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The Influence of System Quality, Information Quality, and Service Quality on Student Satisfaction in Using E-Learning at Universities in Jambi

Mayshel Adinda Viola[1], Abduhakim Kajee Yamkee[2], Friska Aqilah Vilanti[1], Swastini[1]
[1]Universitas Jambi, Jambi, Indonesia
[2]Universiti Utara Malaysia, Malaysia

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ABSTRACT

This research aims to analyze the influence of system quality, information quality and service quality on student satisfaction in using e-learning in universities throughout Jambi Province. The research method used is a quantitative approach with a survey design and Partial Least Squares Structural Equation Modeling (PLS-SEM) technique to analyze the relationship between variables and the suitability of the research model. The research sample was determined using the Convenience Sampling technique with a total of 207 respondents taken from a population of 114,134 students at 7 universities in Jambi City. The research results show that system quality, information quality, and service quality have a significant influence on student satisfaction in using e-learning. This study emphasizes the importance of good system quality, accurate and complete information, and responsive services to increase user satisfaction in the context of e-learning. It is hoped that these findings can become a reference for educational institutions in improving the implementation of e-learning to make it more effective and satisfying for users.

INTRODUCTION

In the era of rapid digitalization, the use of technology in the teaching process in traditional schools has become a necessity. Virtual education systems are one way to implement this technology. The level of user happiness and collaborative participation significantly and positively influences the effectiveness of using the e-learning system (Jaya, 2024). However, there are recommendations that emphasize the use of a hybrid approach that combines face-to-face and virtual learning aspects (Balogun et al., 2023).

Additional research (Desmaryani et al., 2022) , found that a high-quality system determines the level of user satisfaction with e-learning. Quality of service and information then follows. According to (Ngoc Duy Phuong & Thi Dai g, 2018) , The quality of information

provided by application service providers to users is known as information quality. Information quality consists of two components: content (reliability, adequacy, and completeness of information) and content usefulness (informativeness and value of the information displayed).

The quality of goods or services is defined as a systemic and synergistic relationship between teachers, students, *e learning* media, and the *learning* environment to maximize the learning process and fulfill learning objectives and curriculum. (Haryati & Rochman, 2012). Schools must prepare themselves for *e-learning.* This is a challenge when implementing it (Agustina et al., 2016). Moreover, to keep up with these changes, e-learning policies, commitment and resources are essential.

If you use *e-learning* correctly, you will get the best results. *E-learning* has many advantages, including (1) reducing time and costs, (2) allowing easy access to materials, and (3) allowing people to exchange information and access materials repeatedly. (Hartanto, 2016). According to (Desmaryani et al., 2022) . *E-learning* is also known as learning supported by electronic services or media such as computers, telephones, satellite transmissions and audio. It is an attempt to combine traditional learning, distance learning, and blended learning. ((Desmaryani et al., 2022). *E-learning* is considered a social factor that drives development (Andrews, 2011). Most universities in Indonesia use e-learning as an educational method.

According to (Torga, 2013) "Hardware, programs, data, procedures, and people" are components of an information system. (Torga, 2013) also explains the dimensions of information systems as "context, people, process". System quality is a measure of information system processing, according to (C. F. Chen & Chen, 2010).

(Ngoc Duy Phuong & Thi Dai g, 2018) Says that information quality is defined as how good the information displayed by the application service provider. Two aspects shape information quality: content adequacy (reliability, adequacy, and completeness) and content information usefulness (informativeness and value of the information displayed). According to (Al-Fraihat et al., 2020), Information quality is an important factor and is very important for the success of information systems and *e-learning.* This is because the quality of information is critical to achieving learning goals and solving serious problems.

According to (Karoba et al., 2020), User satisfaction is influenced by the quality of information, systems and services. The reactions or feelings shown by users after using an information system are called user satisfaction. According to (Permana et al., 2020), Service quality is also the result of efforts to meet customer needs and desires and how to meet customer expectations with satisfactory service.

1. Literature Review and Hypothesis

1.1 System Quality

While improvements are needed to ensure accessibility during critical times, the high quality of the system is also good. According to (Petter et al., 2013) One of the main measures of the success of an information system is system quality. System quality is a measure of the processing of the information system itself; Operational stability and presence are very important to foster user trust. The result (C. W. Chen, 2010) in line with the researchers' findings (W. S. Chen & Tat Yao, 2016), which states that system quality is an important factor in student satisfaction with e-learning. With an e-learning platform that has

a good system, you can easily and stably get access to learning materials. System output that meets the standards of user expectations is called system quality. System quality variables can be measured through indicators such as ease of access, system synchronization, system integration, and response time (Saadilah et al., 2021).

1.2 Information Quality

In order for information to be deemed significant by users and helpful in the decision-making process, information quality is measured by taking into account both system output and the value of user information output (Saadilah et al., 2021). According to (Jansen et al., 2018) information quality is measured by looking at system output and the value of the output for information consumers. Afrizon's research (Cahyadi et al., 2020) identifies four strategies for disseminating the caliber of accounting information systems. A website may, first and foremost, adjust to changes made by users and handle changes resulting from its operations.

1.3 Service Quality

Good service quality may have a positive impact on customer satisfaction since it makes the customer feel happy and makes them like the services that the personnel provides. Service quality has an impact on customer satisfaction, according to research by (Al-Tit, 2015). Customer happiness and service quality have a direct relationship in the corporate world. When a business offers excellent customer service, its clients will be delighted as well, especially if the service lives up to their expectations. However, if a business offers subpar customer service, it's likely that its clients would be let down and unhappy. Customer satisfaction is positively impacted by service quality, according to studies like (Lestariningsih, 2021), (Pratiwi et al., 2020), and (Yuniarta et al., 2019). However (Maimunah, 2020) asserts that there is no relationship between the quality of service and customer happiness.

1.4 User Satisfaction

A metric known as information quality concentrates on system output and the value of that output to users, making information valuable to them and aiding in their decision-making. User satisfaction will be impacted by accounting information systems that can generate accurate, timely, and pertinent information while adhering to other information quality requirements (Fendini et al., 2013). High-quality information will help users make better decisions, which will increase their satisfaction (Laksmiyati, 2015).

1.5 Hypothesis Development

1.5.1 Involvement of System Quality and Information Quality

To formulate conjectures on the correlation between information quality, we may consult DeLone and McLean's information systems success model (Yulinda et al., 2022). This paradigm states that system quality, information quality, and service quality are the three primary factors that affect an information system's ability to succeed. Features like security, simplicity of use, uniqueness, and concision are examples of system quality. System quality refers to the outputs of the system, such as timeliness, correctness, completeness, and relevance. Research indicates that quality and information have a significant impact on user

happiness and the general use of information systems. One example is the research of Seddon dan Kiew (1996).

Information systems specialists' remarks corroborate this theory. System and information quality are the primary determinants of an information system's deployment success, according to (Laudon & Laudon, 2002). Effective information systems enable users to process the data they require, which boosts productivity and organizational effectiveness. However, an inadequate information system may lead to user dissatisfaction and disappointment, which will impede the attainment of corporate objectives. Furthermore, Turban dkk . (2015) said that the success of information systems depends greatly on the quality of the system and the information. An effective system will generate timely, accurate, and relevant information that will aid in decision-making for businesses. These findings enable us to formulate the following theory:

H1: How system quality affects long-term information system utilization and user happiness.

1.5.2 Involvement of System Quality and Service Quality

Yulinda et al., (2022), state that we might refer back to the information system success model (Delone & Mclean, 1992) when formulating a hypothesis on the relationship between system quality and service quality. According to this concept, system quality and service are the two primary determinants of user satisfaction and regular usage of information systems. A service provider's attributes, such as their promptness, compassion, and assurance of data security, are included in the quality of the service. On the other hand, system quality comprises security, sound transmission, usability, and features that are readily available.

Numerous specialists assert that the degree of system and service quality has a significant impact on users' overall happiness and information system usage. As an example, a research by (Pitt et al., 1995) discovered that the quality of the system and services is the primary factor determining information system user satisfaction. Information systems specialists' perspectives support this notion.

According to O'Brien dan Marakas (2011,)system and service quality is the primary component that determines the rate of information system utilization and adoption inside an organization. Users may do tasks more quickly and effectively with a system and service that have high quality standards. In addition, (Valacich & Schneider, n.d.) stress the importance of system and service quality in achieving positive user experience. Users will be more content and like using an information system that is easy to use and supported by responsive services. Based on those observations, the following hypothesis may be developed:

H1: The impact of system quality on user contentment and sustained beneficial information system usage.

H2: User happiness and the long-term, sustainable usage of information systems are positively impacted by service quality.

1.5.3 Information Quality Engagement and User Satisfaction

When speculating on information quality involvement and user happiness, we might apply (Delone & Mclean, 1992) information systems success model. Information quality is the output of a quality information system, which includes things like timeliness, relevance, completeness, correctness, and a format suitable for the needs of the user. It plays a significant role in influencing user decisions and the long-term viability of information systems. Good information will support users in decision-making and job completion.

Research has indicated that the degree of information has an impact on the degree of user happiness. For instance, a study by Seddon dan Kiew (1996) discovered a positive correlation between user satisfaction with information systems and the quality of the information. Similar conclusions were reached by (Nelson et al., 2005) who claimed that information quality is crucial for both user happiness and the long-term usage of information systems. Information systems specialists provide weight to this theory. The primary determinant of user satisfaction with information systems, according to (Laudon & Laudon, 2002), is the quality of the information. When users have access to timely, relevant, and reliable information, they are better equipped to make more informed decisions.

Furthermore, Turban et al. (2015) noted that user happiness is highly dependent on the quality of the information. They claim that consumers would view information systems that provide high-quality data as important and helpful, which will boost user happiness and encourage continuing usage of the system. These results allow us to formulate the following hypothesis:

H1: Information quality has a positive influence on user satisfaction

1.5.4 Service Quality Engagement and User Satisfaction

According to the information systems success model (Delone & Mclean, 1992) service quality is the primary factor that affects user happiness and the sustainable use of information systems. This model is used to establish hypotheses regarding the relationship between service quality and user satisfaction. Quality of service is reflected in the responsiveness, empathy, and data security of the provider. High-quality services will help users overcome problems or issues that they could encounter when using the information system, therefore increasing their productivity.

Research has indicated that customer satisfaction levels are significantly impacted by service quality. For instance, a study by (Pitt et al., 1995) discovered that user satisfaction with information systems is favorably impacted by service quality (Kettinger et al., 2016), discovered similar results, indicating that service quality plays a critical role in both customer happiness and corporate success. Information systems specialists' remarks corroborate this theory. O'Brien dan Marakas (2011) assert that service quality is a significant factor in determining users' happiness with information systems. Users will feel supported and respected and will be happier with their information systems if services are prompt, compassionate, and dependable.

Furthermore, as noted by (Valacich & Schneider, n.d.), because it will boost user happiness, assist users in resolving issues they may have, and motivate them to keep using the information system, service quality is essential to delivering a great user experience.

H1: User satisfaction is positively influenced by service quality

METHODS

In order to assess and elucidate the correlations among variables and the appropriateness of the study model, a quantitative methodology was employed in the survey design. Partial Least Squares Structural Equation Modeling, or PLS-SEM, was applied. This method works well for studies that incorporate and test previously untested theoretical frameworks and predictions.

3.1 sample and population

This research uses a convenience sampling research approach to collect data at several predetermined points within a certain time. According to (Etikan, 2016), "Convenience sampling (also known as Accidental Sampling or Opportunity Sampling) is a type of non-probability sampling method where samples are selected simply because they are easily available and accessible to the researcher." In research, determining the sample size and population plays an important role in ensuring the validity and reliability of research results. Based on quotes taken from research (Taherdoost H, 2018), the minimum sample size required to achieve a certain level of confidence in a survey can be calculated using several statistical parameters such as confidence level, margin of error, population proportion, and population size.

Calculate Sample Size is used to determine the sample. A sample size of 207 is needed to get an 85% confidence level, a ±5% margin of error, and a 50% population percentage. This indicates that 207 respondents or measures are needed in order to provide accurate survey findings with that degree of confidence. Figure 207 guarantees that the outcomes will accurately represent the population's real value, with a variance of no more than ±5%. Furthermore, sample size is also influenced by population size. The population in the province of Jambi considered as a reference for this study was 114,134 students. Population size data is significant since it can affect how big of a sample size is needed to meet requirements. Sample size computations may alter if the population size is uncertain or deemed infinite.

The sample size determination approach employed ensures that the study results will be very accurate and dependable for drawing conclusions that can be applied to a broader population by taking into account the margin of error and the degree of confidence. This approach, for instance, is utilized in this study to quantify the ways in which student satisfaction with e-learning is influenced by system, information, and service quality. All things considered, sample size calculations, as described by (Taherdoost H, 2018) offer researchers precise instructions for figuring out how many respondents are required to get accurate and trustworthy results. Additionally, it guarantees that findings from study may be extrapolated to a larger population with a high degree of confidence and a manageable margin of error.

3.2 Data Analysis

Partial Least Squares—Structural Equation Modeling (PLS-SEM) technique software is used in the SmartPLS program to analyze data and produce moderator effects. PLS-SEM was chosen as the main analysis method in this research for various reasons. In this study, four variables and five paths demonstrate the ability of PLS-SEM to support the model due

to the complex interactions of indicator variables and paths. Assumptions about data distribution are not affected by this technique. To find causal information, this research uses a predictive strategy for model estimation. PLS-SEM was chosen because it is able to balance information, previous ideas, and predictions of the basis for development. comparing the SEM statistical power of PLS with simple regression methods, CB-SEM, and others. The statistical power of PLS-SEM is especially useful for exploratory research looking at less common concepts. This applies even when predicting common factor model data and allows the identification of correlations between constructs or variables when the results are found in populations. Third, the easy-to-access software package makes this program more user-friendly than other programs such as CB-SEM via SPSS and linear structural relationships (Lisrel).Data were examined with SmartPLS 4, a powerful and easy-to-use latent variable modeling tool that incorporates the latest techniques, such as advanced algorithms and bootstrapping processes. Easy-to-use graphical user interface techniques aim to predict a specific set of hypothesized associations that optimize the explained variance in the dependent variable. PLS is usually better suited to testing relationships between models and new path modeling, which has a more sophisticated study structure. According to Heir et al., PLS-SEM divides the analysis steps into several stages. Initially, convergent and discriminative validity (CV and DV) were assessed, with item loading values, Cronbach alpha, composite reliability, and AVE used to measure CV. The DV value was also assessed using the Fornell-Larcker and heterotrait-monotrait (HTMT) criteria. In the final step, the VIF value is used to evaluate multicollinearity. After the validity and reliability tests were completed, structural model analysis and initial hypotheses were carried out by bootstrapping.

FINDINGS AND DISCUSSION

Characteristics of Effective Schools

1.1 Normal Data Analysis

Before entering the measurement model, it is necessary to test the normality of the data through the kurtosis and skewness values for each item in the descriptive statistics table, as in Table 2. Based on the criteria, all variable items used have kurtosis and skewness values between −0.840 and 2.013 respectively, and − 1.000 and 0.182, which is below 2.2. From these results, all variables were observed to be normally distributed data

Table 1. Descriptive statistical data for testing data normality.

	Mean	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
SQ 1	4.459	1.000	5.000	0.855	5.180	-2.112
SQ2	4.314	1.000	5.000	0.788	3.555	-1.516
SQ 3	4.275	1.000	5.000	0.832	1.846	-1.265
SQ 4	2.208	2.000	5.000	0.652	8.706	3.126
SQ 5	4.420	1.000	5.000	0.830	3.757	-1.790
SQ 6	4.198	1.000	5.000	0.865	0.791	-0.982
SQ 7	4.256	1.000	5.000	0.838	2.604	-1.406
SQ 8	3.966	1.000	5.000	1.023	-0.114	-0.749
SQ 9	4.068	1.000	5.000	0.935	0.966	-1.028
SQ 10	4.237	1.000	5.000	0.894	1.303	-1.180

QOI 1	4.242	1.000	5.000	0.884	2.536	-1.465
QOI 2	4.208	1.000	5.000	0.874	2.762	-1.425
QOI 3	4.232	1.000	5.000	0.848	2.818	-1.421
QOI 4	4.208	1.000	5.000	0.851	2.917	-1.454
QOI 5	4.232	1.000	5.000	0.898	3.105	-1.564
QOI 6	4.251	1.000	5.000	0.837	0.665	-1.001
QOI 7	4.242	1.000	5.000	0.868	2.073	-1.339
QOI 8	4.208	1.000	5.000	0.857	1.721	-1.249
QOI 9	4.266	1.000	5.000	0.852	2.014	-1.295
QOI 10	4.237	1.000	5.000	0.921	2.629	-1.499
QOS 1	4.082	1.000	5.000	1.011	0.779	-1.070
QOS 2	3.894	1.000	5.000	1.072	-0.444	-0.664
QOS 3	4.005	1.000	5.000	0.985	1.183	-1.108
QOS 4	4.179	1.000	5.000	0.880	1.250	-1.086
QOS 5	4.203	1.000	5.000	0.905	2.086	-1.320
QOS 6	4.246	1.000	5.000	0.907	1.842	-1.329
QOS 7	4.217	1.000	5.000	0.899	1.530	-1.248
QOS 8	4.271	1.000	5.000	0.903	2.782	-1.553
QOS 9	4.290	1.000	5.000	0.918	1.887	-1.400
QOS 10	4.126	1.000	5.000	0.924	0.936	-1.067
US 1	4.092	1.000	5.000	0.936	0.972	-1.040
US 2	4.145	1.000	5.000	0.889	0.968	-0.995
US 3	4.106	1.000	5.000	0.878	0.774	-0.942
US 4	4.121	1.000	5.000	0.890	1.210	-1.068
US 5	4.319	1.000	5.000	0.903	2.335	-1.507

1.2 Measurement Model

Sarstedt et al., (2020) suggests assessing the convergent validity, reliability, composite, and value of AVE analysis for measurement models. These estimation steps were carried out usizng the PLS algorithm to analyze the CFA confirmation factors. Figure 1 shows the analysis of additional factor values. Provides a thorough explanation of internal consistency analysis as it relates to CFA-based evaluations of validity, reliability, and discrimination.

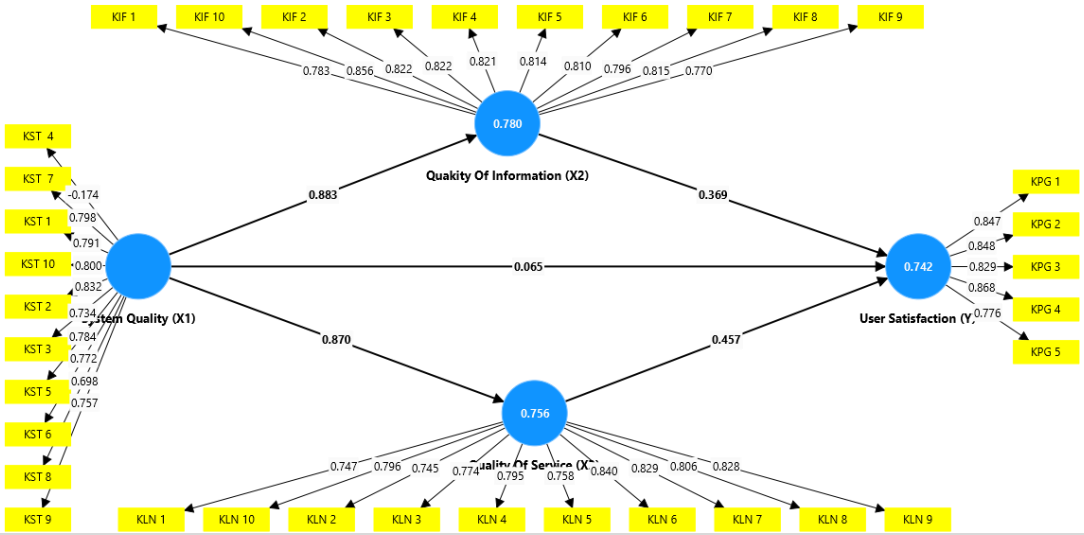

Figure 1. CFA and R-square values in PLS. CFA and R-square values in PLS

1.3 Internal Consistency, Reliability, and Validity

Table 2. Cronbach Alpha, CR, AVE, and Rho-A Values for Internal Consistency Reliability and Validity Analysis

	Cronbach's alpha	Rho-A	Composite reliability	Average Variance Extracted (AVE)
Quality Of Information (X2)	0.942	0.943	0.951	0.658
Quality Of Service (X3)	0.934	0.935	0.944	0.628
User Satisfaction (Y)	0.890	0.890	0.919	0.696
System Quality (X1)	0.877	0.919	0.910	0.544

According to Satyadarma & Syamsud in (2023) various aspects of quality are measured to determine their impact on e-learning user satisfaction. The following is a description of the results of the reliability analysis and construct validity of this research, namely the high value of Cronbach's alpha (0.942) indicating that the quality of the information has very good internal consistency. The Rho-A value (0.943) and Composite Reliability (0.951) also show that this construct is reliable. With an AVE of 0.658, this shows that more than half of the indicator variance can be explained by the construct, indicating good convergent validity. Similar to information quality, service quality also shows excellent reliability with a Cronbach's alpha of 0.934. The Rho-A (0.935) and Composite Reliability (0.944) values support this finding. AVE of 0.628 indicates that this construct has adequate convergent validity. User satisfaction also shows high reliability with Cronbach's alpha of 0.890. The Rho-A (0.890) and Composite Reliability (0.919) values support the consistency and reliability of this construct. With an AVE of 0.696, it can be concluded that the convergent validity of this construct is very good. The quality of the system shows good reliability with Cronbach's alpha of 0.877. The Rho-A (0.919) and Composite Reliability (0.910) values show strong reliability. However, the AVE of 0.544 is slightly lower than the other constructs, although still within acceptable limits, indicating that the convergent validity of this construct is still adequate.

Overall, the results of the reliability and validity analysis show that all constructs measured in this study have good internal consistency and convergent validity. This research provides a strong basis for concluding that system quality, information quality, and service quality have a significant influence on e-learning user satisfaction in higher education, as discussed by (Satyadarma & Syamsudin, 2023). The final step emphasizes discriminant validity (DV) analysis, which is defined as the extent to which each construct is empirically different from other constructs. This was analyzed using two methods, namely the Fornell–Larcker criterion [79] (see Table 4) and the heterotrait-monotrait ratio (HTMT). This is used because some studies assume that DV analysis is less effective if only one method is used.

Table 3. Fornell – Larcker criterion values from smart PLS software.

	SQ	QOI	QOS	US
SQ	0,811			
QOI	0,887	0,792		
QOS	0,883	0,870	0,737	
US	0,832	0,841	0,788	0,834

In addition, the HTMT method is used to ensure discriminant validity by comparing the correlation ratio between heterotraits (different constructs) and monotraits (the same construct). HTMT values below 0.85 usually indicate sufficient discriminant validity.

The use of both approaches, the Fornell-Larcker criterion and the HTMT ratio, in this study, provides strong evidence that each of the constructs measured—system quality, information quality, service quality, and user satisfaction—has good discriminant validity. Because these constructs are empirically different from each other, the analysis and interpretation of research results is reliable.

With proven discriminant validity, this research shows (Pawirosumarto, 2016), that the quality of systems, information and services has a significant influence on user satisfaction of e-learning systems.

Table 4. With proven discriminant validity, this research shows Heterotrait-monotrait (HTMT) value for testing discriminant validity.

	SQ	QOI	QOS	US
SQ				
QOI	0,876			
QOS	0,868	0,806		
US	0,843	0,844	0,822	

1.4 Structural Model

According to (Sarstedt et al., 2020), The structural model assessment process begins by analyzing collinearity problems. This is accompanied by relationship analysis, through the path coefficients of t and p values. To obtain the strength of this model in explaining student satisfaction in using E-Learning, the next analysis was carried out on the coefficient of determination (R2), impact size (F2), and prescriptive relevance (Q2).

The Variable Inflation Factor (VIF) value is used to test collinearity between latent variables. The VIF value increases with the degree of collinearity, and a value higher than 5.00 indicates that there is a problem with collinearity between variables in the structural model. There is no collinearity problem between the variables in this model, as shown in Table 5, because all VIF values are below 5.

Collinearity between latent variables of structural models is an important element that must be considered in regression analysis. More accurate interpretation of results and parameter estimation may be compromised if there are many latent variables. Variance Inflation Factor (VIF) is an indicator used to measure the level of collinarity between latent variables. A study conducted by Larasati and Andayani (2019) found that VIF values above

5.00 usually indicate collinarity problems; Higher VIF values can cause inaccurate interpretation and analysis results

The VIF values for each construct in the model are shown in Table 6. All VIF values are below the threshold of 5.00, which indicates that the model used does not have collinarity problems. The VIF values of each construct are explained below:

- QOI (Knowledge Information Factor): VIF values range between 2.232 and 3.121.
- SQ (Trust in Sharing Knowledge): VIF values range between 1.081 and 3.067.
- QOS (Knowledge Learning): VIF Value 1.991–3.052.
- AS (Knowledge Performance Goals): VIF Value 1.172–2.625.

There is no significant collinarity problem among the latent variables in this structural model, because the VIF value shows that there is no construct that has a VIF value of less than 5. In research conducted by (Larasati & Andayani, 2019), The DeLone and McLean method is used to determine the level of student satisfaction with the learning management system (LMS). They emphasize that the validity and reliability of the model used is very important to ensure the results are accurate and reliable. In the same way, collinarity assessment via VIF is an important step in this research to ensure that the structural model used can provide valid and reliable estimated parameters. The research results show that all VIF values are below the threshold of 5.00, which indicates that this model can measure the relationship between latent variables without experiencing excessive collinarity interference.

Table 5. Variance Inflation Factor (VIF) value

Construct	VIF Value	Construct	VIF Value
QOI 1	2.251	SQ 1	2.768
QOI2	2.558	SQ 2	3.067
QOI3	2.824	QS 3	2.088
QOI4	2.585	QS 4	1.081
QOI5	2.637	QS 5	2.461
QOI6	2.516	QS 6	2.189
QOI7	2.630	QS 7	2.369
QOI8	2.466	QS 8	2.347
QOI9	2.232	QS 9	2.526
QOI10	3.121	QS 10	2.354
QOS 1	1.991	US 1	2.472
QOS 2	2.356	US 2	2.391
QOS 3	2.566	US 3	2.144
QOS 4	2.468	US 4	2.625
QOS 5	2.127	US 5	1.172
QOS 6	3.040		
QOS 7	3.052		
QOS 8	2.668		
QOS 9	3.031		
QOS 10	2.272		

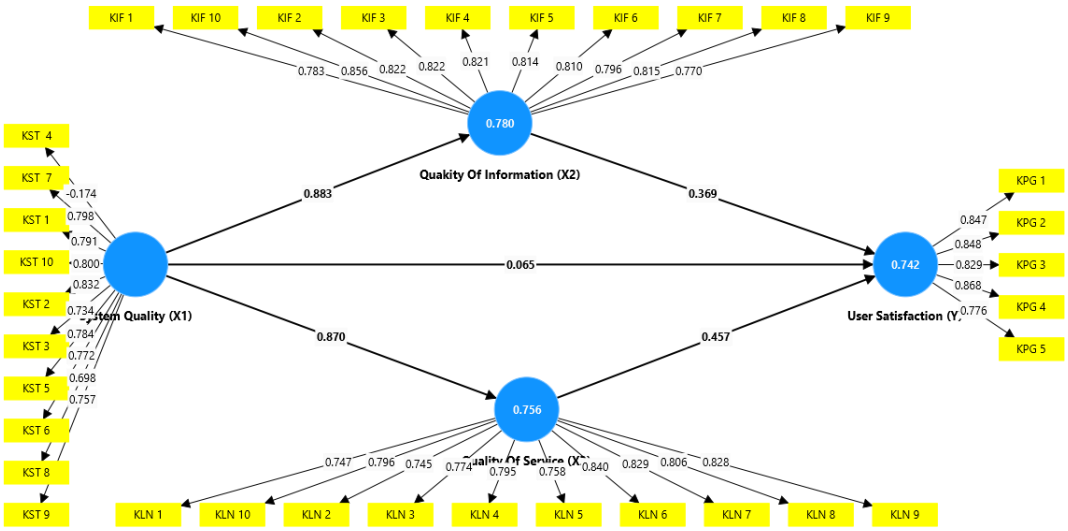

Figure 2. Final model with R square and path coefficients.

1.4 Coefficient of Determination

Due to the extent of the predicted relationship between the dependent and independent variables, the coefficient of determination (R2) is usually used to assess the structure of the model [88, 89]. In the research model, the range is between 0 and 1, with higher R2 values resulting in more accurate predictions. R2 values below 0.25 are categorized as weak, moderate, and substantial, while R2 values above 0.75 are categorized as substantial. As shown in Table 8 and Figure 5, all model dependent variables have high predictive power and accuracy with moderate R2 values, based on the smart PLS results.

Table 6. Coefficient of Determination (R2)

Construck	R2	Interpretation
QOI	0.779	Moderate
QOS	0.755	Moderate
US	0.739	Moderate

1.5 Effect Size (F2)

Based on the evaluation of the structural model, an analysis of the F2 value also needs to be carried out. This construct explains the influence of exogenous on endogenous variables to determine changes in the R2 value when certain exogenous determinants are excluded from the model. F2 values below, between, and above 0.15, 0.15 and 0.35, and 0.35 were categorized as small, medium, and large effects, respectively. Based on the results, perceived benefits have the largest F2 for attitude, as shown in Table 10.

Table 7. Value of Effect Size

Relationship	F-Square	Effect Size
QOI→US	0.085	Small
QOS→US	0.146	Medium
SQ→QOI	3.546	Large
SQ→QOS	3.103	Large
SQ→US	0.003	Small

Discussion

The aim of this research is to find out how much influence the quality of systems, information and services has on student satisfaction with e-learning platforms in the increasingly advanced era of digitalization in Jambi Province. Apart from that, this research also aims to analyze and explain how the quality of systems, information and services influences student satisfaction at online universities in Jambi Province. Quantitative methods are used to show the relationship between research variables. This study uses a survey design and Partial Least Squares structural equation modeling (PLS-SEM) method.

This research utilized a quantitative approach designed as a survey design. The convenience sampling method was used to collect samples, where the student population in Jambi Province was 114,134 students and the sample used was 207 students. This sample determination uses Calculate Sample Size with a confidence level of 85% and a margin of error of 5%. The partial least squares fractional equation modeling technique (PLS-SEM) was used to analyze the data obtained through SmartPLS.

A sufficient kurtosis skewness value indicates that the data in this study are normally distributed. Measuring the quality of systems, information and services shows that they are valid and reliable. Information quality (0.942), service quality (0.934), user satisfaction (0.890), and system quality (0.877) each construct received a Cronbach's alpha value. In addition, convergent validity for all structures is demonstrated by AVE (Average Variance Extracted), although the AVE for system quality is slightly lower (0.544). Discriminant validity was measured by the Fornell-Lacker criterion and the Heterotrait-Monotrait (HTMT) ratio. The results show that each construct has good discriminant validity, which means that the constructs in the model are different from each other. The model's variation inflation factor (VIF) value is below the threshold, according to collinearity analysis. This proves that the analysis of the structural model results is reliable.

This research shows that student satisfaction with e-learning at universities in Jambi Province is significantly influenced by the quality of systems, information and services. This shows that improving the quality of this third element will increase student satisfaction. Higher education institutions in Jambi Province are advised to continuously develop and improve their e-learning systems with a focus on improving systems, information and services so that students feel better.

CONCLUSION

Based on the discussion that has been described, it can be concluded that the success of implementing e-learning in higher education is greatly influenced by three main factors, namely system quality, information quality and service quality. System quality includes elements such as ease of use, speed of response, reliability, flexibility, and security. Information quality involves aspects such as relevance, timeliness, accuracy and completeness of the information presented. Meanwhile, service quality focuses on responsiveness, guarantees, physical capabilities of the service, as well as attention and empathy towards users. Research shows that these three factors have a significant influence on student satisfaction in using e-learning. High user satisfaction will encourage

them to continue using the e-learning system on an ongoing basis, thereby increasing learning effectiveness.

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