

Analysis of the Influence of WebQual 4.0 Dimensions and the Timeliness Aspect on E-Learning Website User Satisfaction

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This study analyzes the level of user satisfaction, consisting of students and teachers, towards the Madrasah E-learning system at MIN 2 South Tangerang. This study applies a quantitative approach by combining the Webqual 4.0 method which includes the dimensions of Usability Quality, Information Quality, Service Interaction Quality, and one aspect of End-User Computing Satisfaction (EUCS), namely Timeliness. Data collection was carried out by distributing questionnaires to selected respondents using the Simple Random Sampling technique, and the collected data were analyzed using multiple linear regression analysis with the help of SPSS Statistics 27 software. The purpose of this study is to measure the influence of each variable on user satisfaction in order to determine key factors that need to be improved to optimize the quality of e-learning system services. The results of the study indicate that simultaneously, all independent variables have a significant effect on user satisfaction. However, partially, only the Usability Quality and Information Quality variables are proven to have a positive and significant effect on user satisfaction. The Service Interaction Quality and Timeliness variables were found to have no significant effect. With a coefficient of determination (R Square) value of 57.3%, this study concludes that system usability and information quality are the dominant factors that shape e-learning user satisfaction at MIN 2 South Tangerang.

Keywords: Webqual 4.0, EUCS, timeliness, user satisfaction, e-learning, MIN 2 Tangerang Selatan.

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1. Introduction

The rapid development of information technology in this digital era has encouraged many educational institutions to integrate technology into their operations, including in providing information and services to various stakeholders. E-learning has become one of the main learning media for teachers and students. Law No. 20 of 2003 concerning the National Education System explains that Education is understanding directed ways to create learning situations and methods and learning methods so that students actively advance their potential to have spiritual religious strength, self-control, personality, moral intelligence, nobility and skills needed by themselves, society, nation and state [1].

The researchers selected these two methods after conducting a Systematic Literature Review (SLR) of studies published between 2019 and 2024 from Neliti, Sinta, university journal portals, Google Scholar, and ResearchGate using the keywords *Webqual*, EUCS, and user satisfaction. The review of 55 national papers showed that Webqual and EUCS are the two most widely used methods for user satisfaction analysis. Therefore, this study employs both methods to evaluate user satisfaction with the Madrasah E-learning system [2].

Webqual 4.0 evaluates website quality through three dimensions: Usability, Information Quality, and Service Interaction Quality [3]. Its strengths include clear dimensions, broad applicability, and the ability to identify strategic improvement priorities while being integrated with methods such as IPA or SERVQUAL [4]. However, it relies heavily on users' subjective perceptions and does not assess the Timeliness aspect,

which is essential in e-learning environments requiring prompt delivery of learning materials and assignments [5]. In addition, Webqual pays limited attention to technical aspects such as system speed, security, service continuity, and practical technical recommendations [6]. To address these limitations, this study combines Webqual 4.0 with the End User Computing Satisfaction (EUCS) model, which measures Content, Accuracy, Format, Ease of Use, and Timeliness [7]. The Timeliness dimension is particularly relevant because users of the Madrasah E-learning system at MIN 2 South Tangerang frequently reported delays in information delivery that affected learning effectiveness. EUCS provides a holistic, flexible, and user-friendly evaluation approach [8], although it is less sensitive to social and cultural contexts, system sustainability, and users' emotional or aesthetic experiences [9]. Therefore, integrating Webqual 4.0 with the Timeliness dimension of EUCS is expected to provide a more comprehensive evaluation of user satisfaction.

The combined model was applied to evaluate the quality and user satisfaction of the Madrasah E-learning platform developed by the Indonesian Ministry of Religious Affairs and implemented at MIN 2 South Tangerang since the COVID-19 pandemic to support hybrid learning. Although the platform facilitates online teaching, assignments, examinations, and communication, its user satisfaction level remains unknown. Reported issues, including delayed information access and inefficient navigation, highlight the need for a comprehensive evaluation.

Previous studies consistently reported significant relationships between Webqual dimensions and user satisfaction [10]. Research on the Shopee website identified Usability as the strongest factor, while Information Quality still required improvement [11]. Studies applying EUCS also found that Content, Accuracy, Format, Ease of Use, and Timeliness significantly influence user satisfaction, with Format emerging as the dominant factor in the MyTelkomsel application ([12]. Similar positive findings were reported for online shopping applications [13] and the KAI Access application, where all five EUCS dimensions significantly affected user satisfaction.

Despite extensive research using Webqual 4.0 and EUCS separately, studies that specifically integrate Webqual 4.0 with only the Timeliness dimension of EUCS in the context of Madrasah E-learning remain limited. Since timely information delivery is critical for effective online learning, this study addresses this research gap by proposing a focused yet comprehensive framework for evaluating website-based e-learning user satisfaction.

Previous similar studies above made researchers interested in conducting further research entitled "Analysis of the Influence of WebQual 4.0 Dimensions and the Timeliness Aspect on E-Learning Website User Satisfaction" The results of this study can serve as information and recommendations for developers of the MIN 2 Tangerang Selatan e-learning information system. This can help them in making the right decisions to develop system improvements, with the aim of increasing user satisfaction and encouraging the progress of the system.

2. Methods

Research Method

This study employed a quantitative approach to measure user satisfaction with the Madrasah E-learning system. User satisfaction was evaluated using the Webqual 4.0 dimensions Usability, Information Quality, and Service Interaction Quality along with the Timeliness dimension from the End User Computing Satisfaction (EUCS) model. Data were collected through questionnaires distributed to students and teachers of MIN 2 South Tangerang who use the Madrasah E-learning platform. The collected data were analyzed using Microsoft Excel 2021 and SPSS Statistics 27.

Research Procedure

The research procedure began with a literature review, followed by interviews with representatives of MIN 2 South Tangerang to identify issues related to the implementation of the Madrasah E-learning system. The findings were then used to formulate the research problem, analyze the data, interpret the results, and draw the final conclusions.

Literature Review

The first stage involved reviewing literature related to Webqual 4.0, EUCS, SPSS Statistics 27, and user satisfaction. Relevant books and scientific journals were examined to provide the theoretical foundation for the study.

Interview

The next stage involved conducting interviews with representatives from MIN 2 South Tangerang. The interviews aimed to obtain first-hand information regarding the challenges and experiences of users in utilizing the Madrasah E-learning system.

Population and Sample

The population consisted of students and teachers who use the Madrasah E-learning system at MIN 2 South Tangerang. Although the school had 338 students in the 2024/2025 academic year, only students in Grades 4–6 used the platform, resulting in 166 student users. Among the teaching staff, only homeroom and subject teachers used the system, totaling 16 teachers. Therefore, the total population comprised 182 active users.

The study applied Simple Random Sampling because the target population consisted of active users who were directly involved with the Madrasah E-learning system. This sampling technique was considered appropriate due to the study's time and cost limitations while ensuring that respondents represented the relevant user population. The sample size was determined using the Slovin formula, which is suitable for studies with a known population size (Maimunah et al., 2020).

$$n = \frac{N}{1+N(e)^2} \quad (3.1)$$

Description:

n: number of samples

N: population size

e: error tolerance limit

The samples in this study are:

$$n = \frac{182}{1+182(0.1)^2} \quad (3.2)$$

$$n = \frac{182}{1+182(0.01)} \quad (3.3)$$

$$n = \frac{182}{1+1.82} \quad (3.4)$$

$$n = \frac{182}{2.82} \quad (3.5)$$

$$n = 64.5$$

The result of the Slovin formula calculation is 64.5, so if rounded up, the minimum number of samples to be used in this study is 65 respondents. This study uses a 10% error tolerance limit because the number of users who use e-learning in terms of duration of use and user effectiveness are 6th grade students and teachers.

3. Result and Discussion

Data Analysis Results

Demographic Identification Results

This research was conducted solely within the MIN 2 South Tangerang school environment, so the demographics collected in this study focused on user occupations. The demographics obtained were a comparison of the number of teachers and students actively using e-learning at MIN 2 South Tangerang. Figure 4.3 shows a diagram of teacher and student respondents, showing that the percentage of students who completed the questionnaire was 77% and the percentage of teachers was 23%, with a total of 16 teachers and 54 students.

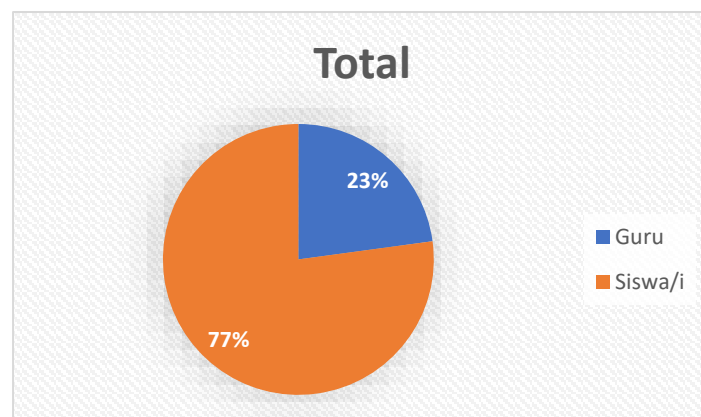


Figure 1. Diagram of Teacher and Student Respondents

Validity Test

The validity test aims to determine whether the obtained data is valid and whether it aligns with the research conducted by correlating the score values and the total score values of the variables (Puspitasari et al., 2022). This study used Microsoft Excel and SPSS Statistics 27 software to conduct the validity test. The researcher initially needed to determine the r value. An r value of 0.235 was obtained, meaning the variable or data is considered valid if the calculated r value is greater than the table r value.

Table 1. Validity Test Results

Variable	R count	R table	Result
UQ1	0.559	0.235	VALID
UQ2	0.601	0.235	VALID
UQ3	0.540	0.235	VALID
UQ4	0.678	0.235	VALID
UQ5	0.584	0.235	VALID
UQ6	0.460	0.235	VALID
UQ7	0.489	0.235	VALID
UQ8	0.670	0.235	VALID
IQ1	0.622	0.235	VALID
IQ2	0.708	0.235	VALID
IQ3	0.706	0.235	VALID
IQ4	0.543	0.235	VALID
IQ5	0.820	0.235	VALID
IQ6	0.650	0.235	VALID
IQ7	0.747	0.235	VALID
SQ1	0.652	0.235	VALID

Variable	R count	R table	Result
SQ2	0.497	0.235	VALID
SQ3	0.670	0.235	VALID
SQ4	0.674	0.235	VALID
SQ5	0.538	0.235	VALID
T1	0.746	0.235	VALID
T2	0.593	0.235	VALID
T3	0.662	0.235	VALID
T4	0.687	0.235	VALID
US	0.654	0.235	VALID
US	0.705	0.235	VALID

The results from Table 1 show that the results of these four variables, each consisting of statements, have been tested through a validity test, and all were declared valid. This is because the calculated r-value was greater than the table r-value.

Reliability Test

The researcher has conducted a validity test and the results are valid. The next step is to test the reliability of each variable to determine whether each variable is consistent or not. A variable is considered reliable if the Cronbach's Alpha value is > 0.6 , as shown in Table 2 below.

Table 2. Reliability Test Results

Variable	Cronbach's Alpha	Reliable Scale	Description
Usability Quality (UQ)	0.815	0.6	Reliable
Information Quality (IQ)	0.872	0.6	Reliable
Services Interaction Quality(SQ)	0.726	0.6	Reliable
Timeliness (T)	0.816	0.6	Reliable
User Satisfaction (US)	0.636	0.6	Reliable

Reliable Scale: Table 2 shows that all variables used were reliable after being tested, as the Cronbach's Alpha value was > 0.6 .

Classical Assumption Test

Normality Test

Table 3. Normality Test Results

Test / Statistic	Value
N	70
Mean	0.0000000
Std. Deviation	0.84361716
Most Extreme Differences - Absolute	0.063
Most Extreme Differences — Positive	0.063
Most Extreme Differences — Negative	-0.062
Test Statistic	0.063
Asymp. Sig. (2-tailed)	0.200
Monte Carlo Sig. (2-tailed) — Sig.	0.691
99% Confidence Interval — Lower Bound	0.679
99% Confidence Interval — Upper Bound	0.703

Table 3 shows the results of the normality test using the One-Sample Kolmogorov-Smirnov Test. The tested data consisted of 70 samples with a mean of 0.0000000 and a standard deviation of 0.84361716. The Kolmogorov-Smirnov test statistic was 0.063, with a maximum extreme difference of 0.063 for positive values and -0.062 for negative values. The test results showed an asymptotic significance value (Asymp. Sig. (2-tailed)) of 0.200 and a Monte Carlo significance value of 0.691, with a 99% confidence interval between 0.679 and 0.703. If the significance value is greater than 0.05, there is insufficient evidence to reject the null hypothesis (H_0), meaning the residual data are normally distributed. The assumption of normality is met, and the data can be used for analyses requiring a normal distribution.

Multicollinearity Test

Table 4. Multicollinearity Test Results

Variable	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	0.215	0.880	—	0.245	0.807	—	—
UQ_Total	0.073	0.034	0.241	2.110	0.039	0.506	1.976
IQ_Total	0.120	0.054	0.363	2.220	0.030	0.246	4.065
SQ_Total	0.107	0.076	0.210	1.409	0.164	0.295	3.384
T_Total	0.018	0.070	0.033	0.261	0.795	0.410	2.437

Table 4 explains that the multicollinearity test in this figure can be analyzed based on the Tolerance and Variance Inflation Factor (VIF) values found in the Collinearity Statistics column. Multicollinearity occurs when there is a strong linear relationship between independent variables in a regression model, which can cause instability in the regression coefficient estimates.

The Tolerance value indicates the extent of variability in one independent variable that cannot be explained by the other independent variables. If the Tolerance value is below 0.10, there is a strong indication of multicollinearity. Figure 4.5 shows that the Tolerance values range from 0.246 to 0.506, meaning that no values fall below the critical limit of 0.10, thus there is no strong indication of multicollinearity.

The VIF (Variance Inflation Factor) value is used to detect the level of multicollinearity. If the VIF value is greater than 10, there is an indication of serious multicollinearity. The highest VIF value was 4.065 for the IQ_Total variable, while other values ranged from 1.976 to 2.437. The absence of VIF values exceeding 10 indicates no significant multicollinearity in this regression model. The results of the Tolerance and VIF analyses indicate that this regression model does not experience serious multicollinearity issues, and therefore can be used for further analysis without concern for the strong linear relationship between the independent variables [14].

Heteroscedasticity Test

Table 5. Heteroscedasticity Test Results

Variable	UQ_Total	IQ_Total	SQ_Total	T_Total	Unstandardized Residual
UQ_Total	r=1.000 p=— N=70	r=.644 p=<.001 N=70	r=.586 p=<.001 N=70	r=.641 p=<.001 N=70	r=-.005 p=.967 N=70
IQ_Total	r=.644 p=<.001 N=70	r=1.000 p=— N=70	r=.847 p=<.001 N=70	r=.746 p=<.001 N=70	r=.098 p=.420 N=70
SQ_Total	r=.586 p=<.001 N=70	r=.847 p=<.001 N=70	r=1.000 p=— N=70	r=.678 p=<.001 N=70	r=.082 p=.499 N=70

Variable	UQ_Total	IQ_Total	SQ_Total	T_Total	Unstandardized Residual
T_Total	r=.641 p=<.001 N=70	r=.746 p=<.001 N=70	r=.678 p=<.001 N=70	r=1.000 p=— N=70	r=.019 p=.879 N=70
Unstandardized Residual	r=-.005 p=.967 N=70	r=.098 p=.420 N=70	r=.082 p=.499 N=70	r=.019 p=.879 N=70	r=1.000 p=— N=70

Table 5 shows the results of the heteroscedasticity test. This figure can be analyzed based on the correlation between the independent variables (UQ_Total, IQ_Total, SQ_Total, T_Total) and the unstandardized residuals. Heteroscedasticity occurs when the variance of the residuals is not constant across the range of independent variable values, which can lead to inefficient estimation results [15]. To detect heteroscedasticity, the Spearman correlation test can be used between the independent variables and residuals. A significant correlation between the independent variables and residuals (p-value <0.05) indicates heteroscedasticity. The correlation values between all independent variables and the unstandardized residuals are as follows:

- UQ_Total with residuals: -0.005 (p = 0.967)
- IQ_Total with residuals: 0.098 (p = 0.420)
- SQ_Total with residuals: 0.082 (p = 0.499)
- T_Total with residuals: 0.019 (p = 0.879)

The p-value is greater than 0.05, indicating no significant relationship between the independent variables and the residuals. This indicates that there is no heteroscedasticity problem in this regression model. The Spearman correlation test results indicate that the residuals in this regression model are randomly distributed and have constant variance, thus meeting the homoscedasticity assumption. This regression model can be used for further analysis without the need for correction for heteroscedasticity.

Autocorrelation Test

Table 6. Autocorrelation Test Results

Runs Test	Unstandardized Residual
Test Value ^a	0.04160
Cases < Test Value	35
Cases >= Test Value	35
Total Cases	70
Number of Runs	31
Z	-1.204
Asymp. Sig. (2-tailed)	0.229

Table 6 illustrates the autocorrelation test using the Runs Test in the output above, used to detect the presence of autocorrelation in the residual data from a regression model. Figure 5 shows a Test Value of 0.04160, which is the median value of the residuals used to separate the data into two groups: Cases < Test Value (35 cases) and Cases >= Test Value (35 cases). The total number of cases was 70, and the number of runs (changes in the order of the two residual categories) was 31. The obtained Z-score was -1.204, and the two-tailed asymptotic significance (Asymp. Sig. (2-tailed)) was 0.229.

The interpretation of these results is as follows: if the significance value (p-value) is greater than 0.05, then there is insufficient evidence to reject the null hypothesis (H_0), which states that there is no systematic pattern in the order of the residuals, or in other words, the residuals are random (no autocorrelation). If the p-value of 0.229 is greater than 0.05, it can be concluded that there is no autocorrelation in the residuals, so the regression model is considered to meet the assumption of residual independence.

Multiple Linear Regression Analysis

Table 7. Multiple Linear Regression Test Results

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	0.215	0.880	—	0.245	0.807
UQ_Total	0.073	0.034	0.241	2.110	0.039
IQ_Total	0.120	0.054	0.363	2.220	0.030
SQ_Total	0.107	0.076	0.210	1.409	0.164
T_Total	0.018	0.070	0.033	0.261	0.795

T-Test Results

The t-test results in Figure 4.8 are used to partially test the significance of the influence of each independent variable on the dependent variable. This test is performed by examining the t-statistic (t-value) and significance value (Sig.) for each independent variable. If the Sig. value is <0.05, then the variable has a significant effect on the dependent variable. Tbal 7 shows the t-value for the Usability Quality (UQ_Total) variable is 2.110 with a Sig. value of 0.039, which is less than 0.05. This indicates that Usability Quality has a significant effect on User Satisfaction. The Information Quality (IQ_Total) variable has a t-value of 2.220 with a Sig. value of 0.030, which is also less than 0.05. The Information Quality variable has a significant effect on User Satisfaction.

The Service Interaction Quality (SQ_Total) variable has a t-value of 1.409 with a significance level of 0.164, which is greater than 0.05. Therefore, it can be concluded that this variable does not significantly influence User Satisfaction. The Timeliness (T_Total) variable has a t-value of 0.261 with a significance level of 0.795, which is much greater than 0.05. Therefore, Timeliness does not significantly influence User Satisfaction.

Results of the Coefficient of Determination Test

Table 8. Results of the Coefficient of Determination Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.757 ^a	.573	.546	.86919

The coefficient of determination (R Square) of 0.573 indicates that the regression model is able to explain 57.3% of the variation in the User Satisfaction variable. This value indicates a fairly strong relationship and generally reflects the model's suitability in the context of social/information technology research. The remaining 42.7% is influenced by other factors not explained in this model, which could be an opportunity for further research.

F-Test Results

Table 9. F-Test Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	65.765	4	16.441	21.762	<.001 ^b
Residual	49.107	65	.755	—	—
Total	114.871	69	—	—	—

The F-test results in table 9 of the ANOVA table were used to test the significance of the overall regression model, namely whether the independent variables (T_Total, UQ_Total, SQ_Total, IQ_Total) collectively have a significant effect on the dependent variable (US_Total). Figure 8 shows the F-value obtained was 21.762 with a Sig. <0.001. If the Sig. <0.05, it can be concluded that the regression model used is significant overall. This concludes that at least one independent variable has a significant relationship with the dependent variable. The Sum of Squares indicates that the total variation in the data is 114,871, of which 65,765 comes from the regression (explained by the model) and 49,107 comes from the residual (error or variation not explained by the model). The mean square regression value is 16.441, which is greater than the residual

of 0.755, indicating that the model has good predictive power. The F-test results indicate that the regression model constructed using the variables T_Total, UQ_Total, SQ_Total, and IQ_Total together has a significant effect on US_Total. This model can be used to explain the relationship between the independent variables and user satisfaction.

Interpretation of Analysis Results

The results of the multiple linear regression analysis conducted aimed to test the effect of Usability Quality (UQ), Information Quality (IQ), Service Interaction Quality (SQ), and Timeliness (T) on User Satisfaction (US).

F-Test (Overall Model Significance)

The F-test results in the ANOVA table show an F-value of 21.762 with a significance value < 0.001 . If the significance value is less than 0.05, it can be concluded that the regression model is significant overall, meaning that at least one independent variable influences the dependent variable (User Satisfaction).

T-Test (Partial Effect of Each Variable)

The t-test results in the Coefficients table show that:

- Usability Quality (UQ) has a t-value of 2.110 with a significance of 0.039 ($p < 0.05$), thus significantly influencing User Satisfaction (US). Ease of use is a key driver of satisfaction. Users will be more satisfied if they can navigate and interact with the system without difficulty. A smooth user experience directly increases positive perceptions of the platform.
- Information Quality (IQ) has a t-value of 2.220 with a significance of 0.030 ($p < 0.05$), which also significantly influences User Satisfaction (US). The core value of an e-learning platform lies in the quality of its information. If information is inaccurate, irrelevant, or difficult to understand, the platform's primary function as a learning medium will fail, leading to user dissatisfaction.
- Service Interaction Quality (SQ) has a t-value of 1.409 with a significance level of 0.164 ($p > 0.05$), indicating no significant effect on User Satisfaction (US). There is a significant gap between user behavior and the interaction features provided by this e-learning platform. This insignificance does not mean that interaction is unimportant, but rather that the interaction features on the current platform are ineffective or underutilized. This represents a missed opportunity to build loyalty and provide better support.
- Timeliness (T) has a t-value of 0.261 with a significance level of 0.795 ($p > 0.05$), indicating that this variable also has no significant effect on User Satisfaction (US). This statistical insignificance masks a real problem. Information delays are a real issue, but their impact on satisfaction with this e-learning platform can be mitigated because users have alternative solutions, such as using WhatsApp. This reliance on external platforms damages e-learning's image as a reliable and timely source of information.

Regression Coefficient Value

The regression model obtained from the coefficients table is:

$$Y = 0.215 + 0.073X_1 + 0.120X_2 + 0.107X_3 + 0.018X_4$$

The interpretation of this equation is:

- The constant 0.215 indicates that if all independent variables are zero, then User Satisfaction has a value of 0.215.
- Usability Quality (UQ) has a coefficient of 0.073, meaning that every one-unit increase in Usability Quality will increase User Satisfaction by 0.073, assuming other variables remain constant.
- Information Quality (IQ) has a coefficient of 0.120, meaning that every one-unit increase in information quality will increase User Satisfaction by 0.120.
- Service Interaction Quality (SQ) has a coefficient of 0.107, but because its significance value is greater than 0.05, its effect is not considered significant in this model.

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e. Timeliness (T) has a coefficient of 0.018, but because its significance value is also insignificant, its effect on User Satisfaction can be ignored.

If the regression test is connected to the hypothesis testing (H1, H2, H3, and H4) as follows:

1. Hypothesis H1 (Usability Quality → User Satisfaction)

In the regression table, Usability Quality (UQ_Total) has a B value of 0.073 with $p = 0.039$ (<0.05), so hypothesis H1 is accepted. This means that usability quality has a significant effect on user satisfaction.

2. Hypothesis H2 (Information Quality → User Satisfaction)

Information Quality (IQ_Total) has a B value of 0.120 with $p = 0.030$ (<0.05), indicating that hypothesis H2 is accepted. Information quality has a significant influence on user satisfaction and is the variable with the largest influence in this model.

3. Hypothesis H3 (Service Interaction Quality → User Satisfaction)

Service Interaction Quality (SQ_Total) has a B value of 0.107, but $p = 0.164$ (>0.05), indicating that hypothesis H3 is rejected. This value indicates that service interaction quality does not have a significant influence on user satisfaction in this model.

4. Hypothesis H4 (Timeliness → User Satisfaction)

Timeliness (T_Total) has a B value of 0.018 with $p = 0.795$ (>0.05), therefore hypothesis H4 is rejected. These results indicate that timeliness does not significantly influence user satisfaction.

It was concluded that only Usability Quality (H1) and Information Quality (H2) significantly influence User Satisfaction (Y). Service Interaction Quality (H3) and Timeliness (H4) did not significantly influence. These results indicate that in increasing user satisfaction, the most important aspects to consider are usability quality and information quality, while service interaction quality and timeliness did not have a significant impact in this model.

4. Conclusion

This study concludes that Usability Quality and Information Quality are the main factors significantly influencing user satisfaction with the Madrasah E-learning system at MIN 2 South Tangerang, while Service Interaction Quality and Timeliness do not have a statistically significant effect. All research variables demonstrated acceptable validity and reliability, and the regression model explained 57.3% of the variation in user satisfaction. However, this study has several limitations. The research was conducted only at MIN 2 South Tangerang with 70 respondents consisting of students and teachers, so the findings may not be fully generalizable to other educational institutions or e-learning users with different characteristics. In addition, the study relies on questionnaire-based perceptions and focuses on the WebQual 4.0 dimensions combined with Timeliness, while other factors that may influence user satisfaction remain outside the model, as indicated by the unexplained 42.7% of variance.

Future research is therefore recommended to involve a larger and more diverse number of respondents from different educational institutions and to consider additional variables that may explain user satisfaction. Comparative studies using other evaluation models or integrating additional dimensions beyond WebQual 4.0 and Timeliness are also recommended to provide a more comprehensive understanding of user satisfaction with e-learning systems. This approach may help identify factors that were not captured in the present model and strengthen the generalizability of future findings.

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