Understanding the Links between System Quality, Information Quality, Service Quality, and User Satisfaction in the Context of Online Learning

Yulis Nuryanti[1*], Dhaniel Hutagalung[2], Multi Nadeak[3], Siti Abadiyah[4], Dewiana Novitasari[5]

[1]STMIK Insan Pembangunan, Tangerang, Indonesia
[2,5]Sekolah Tinggi Ilmu Ekonomi Insan Pembangunan, Tangerang, Indonesia
[3]Sekolah Tinggi Teknologi Bandung, Bandung, Indonesia
[4]Universitas Muhammadiyah Tangerang, Tangerang, Indonesia
Corresponding email: yulis_ip@yahoo.co.id

Abstract - *This study aims to determine and analyze the effect of system quality, information quality, service quality on user satisfaction of online learning systems at a private university in Tangerang. The number of research samples was 429 students. The sampling technique used is simple random sampling. The analytical method used is SEM with the help of SmartPLS 3.0 software. The results showed that system quality, information quality, and service quality had a significant effect on user satisfaction of e-learning systems. The better the perception of system quality, information quality, and service quality, the more user satisfaction will increase.*

Keywords: *System quality, information quality, service quality, and user satisfaction.*

I. INTRODUCTION

The development and use of technology in Indonesia show an increasing trend, one of the means of using technology in Indonesia is the internet. Internet users in Indonesia in early 2021 reached 202.6 million people. This number increased by 15.5 percent or 27 million people when compared to January 2020. The total population of Indonesia itself is currently 274.9 million people. This means that internet penetration in Indonesia in early 2021 will reach 73.7 percent. This is contained in a recent report released by content management service HootSuite, and social media marketing agency We Are Social in a report titled "Digital 2021" (Riyanto, 2021). The phenomenon of the development and use of Science and Technology as described above greatly influences the tendency of change in the world of education. This is indicated by: (1) learning resources are very easy to find, (2) the use and utilization of ICT such as media and multimedia as well as e-learning, mobile learning, web-learning, and others in learning activities, and (3) learning models with systems like individual learning or blended learning. The e-Learning system provides new hope as an alternative solution to most educational problems in Indonesia, with functions that can be adapted to needs, either as a supplement (additional), complement (complimentary), or substitution (substitute) for learning activities in the classroom that has been used (Mohammadi, 2015; Selim, 2007; Yoo et al., 2012). The use of the e-learning system is expected to be able to assist students in improving learning both in the classroom and outside the classroom. Individuals and groups will take advantage of the e-learning system if the system can provide benefits for them. Research conducted by Hsu et al. (2011) and Smola (2011) on e-learning system users using the Moodle platform by comparing learning with conventional methods and e-learning system methods and to find out the gap

between high-achieving students and low-achieving students. The results showed that there was a negative relationship between the efficiency of the e-learning system and accessibility to computers, while there was a positive relationship between the frequency of taking the e-learning system and students' test scores. The success model of information systems has been widely developed by researchers (Chen, 2008; Ojo, 2017). From several models of information system success, the DeLone and McLean (1992) model received much attention from subsequent researchers (Aldholay et al., 2018; Ojo, 2017). Ojo (2017) empirically tested the DeLone and McLean (D and M) model, the results prove that the success of information systems is influenced by the quality of information systems and the quality of information generated from the system in question, and the quality of services.
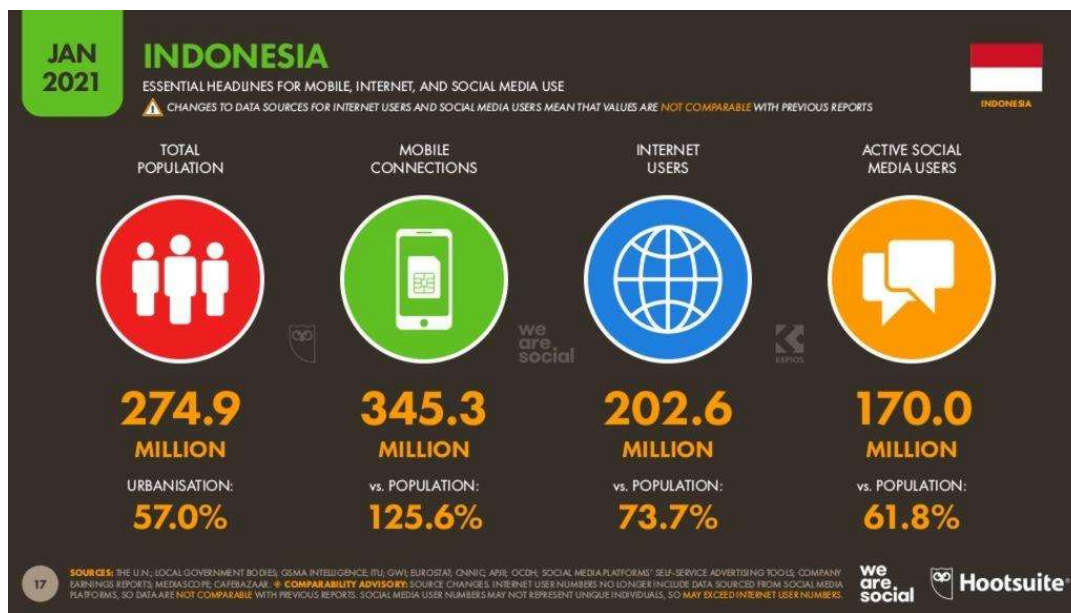

Figure 1. Number of Internet Users in Indonesia in Early 2021
Source: Riyanto (2021)

This study focuses on individual perceptions, namely individual perceptions related to system quality, information quality, service quality, usage, and user satisfaction with the use of e-learning systems. Individual readiness for technology refers to a person's tendency to accept and use technology to accomplish goals in everyday life and at work (A. Parasuraman, 2010).

II. LITERATURE STUDY AND HYPOTHESES DEVELOPMENT

A. *User Satisfaction*

Satisfaction is a consideration of a product or service that provides a pleasant level of fulfillment of user desires at the lower or upper level (Sharma & Lijuan, 2015). This definition emphasizes consumers rather than customers because even if customers pay for products or services, they are not likely to use or serve directly. Satisfaction with a product or service/service requires the experience and use of a product/service/service for each individual. User satisfaction has a very central role in the development of information systems. The results of the research presented by Dreheeb et al. (2016) and Laumer et al. (2017) found that user understanding is an effective variable and determines user satisfaction, system success, and system quality. The use of the three variable terms (user satisfaction, system success, and system quality) is often confused. Often user satisfaction is considered the same as system quality, or otherwise, user satisfaction is used to measure system quality. Laumer et al. (2017) stated that the use of user satisfaction to measure system quality would lead to a subjective assessment of the notion of system

quality. User satisfaction is more concerned with the user's view of the information system, but not on the technical quality aspect of the system concerned. In other words, user satisfaction measures the perception of what is provided by the information system rather than providing information about the functional capabilities of the information system in question. Success Dimension of user satisfaction is the level of user satisfaction when using IS. This is considered to be one of the most important steps of IS success. Information system user satisfaction can be assessed using the following criteria: adequacy, effectiveness, efficiency, overall satisfaction, enjoyment, information satisfaction, system satisfaction (Almarashdeh, 2016; Dreheeb et al., 2016; Laumer et al., 2017; Pham et al., 2019; Rita et al., 2019; Sharma & Lijuan, 2015; Wismantoro et al., 2020; Xu & Du, 2018).

B.   *System Quality*

System quality is a measurement of the information system process that focuses on the results of the interaction between users and the system. The quality of the system has attributes such as equipment availability, equipment reliability, ease of use, and response time are the determining factors why an information system is used or not used (Aldholay et al., 2018; Dreheeb et al., 2016). Nielsen (2000) argues that there are several usability principles, namely online environment, namely, navigation, response time, credibility, and content. From various literature, there are four dimensions of system quality that consist of: navigation, ease of use, response time, and security. McKinney et al. (2002) suggested that there are three dimensions of system quality, the three dimensions are access, usability, and navigation. The quality of the system can be measured by looking at its functional part, which is usability. Usability is part of the principle of interaction between human computers that provides a collection of important instructions about instructional design. Duffy (2001) argues that usability consists of four basic principles in online activities, namely: navigation, timeliness, credibility, and content. Palmer (2002) argues that several important elements in the use of the website are consistency, ease of use, clarity of interaction, ease to read, and information arrangement, speed, and layout/website design. Thus the level of use of e-learning systems is better so that students can be more motivated to use e-learning systems (Allen, 2016; Pham et al., 2019; Smola, 2011). Therefore, the first hypotheses of this research are stated as follows:

H1: *System quality improves user satisfaction.*

C.   *Information Quality*

Information quality is related to system use, user satisfaction, and net benefits (McKnight et al., 2017; Wismantoro et al., 2020; Xu & Du, 2018). Information quality has attributes such as information obtained from a system, accuracy of the information, relevance of information, timeliness, and completeness of the information. Information quality is often a key dimension regarding instrument end-user satisfaction (Ives et al., 1983; Baroudi and Orlikowski, 1988; Doll et al., 1994). As a result, information quality is often not distinguished as a unique construct but is measured as a component of user satisfaction. Therefore the size of these dimensions is a problem for IS success studies. DeLone and McLean (1992) and the Seddon (1997) model show that system quality and information quality have a significant positive effect on information system user satisfaction. The quality of information referred to in this study is the user's perception of the quality of information generated by the internet which is used by students to obtain the required information. Some of the characteristics used to assess the quality of information include accuracy, timeliness, relevance, informativeness, and competitiveness (Laumer et al., 2017; McKnight et al., 2017). The quality of information is the level of relevance (relevant), timeliness (timely), safe and presented with a good information design on a website (Phuong & Dai Trang, 2018). The best quality of information can be provided by the internet when it can be obtained easily (not difficult to find), organized (regularly), and available in large quantities. The quality of information can also be seen with the potential to produce unlimited information both within the organization and outside the organization (McKnight et al., 2017). Quality information is information that is accurate, clear, detailed, relevant, easy to obtain, timely, up to date, and by user needs (Phuong & Dai Trang, 2018). Information with the best quality will increase the usefulness of user perceptions and increase the use of information systems. Aldholay et al. (2018) also add that user acceptance or rejection of a system is caused by the quality provided by a system. Therefore, the second hypothesis of this research is stated as follows:

H2: *Information quality improves user satisfaction.*

D.   *Service Quality*

Zeithaml (2000) formulated a model that underscores the important provisions that service providers need to comply with in improving the service quality. Wismantoro et al. (2020) view SERQUAL as consisting of four dimensions, namely: empathy, reliability, responsiveness, and assurance. The other dimensions are price, time, ease of use, and usefulness. Service quality (service quality) proposed by Parasuraman et al. (2005), that is based on a comparison between what should be offered (offered) and what is provided (provided). Companies that have a high level of service quality in particular develop two information systems that are very important to improve service capabilities. First, an information system collects service performance information for management purposes and student motivation. Second, information systems disseminate information that is valued (valued) useful by customers. According to Ojo (2017) who explains the concept of DeLone and McLean, states that service quality is more important than other applications because users of the current system are more customers and not students or internal users of the organization. Hence, poor support will lead to lost customers and even lost sales. Therefore, the third hypothesis of this research is stated as follows:

H3: *Service quality improves user satisfaction.*

In conclusion from the related literature review above, the following is a conceptual framework that has been developed for this study (see Figure 2) and continued for hypothesis testing.
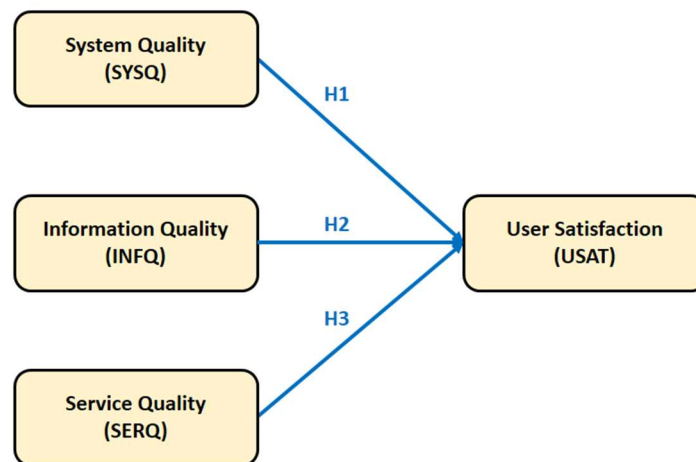

Figure 2. Research Conceptual Model

III. METHODS

The purpose of this study is to collect maximally useful knowledge to form valid hypotheses far from subjective input. Thus, the positivist theory was adopted in this study because it identified similarities that were seen through observation and workplace investigations. Therefore, a deductive approach is followed, seeking to propose and test hypotheses to fit existing theories. This study adopted a survey technique using quantitative analysis and to collect data on the effect of system quality, information quality, and service quality on user satisfaction. This technique was adopted because of its ability to collect data quickly compared to other tools, while allowing random sample selection, and allowing the researcher to measure and control multiple variables. After that, to identify findings or patterns in the related sample, the collected data is then analyzed in depth.

For this study, the questionnaire was designed in several parts: The first part includes demographic questions in which students anonymously state their gender, age, and tenure in the company. The second part includes three-question items that measure the system quality variable (SYSQ1-SYSQ3), five-question items that measure the information quality variable (INFQ1-INFQ5), three-question items that measure the service quality variable (SERQ1-SERQ3), and three question items measuring the user satisfaction variable (USAT1-USAT3). The instrument of these

four variables was adapted from Aldholay et al. (2018). The questionnaire was designed in such a way as to target students studying at one of the universities in Tangerang. To ensure the adequacy of the research tools in context, the researcher forwarded a questionnaire to four researchers whose notes were then entered. Furthermore, the questionnaire was tested on 30 students. The trial resulted in a few word changes in the questionnaire item scale for better understanding. From the list, a random sample was used to collect data from students. Researchers collected data anonymously according to research ethical standards and were able to receive a sizable response rate through online communications.

IV. RESULT AND DISCUSSION

A. Sample Description

A total of 429 students participated, consisting of boys (67%) and girls (33%). They have different age groups, ranging from under the age of 20 years (25%), 20-25 years (57%), and over 25 years (18%). Their tenure in the companies where they work also varies, 33% of them are under 1 year, 54% have worked between 1-3 years, and the remaining 13% have worked more than 3 years.

B. Results of Validity Test and Research Reliability Indicator

Stages of measuring on testing models involve convergent validity tests and discriminant validity. Meanwhile, the value of Cronbach's alpha and composite reliability is needed in testing for construction reliability. PLS analysis results could be used to test for research hypotheses if all indicators in the PLS model have met the requirements of convergent validity, discriminant validity, and reliability test.

C. Convergent Validity Test

Convergent validity test is done by seeing the value of the loading factor of each indicator towards the construct. In most references, a factor weighing from at least 0.7 is considered to have validity that is strong enough to explain the latent construct (Chin, 1998; Ghozali, 2014; Hair et al., 2010). In this research, the minimum limit of the loading factor that is accepted is 0.7, with the condition of AVE score for every construct, which is > 0.5 (Ghozali, 2014). After going through data processing with SmartPLS 3.0, all indicators have the loading factor value above 0.5 or have met the requirements of an AVE score above 0.5. The fit or valid model in this research can be seen in Figure 3. Therefore, the convergent validity of this research model has met the requirements. Loading factors, Cronbach's alpha, composite reliability, and AVE in every construct can be seen in Table 1.

D. Discriminant Validity test

Discriminant validity is done to ensure that every concept of each latent variable is in contrast with the other latent variables. A model has a good discriminant validity if the quadratic value of AVE in each exogenous construct (value on the diagonal) exceeds the correlation between the construct with the other construct (value below diagonal) (Ghozali, 2014). The result of discriminant validity research is done by the quadratic value of AVE, which means by seeing the Fornell-Larcker Criterion Value that is mentioned in Table 3. The discriminant validity test result shown in Table 3 above indicates the whole construct having a square root value of AVE above correlation value with the other latent construct (through Fornell-Larcker Criterion). Likewise, cross-loading the value of all items from other indicators as mentioned in Table 2, so it can be concluded that a model has met a discriminant validity (Fornell & Larcker, 1981).

Next, a collinearity evaluation is done to discover whether there is collinearity in the model. To find out about collinearity, VIF estimation from every construct is required. If the VIF score is higher than 5, then the model will show collinearity (Hair et al., 2014). As shown in Table 4, all VIF scores are less than 5, i.e. the results of the collinearity structural model reveal VIF values below 2. This shows that this research model does not have multicollinearity problems.

E. Construct Reliability Test

Construct reliability can be assessed from the value of Cronbach's alpha and composite reliability from each construct. The value of composite reliability and Cronbach's alpha is suggested to be more than 0.7 (Ghozali, 2014). The reliability test results in Table 2 above shows that all constructs have composite reliability value and Cronbach's alpha value higher than 0.7 (> 0.7). In conclusion, all constructs have met the reliability that is required.
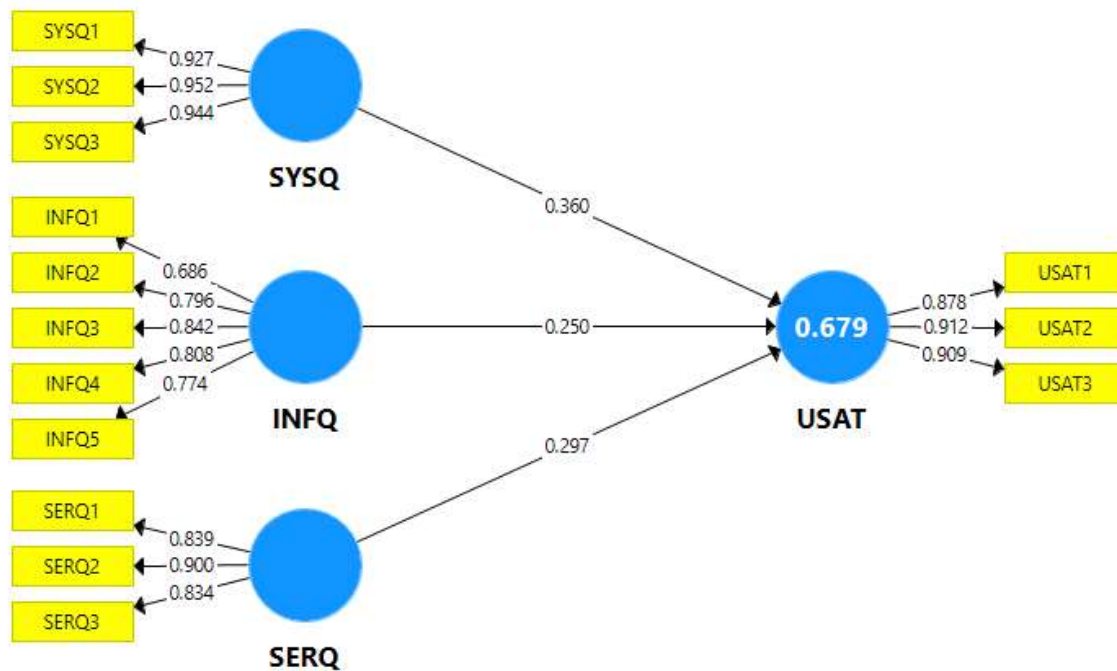

Figure 3. Valid Research Model
Source: SmartPLS 3.0 Processing Results (2021)

Tabel 1. Items Loadings, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE)

Variables	Items	Loadings	Cronbach's Alpha	Composite Reliability	AVE
System Quality (SYSQ)	SYSQ1	0.927	0.935	0.959	0.885
	SYSQ2	0.952			
	SYSQ3	0.944			
Information Quality (INFQ)	INFQ1	0.686	0.841	0.887	0.613
	INFQ2	0.796			
	INFQ3	0.842			
	INFQ4	0.808			
	INFQ5	0.774			
Service Quality (SERQ)	SERQ1	0.839	0.821	0.893	0.737
	SERQ2	0.900			
	SERQ3	0.834			
User Satisfaction (USAT)	USAT1	0.878	0.883	0.927	0.810
	USAT2	0.912			
	USAT3	0.909			

Source: SmartPLS 3.0 Processing Results (2021)

Tabel 2. Discriminant Validity

Variables	INFQ	SERQ	SYSQ	USAT
INFQ	0.783			
SERQ	0.759	0.858		
SYSQ	0.713	0.746	0.941	
USAT	0.731	0.754	0.759	0.900

Source: SmartPLS 3.0 Processing Results (2021)

Tabel 3. Collinearity (VIF)

Variables	INFQ	SERQ	SYSQ	USAT
INFQ				2.663
SERQ				2.952
SYSQ				2.544
USAT				

Source: SmartPLS 3.0 Processing Results (2021)

Tabel 4. R Square Value

Variables	R Square	R Square Adjusted
USAT	0.679	0.677

Source: SmartPLS 3.0 Processing Results (2021)

Tabel 5. Hypotheses Testing

Hyp.	Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
H1	SYSQ -> USAT	0.360	0.364	0.056	6.373	0.000	Supported
H2	INFQ -> USAT	0.250	0.249	0.055	4.574	0.000	Supported
H5	SERQ -> USAT	0.297	0.294	0.050	5.927	0.000	Supported

Source: SmartPLS 3.0 Processing Results (2021)

F. Hypotheses Testing

Hypothesis testing in PLS is also known as inner model testing. This test includes a test of the significance of direct and indirect effects as well as measuring the magnitude of the effect of exogenous variables on endogenous variables. To determine the effect of system quality, information quality, and service quality on user satisfaction, a direct influence test is needed. The effect test was carried out using the t-statistical test in the partial least squared (PLS) analysis model using the SmartPLS 3.0 software. With the bootstrapping technique, the R Square value and the significance test value were obtained in Table 4 and Table 5. Based on Table 4 above, the value of R Square of user satisfaction (USAT) is 0.679 which means that the variable user satisfaction (USAT) can be explained by system quality (SYSQ), information quality (INFQ), and service quality (SRQ) of 67.9%, while the remaining 32.1% is explained by other variables not discussed in this study. This means that the substance of influence in the relationship model in this research model is fairly strong (Chin, 1998). Meanwhile, Table 5 shows the t-statistics and p-values that show the influence between the research variables that have been mentioned.

G. Discussion

1. The Influence of System Quality on User Satisfaction

Testing the hypothesis between the relationship between system quality and user satisfaction is completely presented in Table 5, quantitatively presented as follows: SEM analysis produces an estimated value of 0.360, a critical ratio value of 6.373, and p-values of 0.000, so that the quality of the system has a significant effect on user satisfaction (**H1 accepted**). Considering the value of the estimate is positive, this means that there is a unidirectional relationship between the quality of the system and user satisfaction, namely the higher the quality of the e-learning system provided by the campus, the higher the level of satisfaction of the users of the e-learning system on campus. The quality of the information system is a characteristic of the inherent information about the system itself. As perceived ease of use, which is the level of how much computer technology is felt, it is relatively easy to understand and use. This shows that if users of information systems feel that using the system is easy, they do not require much energy and time to use it, so they will be happier to work and feel satisfied. The higher the quality of the information system used, it is predicted that it will affect the higher level of satisfaction of the end-user of the information system. The findings of this study confirm and expand the Theory of Reasoned Action (TRA) developed by Ajzen (1991), in which a person will use an information system because the system will produce benefits for himself. This TRA describes the stages of human behavior. In the early stages, behavior is assumed to be determined by intention. At the next stage, intentions can be explained in the form of attitudes toward the behavior and subjective norms in the form of beliefs about the consequences of doing behavior about the normative expectations of relevant people. When someone receives a system with good system quality, then in the person's mind he will feel happy and satisfied with the information system. The findings of this study also confirm and expand the opinion of DeLone & McLean (1992) that good system quality and information quality, represented by the usefulness of the system output obtained, can affect the level of intended use and user satisfaction. Information system success is influenced by perceived information quality and perceived system quality, which are significant predictors of user satisfaction. User satisfaction is a significant predictor of intended use and perceived individual impact (Aldholay et al., 2018; Dreheeb et al., 2016; McKnight et al., 2017).

2. The Influence of Information Quality on User Satisfaction

Testing the hypothesis between the relationship between information quality and user satisfaction is completely presented in Table 5, quantitatively presented as follows: SEM analysis produces an estimated value of 0.250, a critical ratio value of 4.574, and p-values of 0.000, so that the quality of information has a significant effect on user satisfaction (**H2 accepted**). Considering the value of the estimate is positive, this means that there is a unidirectional relationship between the quality of information and user satisfaction, namely the higher the quality of the information provided by the e-learning system, the better it will lead to a higher level of user satisfaction with the e-learning system. Information quality is the quality of output in the form of information generated by the information system used. Users of information systems certainly hope that by using the system they will get the information they need. The characteristics of the information produced by a particular information system may differ from information from other information systems. An information system that can produce timely, accurate, as needed, and relevant information and meets other criteria and measures of information quality, will affect user satisfaction. The findings of this study also confirm and expand the Theory of Planned Behavior (TPB) which is the development of TRA. Ajzen (1991) developed a construct that did not yet exist in TRA. The construct is considered as perceived behavioral control. This construct is used to control the shortcomings and limitations of the lack of resources used to perform the behavior. The limitations of a human in providing or inputting information will be supported by the quality of the information obtained so that users become satisfied. The findings of this study also confirm and expand the opinion of Aldholay et al. (2018) which confirms that user satisfaction on a computer system is reflected by the quality of the information held. User satisfaction with an information system is how the user perceives the information system in real terms, not on the technical quality of the system (Aldholay et al., 2018; Laumer et al., 2017; McKnight et al., 2017; Phuong & Dai Trang, 2018).

3. The Influence of Service Quality on User Satisfaction

Testing the hypothesis between the relationship between service quality and user satisfaction is completely presented in Table 5, quantitatively presented as follows: SEM analysis produces an estimated value of 0.297, a critical ratio value of 5.927, and p-values of 0.000, so that service quality has a significant effect on usage (**H3 is accepted**). Given the value of the estimate is positive, this means that there is a unidirectional relationship between service quality

and usage, namely the higher the quality of services provided by the e-learning system, the higher the level of use of the e-learning system (Sasono & Novitasari, 2020). The findings of this study confirm and extend the research conducted by Wang (2008) examining the success of e-commerce in Taiwan and Wang & Liao (2008) examining the success of e-government in Taiwan. Both studies show a significant positive relationship between service quality and system use. The positive relationship between the two studies can occur because the research was carried out in a system environment as a supporter of the services provided (Sharma & Lijuan, 2015).

V. CONCLUSION

This study aims to investigate the effect of system quality, information quality, and service quality on user satisfaction of a website-based e-learning system at a private university in Tangerang. The conclusions that can be drawn are as follows: First, the better the perception of the quality of the system, the more user satisfaction of the e-learning system will be. This finding confirms previous studies which state that system quality has a significant effect on user satisfaction (Aldholay et al., 2018; Dreheeb et al., 2016; McKnight et al., 2017). Second, the better the perception of the quality of information, the more user satisfaction of the e-learning system will be. This finding confirms previous studies which state that information quality has a significant effect on user satisfaction (Aldholay et al., 2018; Laumer et al., 2017; McKnight et al., 2017; Phuong & Dai Trang, 2018). Third, the better the quality of e-learning services will further increase the satisfaction of e-learning system users. This finding confirms previous studies which state that usage has a significant effect on user satisfaction (Sharma & Lijuan, 2015). Suggestions for further research, in this study only involves a single student perspective. Future research is recommended to use the perspective of the organization/institution (e-learning system management unit), lecturers, and university campus employees.

REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Aldholay, A. H., Isaac, O., Abdullah, Z., & Ramayah, T. (2018). The role of transformational leadership as a mediating variable in DeLone and McLean information system success model: The context of online learning usage in Yemen. *Telematics and Informatics*, *35*(5), 1421–1437. https://doi.org/10.1016/j.tele.2018.03.012

Allen, M. W. (2016). *Michael Allen's guide to e-learning: Building interactive, fun, and effective learning programs for any company*. John Wiley & Sons.

Almarashdeh, I. (2016). Sharing instructors experience of learning management system: A technology perspective of user satisfaction in distance learning course. *Computers in Human Behavior*, *63*, 249–255.

Chen, E. T. (2008). Successful e-learning in corporations. *Communications of the IIMA*, *8*(2), 5.

Chin, W. (1998). *The Partial Least Squares Approach to Structural Equation Modeling* (E. Modern Methods for Business Research, In: G. A. Marcoulides (ed.)). Lawrence Erlbaum Associates Publisher.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95.

Dreheeb, A. E., Basir, N., & Fabil, N. (2016). Impact of system quality on Users' satisfaction in continuation of the use of E-learning system. *International Journal of E-Education, e-Business, e-Management and e-Learning*, *6*(1), 13.

Duffy, C. M. (2001). *Designing Web Usability: The Practice of Simplicity, by Jakob Nielsen, New Riders Publishing, Indianapolis, Indiana, USA, 420 pp., 2000., Paper: ISBN 1-56205-810-X, $45.00.* Wiley Online Library.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39. https://doi.org/10.2307/3151312

Ghozali, I. (2014). *Structural Equation Modeling, Metode Alternatif dengan Partial Least Square (PLS)* (4th ed.). Badan Penerbit Universitas Diponegoro.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Pearson Prentice Hall.

Hsu, D., Karampatziakis, N., Langford, J., & Smola, A. (2011). Parallel online learning. *ArXiv Preprint ArXiv:1103.4204*.

Laumer, S., Maier, C., & Weitzel, T. (2017). Information quality, user satisfaction, and the manifestation of workarounds: a qualitative and quantitative study of enterprise content management system users. *European Journal of Information Systems*, *26*(4), 333–360.

McKinney, V., Yoon, K., & Zahedi, F. "Mariam." (2002). The measurement of web-customer satisfaction: An expectation and disconfirmation approach. *Information Systems Research*, *13*(3), 296–315.

McKnight, D. H., Lankton, N. K., Nicolaou, A., & Price, J. (2017). Distinguishing the effects of B2B information quality, system quality, and service outcome quality on trust and distrust. *The Journal of Strategic Information Systems*, *26*(2), 118–141.

Mohammadi, H. (2015). Investigating users' perspectives on e-learning: An integration of TAM and IS success model. *Computers in Human Behavior*, *45*, 359–374. https://doi.org/10.1016/j.chb.2014.07.044

Ojo, A. I. (2017). Validation of the DeLone and McLean information systems success model. *Healthcare Informatics Research*, *23*(1), 60–66.

Palmer, J. W. (2002). Web site usability, design, and performance metrics. *Information Systems Research*, *13*(2), 151–167.

Parasuraman, A. (2010). Service productivity, quality and innovation: Implications for service-design practice and research. *International Journal of Quality and Service Sciences*, *2*(3), 277–286. https://doi.org/10.1108/17566691011090026

Parasuraman, Ananthanarayanan, Zeithaml, V. A., & Malhotra, A. (2005). ES-QUAL: A multiple-item scale for assessing electronic service quality. *Journal of Service Research*, *7*(3), 213–233.

Pham, L., Limbu, Y. B., Bui, T. K., Nguyen, H. T., & Pham, H. T. (2019). Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. *International Journal of Educational Technology in Higher Education*, *16*(1), 1–26.

Phuong, N. N. D., & Dai Trang, T. T. (2018). Repurchase intention: The effect of service quality, system quality, information quality, and customer satisfaction as mediating role: a PLS approach of m-commerce ride hailing service in Vietnam. *Marketing and Branding Research*, *5*(2), 78.

Rita, P., Oliveira, T., & Farisa, A. (2019). The impact of e-service quality and customer satisfaction on customer behavior in online shopping. *Heliyon*, *5*(10), e02690.

Riyanto, G. P. (2021). Jumlah Pengguna Internet Indonesia 2021 Tembus 202 Juta. *Kompas.Com*, *53*(9), 6. https://tekno.kompas.com/read/2021/02/23/16100057/jumlah-pengguna-internet-indonesia-2021-tembus-202-juta.

Sasono, I., & Novitasari, D. (2020). Enhancing Service Quality through Innovation Capabilities and Work Productivity. *International Journal of Science and Management Studies (IJSMS)*, *3*(5), 123–133. https://doi.org/10.51386/25815946/ijsms-v3i6p111

Selim, H. M. (2007). Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers and Education*, *49*(2), 396–413. https://doi.org/10.1016/j.compedu.2005.09.004

Sharma, G., & Lijuan, W. (2015). The effects of online service quality of e-commerce Websites on user satisfaction. *The Electronic Library*.

Smola, A. J. (2011). Parallel Online Learning. *Scaling up Machine Learning: Parallel and Distributed Approaches*.

Wang, Y.-S., & Liao, Y.-W. (2008). Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success. *Government Information Quarterly*, *25*(4), 717–733.

Wang, Y. (2008). Assessing e-commerce systems success: a respecification and validation of the DeLone and McLean model of IS success. *Information Systems Journal*, *18*(5), 529–557.

Wismantoro, Y., Himawan, H., & Widiyatmoko, K. (2020). The effect of IS SERVQUAL and user information satisfaction (UIS) adoption on user satisfaction. *Uncertain Supply Chain Management*, *8*(3), 495–504.

Xu, F., & Du, J. T. (2018). Factors influencing users' satisfaction and loyalty to digital libraries in Chinese universities. *Computers in Human Behavior*, *83*, 64–72.

Yoo, S. J., Han, S. H., & Huang, W. (2012). The roles of intrinsic motivators and extrinsic motivators in promoting e-learning in the workplace: A case from South Korea. *Computers in Human Behavior*, *28*(3), 942–950. https://doi.org/10.1016/j.chb.2011.12.015

Zeithaml, V. A. (2000). Service quality, profitability, and the economic worth of customers: what we know and what we need to learn. *Journal of the Academy of Marketing Science*, *28*(1), 67–85.