Figure 5, performance varies noticeably across the three WebQual 4.0 dimensions. Service Interaction Quality achieved the highest dimensional rating with RK = 3.87 or WQI = 77.33% (JSK = 1,562; JK = 404), driven by indicator SIQ2 regarding timely lecture schedule access (RK = 3.98; WQI = 79.60%). Usability Quality ranked second with RK = 3.84 or WQI = 76.86% (JSK = 2,717; JK = 707), highlighted by strong mobile smartphone accessibility (UQ6 = 3.92; 78.42%). Conversely, Information Quality recorded the lowest dimensional average at RK = 3.65 or WQI = 72.97% (JSK = 2,948; JK = 808). This gap is directly attributable to indicator IQ6 ('Data outputs generated by SATUVA are free from errors'), which scored 2.34 (WQI = 46.73%; Dissatisfied), where 58 of the 101 respondents reported encountering data discrepancies or output errors.

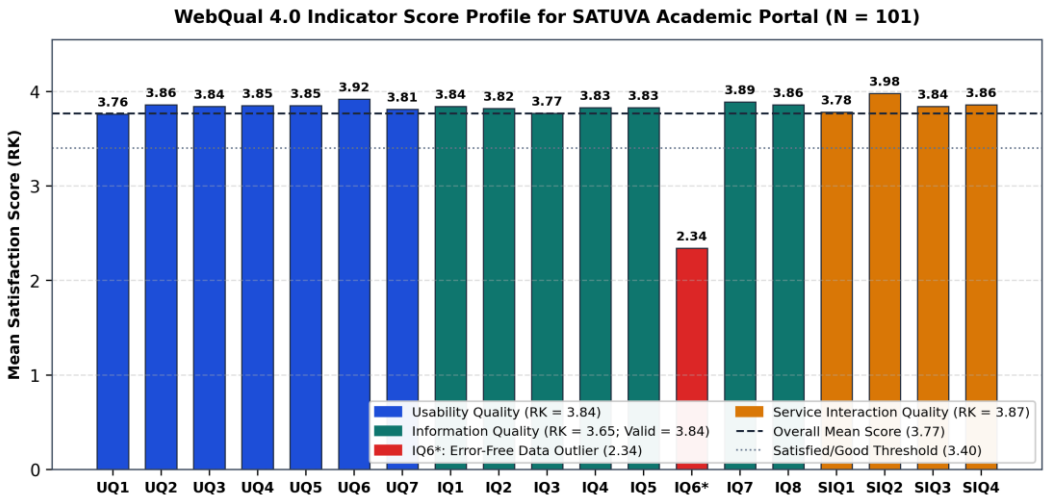


Figure 5. Comparison of Mean Satisfaction Scores (RK) Across WebQual 4.0 Indicators on the SATUVA Portal

4.4 Multiple Linear Regression Hypothesis Testing

Following Step 5 of the computational algorithm (Equations (8)–(10)), the causal impact of the three WebQual 4.0 dimensions—Usability Quality (X1: UQ1–UQ6), Information Quality (X2: IQ1–IQ6), and Service Interaction Quality (X3: SIQ1–SIQ4)—on User Satisfaction and Academic Effectiveness (Y: US1/IQ7, US2/IQ8, US3/UQ7) was estimated via Ordinary Least Squares (OLS) multiple linear regression. The parameter estimates, partial t-statistics, simultaneous F-statistic, and coefficient of determination are summarized in Table 6.

Table 6. Multiple Linear Regression Results of WebQual 4.0 Dimensions on User Satisfaction and Effectiveness (Y)

Independent Variable (WebQual 4.0 Construct)	Coeff. (B)	Std. Error	t-Stat	Sig. (p)	Hypothesis Decision
Constant (Intercept a)	-0.102	0.118	-0.866	0.3890	-
Usability Quality (X1)	0.338	0.120	2.814	0.0059	H1 Accepted (Significant)
Information Quality (X2)	0.309	0.107	2.896	0.0047	H2 Accepted (Significant)
Service Interaction Quality (X3)	0.402	0.116	3.479	0.0008	H3 Accepted (Dominant)
Simultaneous Model & Fit Summary	**R = 0.968**	**R^2 = 0.937**	**Adj. R^2 = 0.935**	**F = 479.65**	**H4 Accepted (p < 0.001)**

Based on Table 6, the estimated regression equation is Y = -0.102 + 0.338X1 + 0.309X2 + 0.402X3. Four key empirical insights emerge from these inferential findings:
1) Effect of Usability Quality (X1): Usability Quality exerts a positive and statistically significant effect on User Satisfaction and Effectiveness (t = 2.814 > 1.985; p = 0.0059 < 0.05). This confirms that clean layout structure, modern visual design, and mobile compatibility directly elevate user satisfaction, corroborating Hafiz and Hariyanto [3] and Pakpahan et al. [12].
2) Effect of Information Quality (X2): Information Quality positively and significantly influences User Satisfaction and Effectiveness (t = 2.896; p = 0.0047 < 0.05), reinforcing the findings of Hariyanto et al. [2] and Zahri et al. [13] that accurate, complete data outputs are

essential for academic productivity.
3) Effect of Service Interaction Quality (X3): Service Interaction Quality emerges as the most dominant predictor (B = 0.402; t = 3.479; p = 0.0008 < 0.001), aligning with Syah et al. [14], who demonstrated that reliable service interaction is the primary driver of satisfaction in higher education portals.
4) Simultaneous Model Fit (R^2): The simultaneous F-test yields F = 479.65 (p < 0.001) with R^2 = 0.937 (Adjusted R^2 = 0.935), indicating that 93.7% of the variance in user satisfaction and academic effectiveness is jointly explained by the three WebQual 4.0 dimensions.

4.5 Thematic Synthesis of Qualitative Respondent Feedback

Executing Step 6 of the WebQual 4.0 algorithm, a thematic content analysis was conducted on the open-ended feedback column of the 101-respondent dataset to investigate the root causes behind the low score on indicator IQ6 (2.34). Four operational bottlenecks and their corresponding engineering solutions are synthesized in Table 7.

Table 7. Thematic Mapping of Qualitative User Feedback and WebQual 4.0 Engineering Recommendations

Related Dimension	Stakeholder Group	Empirical Bottlenecks Identified in Survey Feedback	Recommended Engineering & Policy Solutions
Service Interaction & Information Quality	Lecturers (Islamic Educ., Accounting, Management)	Geolocation (geofencing) attendance radius is too narrow, leaving several classrooms unreachable; the 15-minute attendance window is overly strict and triggers automatic teaching fee deductions.	Expand GPS geofencing polygons across all campus buildings, extend attendance tolerance to 30 minutes, and add a verified late/missed-attendance appeal module.
Information Quality (Indicator IQ6/C22)	Lecturers & Students (Management)	Midterm/Final exam (UTS/UAS) schedules in SATUVA occasionally mismatch actual schedules; no dedicated slot exists for make-up classes (max 2 per semester); student tuition bills do not display automatically.	Implement real-time database validation for exam schedules, add a make-up lecture reporting workflow, and automate semester tuition billing display upon login.
Usability Quality & Infrastructure	Lecturers & Students (Economics, Law)	Unstable mobile cellular reception inside classrooms hinders SATUVA login and administrative report submission during peak hours.	Integrate SATUVA authentication directly with campus Wi-Fi/intranet infrastructure so local access functions seamlessly without mobile data.
Information Quality (Academic Content)	Lecturers & Students (Islamic Educ., English)	Limited repository features for downloadable course materials; first-time users experience initial navigation friction.	Embed an integrated course material repository module per subject and deploy interactive onboarding tooltips for new users.

Conclusion

Based on the empirical evaluation using the WebQual 4.0 framework across 101 active users of the Integrated Academic System of Universitas Al Washliyah Medan (SATUVA), this study concludes that overall portal service quality falls into the Satisfied/Good category with an aggregate mean score of RK = 3.77 out of 5.00 (WebQual Index = 75.32%). Service Interaction Quality achieved the highest dimensional score at 3.87 (77.33%), followed by Usability Quality at 3.84 (76.86%), whereas Information Quality recorded the lowest score at 3.65 (72.97%) due to user dissatisfaction regarding error-free data outputs (IQ6 = 2.34; 46.73%). Multiple linear regression analysis confirms that Usability Quality (B = 0.338, p =

0.0059), Information Quality (B = 0.309, p = 0.0047), and Service Interaction Quality (B = 0.402, p = 0.0008) exert positive and statistically significant partial and simultaneous effects (F = 479.65, R^2 = 0.937) on user satisfaction and academic effectiveness.

Practically, these findings imply that IT administrators at Universitas Al Washliyah Medan should prioritize database validation refactoring to eliminate exam schedule discrepancies, automate student tuition bill displays, provide a make-up class reporting feature, expand the GPS attendance geofencing radius with a 30-minute tolerance window, and integrate SATUVA with campus Wi-Fi networks. Future research is encouraged to combine WebQual 4.0 with Importance-Performance Analysis (IPA) or OWASP-based security auditing to map technical priorities and cybersecurity resilience continuously.

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