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SEM - PLS in the WebQual 4.0 Method for Enhancing the Quality of Online Tutorial Learning Applications at Open Universities

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ABSTRAK

Universitas Terbuka (UT) menyelenggarakan pembelajaran jarak jauh melalui layanan Tutorial Online (Tuton). Tuton adalah layanan tutorial berbasis internet yang dapat diakses melalui situs http://elearning.ut.ac.id oleh seluruh mahasiswa UT termasuk mahasiswa UPBJJ UT Denpasar. Masalah yang sering dialami mahasiswa yaitu mengalami kendala dalam registrasi, jadwal sesi aktif terkadang tidak sesuai dengan jadwal tuton yang menyebabkan mahasiswa tidak bisa unggah tugas dan diskusi serta analisis kualitas layanan mahasiswa UPBJJ UT Denpasar terhadap aplikasi tuton belum pernah dilakukan sebelumnya. Berdasarkan masalah tersebut, penelitian ini bertujuan untuk menganalisis dan mengukur kualitas layanan aplikasi Tuton dengan menggunakan dimensi webqual 4.0 yang dimodersi dengan variabel gender dan umur. Penelitian ini menggunakan metode kuantitatif pada data kepuasan mahasiswa UT UPBJJ Denpasar Program Studi Manajemen yang telah menggunakan metode pembelajaran aplikasi Tuton lebih dari tiga semester. Teknik analisis data dengan menggunakan Metode SEM – PLS. Berdasarkan hasil analisis diperoleh bahwa terdapat pengaruh yang positif antara variabel usability, variabel service interaction quality dan variabel Information Quality terhadap variabel user satisfaction. Variabel moderasi gender mampu sebagai moderasi murni pada variabel service interaction quality dan variabel Information Quality. Sedangkan variabel umur sebagai moderasi potensial pada ketiga variabel. Dari hasil ini dapat disimpulkan bahwa kualitas layanan aplikasi tuton menunjukan model yang kuat pada indikator-indikator Metode Webqual terhadap variabel user satisfaction dan aplikasi ini sangat bermanfaat serta sesuai dengan kebutuhan mahasiswa. Adapun aspek penunjang pembelajaran masih perlu diperbaiki terutama kecepatan waktu merespon dan keakuratan layanan tutorial yang diberikan tutor.

ABSTRACT

Universitas Terbuka (UT, literally Open University) organizes distance learning through the Online Tutorial (Tuton) service. Tuton is an internet-based tutorial service that can be accessed via the site http://elearning.ut.ac.id by all UT students, including UPBJJ UT Denpasar students. Analysis of the quality of UPBJJ UT Denpasar student tutoring services has never been carried out before. Based on these problems, this research aims to analyze and measure the quality of Tuton application services using WebQual 4.0 dimensions, which are moderated by gender and age variables. This research uses a quantitative method approach to student satisfaction data from the UT UPBJJ Denpasar Management Study Program, who have used the Tuton application for more than three semesters. Data analysis techniques using the SEM–PLS method. Based on the results of the analysis, it was found that there was a positive influence between the usability variable, the service interaction quality variable, and the Information Quality variable on the user satisfaction variable. The gender moderating variable can act as pure moderation on the service interaction quality and Information Quality variables. Meanwhile, the age variable is a potential moderator of the three variables. From these results, it can be concluded that the service quality of the Tuton application shows a robust model on the Webqual Method indicators for user satisfaction variables, and this application is beneficial and in accordance with student needs. The learning support aspects still need to be improved, especially the speed of response time and the accuracy of the tutorial services provided by tutors.

1. INTRODUCTION

Information and communication technology (ICT) applied in education is diverse, and it is progressing continually. Advances in the development of smartphones in terms of software and hardware capabilities have been considerable and have provided new e-learning opportunities. Implementing learning technology has meaning as a product or concept thought to increase the effectiveness and

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efficiency of learning activities. The use of learning media and technology in higher education can contribute to students' knowledge and skills. It can also help teaching staff in higher education to simplify the learning process, clarify learning material with a variety of concrete examples, facilitate interaction with students, provide practice opportunities for students, and provide opportunities to evaluate various forms of learning media and technology (Maritsa et al., 2021; Parikesit et al., 2021). Evaluation of web application system quality measurements is essential to ensure that your web application functions correctly and provides a satisfactory experience to users. Measuring the quality of a web application system can involve a number of dimensions that cover various quality aspects, such as the webqual dimensions that are related to user satisfaction (Bews et al., 2021; Sulistyanto et al., 2022). Currently, the implementation of learning technology has been implemented by the Open University. The Open University (UT) is a tertiary institution implementing a distance and open learning lecture system through online tutorials (Tuton). Tuton is an internet-based tutorial service or web-based tutorial (WBT), offered by UT and attended by students via the internet network and is one of the forms of tutorials held by UT. These tutorials can be accessed through the website http://elearning.ut.ac.id. To access the tutorial, students must activate the account by filling in the registration section. After this process is carried out, students will receive a password to enter the Tuton site. The Tuton application has been used for more than 20 years by all UT students, including UPBJJ UT Denpasar students. The role of this application is to really help students and tutors after the COVID-19 outbreak as a means of supporting independent learning (Basar, 2021; Nafrin & Hudaidah, 2021). As an application that has been implemented for users for more than 20 years, it is necessary to measure the quality of application services regarding user satisfaction spread across the center and 39 city areas in Indonesia as Distance Learning Program Units, including UPBJJ UT Denpasar.

However, until now, analysis and measurement of the quality of the Tuton UPBJJ UT Denpasar application has never been carried out. So, it is not yet known whether the Tuton application has met user satisfaction. Application system testing must be conducted to obtain the quality of learning media products and determine the level of user achievement in understanding and using the application (Yuliyana, Arthana, and Agustini, 2019; Sulistyanto *et al.*, 2022). Another problem is that students often experience problems with registration, the active session schedule sometimes does not match the tutoring schedule which causes students to not be able to upload assignments and discussions and there is no notification for students if there is feedback. Analysis of the quality of the Tuton application has been carried out at UPBJJ UT Makasar and UPBJJ UT Malang. In this research, it is said that there is an influence of online tutorial services on student satisfaction and student accessibility has a positive influence on student satisfaction. Student satisfaction increases in an innovative academic atmosphere and independent learning solutions. Online tutorial learning assistance services, and accessibility, ease of accessing online tutorial service applications. Meanwhile, the quality of tutorial services provided by UPBJJ UT Malang using dimensions of End User Computer Satisfaction states that 78.6% of students feel very satisfied with the facilities available in online tutorials but have not been utilized optimally by the student (Jamil, 2022; Triandika et al., 2021).

Research conducted by (Helmiawan et al., 2019; Minarwati & Hidayah, 2022) in the context of the three dimensions that are part of the Webqual Method regarding the evaluation of the STMIK Sumedang website's user satisfaction, stated that all three dimensions - usability, information quality, and service interaction quality - positively contribute to the user experience, with usability being the most influential dimension. This is because it obtained the highest score compared to the other dimensions, based on the results of multiple linear regression tests. The following study focuses on measuring the quality of online pizza ordering applications (Gardenia, 2018; Minarwati & Hidayah, 2022). This research employs the Webqual Method to analyze the quality of pizza ordering applications concerning user (customer) loyalty and the influence of user (customer) satisfaction on user (customer) loyalty. Structural Equation Model (SEM) is utilized as the analytical technique in this study. The results indicate that the quality of the application significantly affects loyal users (customers), and user (customer) satisfaction also has a significant impact on user (customer) loyalty. Another study delves into measuring the quality of the career development and entrepreneurship unit application at Brawijaya University. The research employs the Webqual 4.0 Method to analyze the application's quality. Data processing utilizes the structural equation model (SEM), with SmartPLS 3.0 software used as a partial least square (PLS) analysis tool. The findings reveal that all three variables, namely usability, information quality, and service interaction quality, positively influence user satisfaction. This is supported by hypothesis testing, which is indicated by coefficient path values exceeding 1.64. Research conducted on the quality of the academic information system of Universitas Pembangunan Nasional "Veteran" East Java, using SEM-PLS within the Webqual Method, indicates that 70.9% of the system's quality is influenced positively by Webqual dimensions, leading to student satisfaction. A similar study on the quality of the STMIK El Rahma website with user

satisfaction states that user satisfaction is influenced by Webqual dimensions to the extent of 84.2%, with usability quality, particularly user-friendliness, being the most influential factor (Fikri et al., 2022; Minarwati & Hidayah, 2022). Based on the issues and several previous research findings, this study will measure the quality of the Tuton application service at http://elearning.ut.ac.id, one of the learning platforms utilized by Universitas Terbuka. This measurement will be conducted based on the dimensions of Webqual 4.0 using the Structural Equation Model with Partial Least Square (SEM-PLS) data analysis method. The Webqual 4.0 method comprises three main dimensions: usability, information quality, and service interaction quality (Gani et al., 2020; Yuliyana et al., 2019).

In addition to assessing the quality of user experience with the UT online tutorial application using the Webqual 4.0 dimensions, this study will introduce moderation variables, namely, gender and age, as generational factors affecting technology acceptance. This is a departure from previous research. User age is believed to negatively affect user satisfaction, while gender is not significantly related to user satisfaction. However, according to (Maharany & Santika, 2019; Tripathi, 2018), age and gender moderate the relationship between user experience, benefits, and user satisfaction. These moderation variables can strengthen or weaken the relationship between independent and dependent variables. This research will contribute to UT's management in maintaining the Tuton system and providing recommendations for its improvement as a distance learning platform in this era of change and disruption.

2. METHOD

The Type and Design of the Research

This quantitative research aims to analyze and measure the quality of Tuton application services using WebQual 4.0 dimensions moderated by gender and age variables. This research was carried out in 4 stages, starting from problem identification, determining the model framework and hypothesis, data collection and analysis, results and discussion, as depicted in Figure 1.

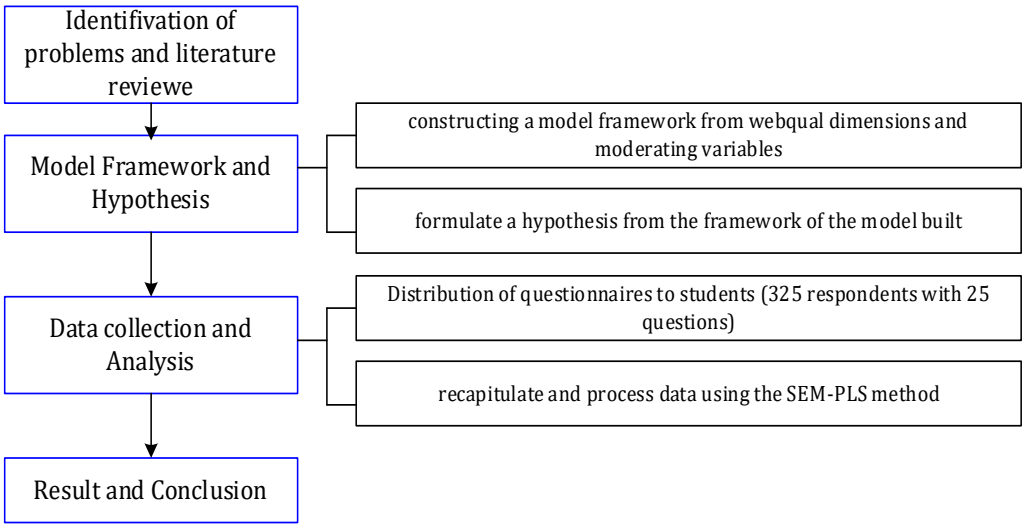

Figure 1. Research Stages

Framework Model and Hypothesis

The model framework for measuring the quality of online tutorial applications is measured using dimensions from the Webqual 4.0 method, namely the dimensions of usability, information quality, and service interaction quality, which are added with the moderating variables gender and age. The relationship patterns of moderation variables will be subjected to hypothesis testing using the following approach, as presented in Table 1.

Table 1. Moderation Variable Analysis Model

No.	Moderation Variable Type	Coefficients
1	Absolute Moderation	H1, H2, H3, H10, H11 are not significant H4, H5, H6, H7, H8, H9 are significant
2	Pure Moderation	H10, H11 are not significant H4, H5, H6, H7, H8, H9 are significant

No.	Moderation Variable Type	Coefficients
3	Spurious Moderation	H10, H11 are significant H4, H5, H6, H7, H8, H9 are significant
4	Potential Moderation	H10, H11 are not significant H4, H5, H6, H7, H8, H9 are not significant
5	Predictor Moderation	H10, H11 are significant H4, H5, H6, H7, H8, H9 are not significant

Data Collection Methods and Research Instruments

In this research, the population was UT UPBJJ Denpasar Management Study Program students participating in online tutorials. The sampling method uses purposive sampling, considering that the respondents are students who have taken online tutorials more than three times. The number of samples taken was 325 from 1739 students. This sample calculation uses the Slovin formula with a margin of error of 5% (Astuti et al., 2018; Sudirtha et al., 2022). Data collection will be carried out using a questionnaire based on the Webqual Method's dimensions. These questions have been modified to align with the research objectives. The indicators can be found in Table 2 (Larasati, Pratama, and Wulansari, 2021; Fikri *et al.*, 2022), considering the moderation variables of age and gender.

Table 2. Research Indicator and Questionnaire Instruments

Variable	Instrument Questions	Code
Usability	1. Students find it easy to learn how to operate the http://elearning.ut.ac.id application.	U1
	2. The interaction between the http://elearning.ut.ac.id application and students is clear and easily understood.	U2
	3. Students find it easy to navigate within the http://elearning.ut.ac.id application.	U3
	4. Students find the http://elearning.ut.ac.id application easy to use.	U4
	5. The http://elearning.ut.ac.id application has an attractive appearance.	U5
	6. The design is suitable for the type of http://elearning.ut.ac.id application.	U6
	7. The http://elearning.ut.ac.id application contains competency.	U7
	8. The http://elearning.ut.ac.id application creates a positive experience for students.	U8
Information Quality	1. The http://elearning.ut.ac.id application provides accurate information.	IQ1
	2. The http://elearning.ut.ac.id application provides trustworthy information.	IQ2
	3. The http://elearning.ut.ac.id application provides timely information.	IQ3
	4. http://elearning.ut.ac.id application provides relevant information.	IQ4
	5. The http://elearning.ut.ac.id application provides information that is easy to understand.	IQ5
	6. The http://elearning.ut.ac.id application provides information at the appropriate level of detail.	IQ6
	7. The http://elearning.ut.ac.id application presents information in a suitable format.	IQ7
Service Interaction Quality	1. The http://elearning.ut.ac.id application has a good reputation.	SIQ1
	2. Students feel safe completing data entries in the http://elearning.ut.ac.id application.	SIQ2
	3. Students feel secure about their personal information in the http://elearning.ut.ac.id application.	SIQ3
	4. The http://elearning.ut.ac.id application provides room for personalization.	SIQ4
	5. The http://elearning.ut.ac.id application provides space for community.	SIQ5

Variable		Instrument Questions	Code
	6.	The http://elearning.ut.ac.id application facilitates communication with the organization/service provider.	SIQ6
	7.	Students have confidence in the services/information provided by the http://elearning.ut.ac.id application.	SIQ7
User Satisfaction	1.	Does the http://elearning.ut.ac.id application meet my information needs?	US1
	2.	Is the http://elearning.ut.ac.id application practical and efficient in its use?	US2
	3.	Overall, students are satisfied with the quality of service provided by the http://elearning.ut.ac.id application.	US3

Data Collection and Analysis Techniques

The data collected will be analyzed using the SEM–PLS method, which aims to find the influence between dimensions and determine how satisfied students are with the performance of the learning media. Additionally, it will examine the impact of moderating variables on the relationship between the Webqual dimensions and user satisfaction. Data analysis will be conducted using SmartPLS software since this research involves confirmatory factor analysis (CFA) (Fikri et al., 2022; Sudirtha et al., 2022). The data analysis process can be seen in Figure 2.

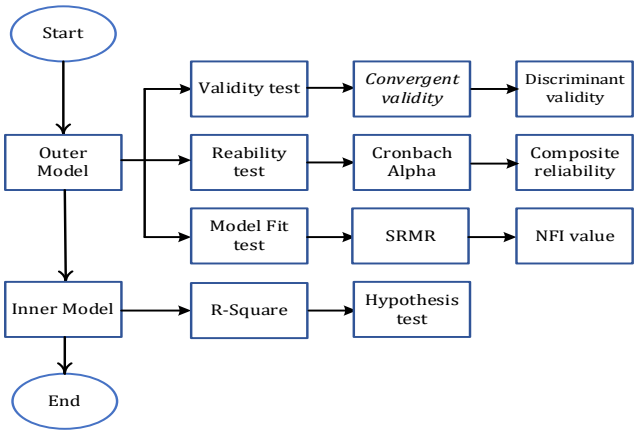

Figure 2. SEM-PLS Analysis Stages

3. RESULT AND DISCUSSION

Result

As per the data analysis above, the research findings begin with the measurement model analysis, including validity and reliability testing through loading factors.

Validation and Reliability Testing

Validity is assessed by examining the values of convergence and discriminant validity. An indicator is considered valid if the convergence value is ≥ 0.70 and the average variance extracted is higher than the correlations involving latent variables. Reliability is assessed using Cronbach Alpha and Composite Reliability. A dimension is considered highly reliable if Cronbach Alpha values range from 0.81 to 1.00, with a composite reliability value > 0.70 (Henseler *et al.*, 2014; Haji-Othman dan Yusuff, 2022). The results of the validity and reliability tests can be seen in Table 3 and Table 4.

Table 3. Validity Test

Indicator	Convergent validity	Validity targets	Discriminant Validity	Information
U1	0.834	0.700	0.851	valid
U2	0.816	0.700		valid
U3	0.842	0.700		valid
U4	0.824	0.700		valid
U5	0.731	0.700		valid

Indicator	Convergent validity	Validity targets	Discriminant Validity	Information
U6	0.797	0.700		valid
U7	0.751	0.700		valid
U8	0.762	0.700		valid
IQ1	0.839	0.700	0.842	valid
IQ2	0.853	0.700		valid
IQ3	0.778	0.700		valid
IQ4	0.855	0.700		valid
IQ5	0.835	0.700		valid
IQ6	0.867	0.700		valid
IQ7	0.861	0.700		valid
SIQ1	0.822	0.700	0.854	valid
SIQ2	0.831	0.700		valid
SIQ3	0.828	0.700		valid
SIQ4	0.852	0.700		valid
SIQ5	0.857	0.700		valid
SIQ6	0.802	0.700		valid
SIQ7	0.862	0.700		valid
US1	0.890	0.700	0.802	valid
US2	0.889	0.700		valid
US3	0.886	0.700		valid

Based on the validity test results in Table 3 above, all indicators have loading factor values above 0.700. Therefore, it can be said that the indicators of latent variables have good convergent validity. In the Usability variable, the indicator U3 has the highest contribution with a value of 0.842, which means that students find it easy to navigate when using the http://elearning.ut.ac.id application. Based on students' perceptions using the http://elearning.ut.ac.id application, the measurement of the Information Quality variable shows that a minor contribution is found in the IQ3 indicator with a value of 0.778, which is still above 0.700. This suggests that, according to students' perceptions, the information provided by the application is timely. Meanwhile, the most significant contribution is found in the IQ6 indicator, which is 0.867, indicating that the information received is very detailed and helpful in the student's learning process. Based on students' perceptions using the http://elearning.ut.ac.id application, the measurement of the Service Interaction Quality variable shows that the most minor contribution is found in the SIQ6 indicator with a value of 0.802. This means that the application facilitates students in interacting with the service provider.

Table 4. Reliability Test

Dimensions	Cronbach's Alpha	Cronbach's Alpha Targets	Composite Reliability	Composite Targets	Explanation
Information Quality	0.931	0.800	0.944	0.700	Reliable
Service Interaction Quality	0.928	0.800	0.942	0.700	Reliable
Usability	0.917	0.800	0.932	0.700	Reliable
User Satisfaction	0.867	0.800	0.918	0.700	Reliable

Based on the tables provided (Table 3 and Table 4), it can be concluded that all indicators are considered valid, and all variables are highly reliable. This is evident from the values of Cronbach's alpha, greater than 0.800, and the composite reliability values, which exceed 0.700 for each variable/dimension.

Model Fit Testing

Model fit testing is conducted by examining the values of the Standardized Root Mean Square Residual (SRMR) and the Normal Fit Index (NFI). A model is considered fit or appropriate if the SRMR value is less than 0.1 or 0.8 (Henseler et al., 2014; Shi et al., 2018) and yields an NFI value between 0 and 1, with values closer to 1 indicating a better fit.

Table 5. Model Fit Test

Method	Saturated Model	Estimated Model
SRMR	0.047	0.047
d_ULS	0.836	0.833
d_G	0.643	0.641
Chi-Square	1180.127	1173.433
NFI	0.841	0.842

Table 5 indicate that the Estimated Model fits the data reasonably well, with comparable fit statistics to the Saturated Model. The SRMR values, d_ULS, d_G, and NFI values all suggest a good fit for both models and the Chi-Square values, while not exceptionally low, indicate an acceptable fit given the sample size(Goto et al., 2019; Henseler et al., 2014).

Hypothesis Testing

Hypothesis testing, part of the inner model testing in partial least square analysis, is conducted to determine the model's adequacy by examining the R-square values. A model can be considered substantial if the R-square value is 0.75. It is considered moderate if the R-square value is 0.50 and weak if the R-square value is 0.25. The R-square values in this study can be seen in Table 6.

Table 6. Coefficient of Determination (R Square)

Variable	R Square	R Square Adjusted	Information
User Satisfaction	0.751	0.742	The model is considered strong

Based on Table 6, the R-square value is 0.751, indicating that the model can be considered substantial. This R-square value implies that user satisfaction can be explained by the constructs, namely usability, information quality, and service interaction quality, to the extent of 75.1%, while the remaining 24.9% is influenced by other variables not included in this research model. Next, hypothesis testing was conducted using the bootstrapping method. The T-statistic values in the coefficient path indicate the significance level in hypothesis testing. The T-Statistic values should be > 1.960 at a 5% alpha level with n = 325 respondents. The results of the T-statistic values for the coefficient paths are as shown in Figure 3.

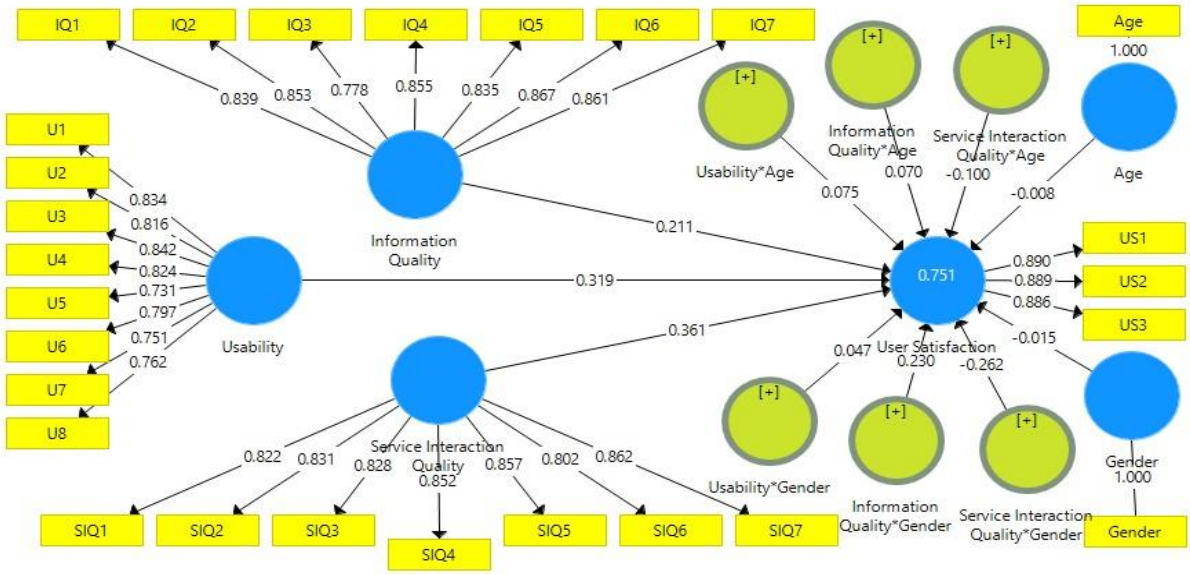

Figure 3. Hypothesis Testing

Based on the hypothesis testing results of the model above, SmartPLS presents the hypothesized model with path coefficient values and P-values. In this testing, a P-value < 0.05 means that the variables used have a significant effect, and the research hypotheses are accepted. The hypothesis testing results are presented in Table 7 for a clearer view.

Table 7. Hypothesis Testing Results (T-Statistic Values)

Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Description
U -> US	0.319	0.300	0.085	3.765	0.000	Significant
IQ -> US	0.211	0.225	0.084	2.514	0.012	Significant
SIQ -> US	0.361	0.368	0.080	4.530	0.000	Significant
U*Gender -> US	0.047	0.038	0.099	0.477	0.634	Not significant
IQ*Gender -> US	0.230	0.222	0.086	2.684	0.008	Significant
SIQ*Gender -> US	-0.262	-0.247	0.077	3.419	0.001	Significant
U*Age -> US	0.075	0.077	0.085	0.881	0.379	Not significant
IQ*Age -> US	0.070	0.067	0.091	0.769	0.442	Not significant
SIQ*Age -> US	-0.100	-0.105	0.090	1.112	0.267	Not significant
Gender -> US	-0.015	-0.016	0.031	0.489	0.625	Not significant
Age -> US	-0.008	-0.005	0.029	0.265	0.791	Not significant

Based on the hypothesis testing in Table 7 above, it shows that the T-Statistics value > 1.960 or P-value < 0.05 is considered significant. To determine whether the effect is positive, look at the value of the original sample (O). If the original sample shows a positive value, it means the direction is positive, and if the original sample value is negative, it means the direction is negative. Looking at the original sample value (0.319) and the P-value (0.000), it can be said that the Usability variable positively influences user satisfaction or student satisfaction with the http://elearning.ut.ac.id/ application. For the Information Quality variable (0.211) and the Service Interaction Quality variable (0.361), it can also be said that they positively influence user satisfaction or student satisfaction with the http://elearning.ut.ac.id/ application. As for the moderation variables, age, and gender, it can be said that both moderations do not significantly impact user satisfaction with the http://elearning.ut.ac.id/ application.

The gender moderation variable does not significantly influence the relationship between usability and user satisfaction, as evidenced by the p-value (0.634) greater than 0.05. Therefore, the gender variable is considered a potential moderation on the relationship between usability and user satisfaction, meaning it can become a moderation variable that affects the strength of the relationship between the independent and dependent variables. This variable does not interact with the independent variable and has no significant relationship with the dependent variable (Bryan & Haryadi, 2018; Umamah, 2019). On the other hand, the gender moderation variable significantly influences the relationship between Information Quality and Service Interaction Quality with user satisfaction. Thus, the gender variable can be considered a pure moderation of the Information Quality and Service Interaction Quality variables with respect to user satisfaction, meaning it moderates or interacts with the independent variable without becoming an independent variable itself (Bryan & Haryadi, 2018; Umamah, 2019). The age moderation variable does not have a significant influence as a moderator on the relationship between usability, information quality, and service interaction quality with user satisfaction or student satisfaction with the http://elearning.ut.ac.id/ application. Therefore, the age variable can be considered a potential moderation variable for usability, information quality, and service interaction quality with respect to user satisfaction, meaning it has the potential to become a moderation variable that affects the strength of the relationship between the independent variables and the dependent variable. This variable does not interact with the independent variables and has no significant relationship with the dependent variable (Bryan & Haryadi, 2018; Umamah, 2019).

Discussion

The outcomes of this research provide profound insights within the context of the http://elearning.ut.ac.id application, allowing us to delve deeper into these findings. Crucial findings in this study include the affirmative impact of variables such as Usability, Information Quality, and Service

Interaction Quality on User Satisfaction. This substantiates that these factors positively affect user contentment concerning the http://elearning.ut.ac.id application. These results align with preceding research discoveries, underscoring that usability, information quality, and service interaction quality are pivotal factors in heightening user satisfaction with e-learning applications. Nonetheless, it is imperative to note that moderating variables, such as age and gender, do not substantially influence the correlation between these critical factors and user satisfaction. This demonstrates that, within the scope of this investigation, age and gender do not moderate the relationship between primary factors and user contentment. Based on the above analysis, it is known that there is a positive influence of the usability variable, service interaction quality variable, and information quality variable on user satisfaction variables on the https://elearning.ut.ac.id/ application. This is because all three variables have statistical values greater than 1.960 and positive original sample values, as seen in Table 7. Several research results have also indicated that the Webqual 4.0 dimensions can be used to analyze customer or user satisfaction (Helmiawan, Akbar, and Sofian, 2019; Fikri *et al.*, 2022). The positive influence of the usability variable indicates that the higher the usability or ease of use of the https://elearning.ut.ac.id/ application, the higher the user satisfaction level, specifically among students. This relationship also applies to the service interaction and information quality variables for the https://elearning.ut.ac.id/ application. Based on these results, it is essential to maintain certain aspects or indicators in the Webqual 4.0 Method so that users, especially students, can use the application more efficiently. WebQual 4.0 is suitable for evaluating the quality of e-commerce websites, e-learning platforms, and other online services (Givi, Keshavarz, and Azad, 2022; Rahmadini, Faroqi and Wulansari, 2022).

Moderation variables applied to the independent variables (Webqual 4.0 dimensions) regarding user satisfaction can provide potential and pure moderation. In this case, the moderation variables are gender and age. These moderation variables can either strengthen or weaken the relationship between the independent and dependent variables. The moderation variables, age, and gender, are shown to be moderating variables in each independent variable with respect to the dependent variable. The moderation variables can introduce two interaction variables into the model: the interaction between information quality and gender on user satisfaction and the interaction between service interaction quality and gender on user satisfaction as pure moderation. Similar to the research conducted by (Bryan & Haryadi, 2018; Umamah, 2019), moderation variables can influence the dependent variable through interactions between the independent variables and the moderation variables. This means that the moderation variables interact with the independent variables without becoming independent variables themselves (Bryan & Haryadi, 2018; Umamah, 2019).

The findings of this study support the prior research discoveries that have identified the significance of factors such as usability, information quality, and service interaction quality in enhancing user satisfaction with e-learning applications. These results are consistent with previous research indicating that user satisfaction is linked to the ease of application use, the provision of quality information, and service interaction facilitation (Biswas et al., 2021; Sumi & Kabir, 2021). The interpretation of these findings suggests that to improve user satisfaction with e-learning applications, developers and service providers should pay heed to factors such as usability, information quality, and service interaction quality. Efforts to enhance user experience regarding navigation, information quality, and interaction with services can contribute to increased user satisfaction. These research findings can be integrated into established theoretical frameworks in the literature. These findings support theories positing that factors like usability, information quality, and service interaction quality (Biswas et al., 2021; Sumi & Kabir, 2021) have a significant impact on user satisfaction. This also aligns with theories emphasizing the importance of research instrument validity and reliability in supporting credible findings. The research findings can be generalized to similar situations in various e-learning application contexts. It is essential to recognize that the factors identified in this study may apply more broadly to other e-learning applications, albeit with certain adjustments depending on the context and purpose of the application.

4. CONCLUSION

This research holds significant implications for understanding the factors that influence user satisfaction in e-learning applications. The study's findings emphasize that factors such as usability, information quality, and service interaction quality substantially impact user satisfaction levels. In practical terms, these findings can assist developers and e-learning application service providers in enhancing the user experience. By improving usability, delivering quality information, and facilitating effective service interaction, users will likely be more content with the application. The implications of this research extend beyond its immediate context, applying not only to this specific study but also to various similar situations in e-learning applications. This underscores the relevance of the research findings in

efforts to enhance the overall quality of e-learning services. This research contributes a deeper understanding of how users assess and perceive e-learning applications. As a result, it offers valuable insights for the development of better and more satisfying e-learning applications for users.

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