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Information system success model: continuous intention on users' perception of e-learning satisfaction

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ABSTRACT

The information systems success strategy contributes to understanding of digitalization. This research aims to evaluate user satisfaction with the e-learning system continuously. The research method is hybrid, combining constructs of a unified theory of acceptance and use of technology, the technology acceptance model, and service quality (SVQ). Data collection was conducted through the distribution of questionnaires targeting instructors. Data analysis utilized structural equation modeling with partial least squares. This method was used to test the measurement model with factor loadings and average variance extracted (AVE) above 0.5. Meanwhile, validity testing on cross-loading had indicator values for each variable higher than other variables, with composite reliability above 0.7. These results were supported by hypothesis testing, which indicated that website quality positively influences user satisfaction, leading to sustained intention. The original sample obtained a value of 0.633; mean of 0.624; standard deviation of 0.105, and a p-value below 0.01. Additionally, user subjective norms have a strong relationship between sustained intention and system appropriateness, of 0.763 in using e-learning.

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1. INTRODUCTION

The transformation of higher education demands technological trends and the requirement for digital proficiency in self-directed learning. Changes in student and teacher behavior serve as benchmarks for the performance improving and academic achievement [1]. Factors that hinder e-learning include internet data and network or connectivity issues [2], the devices used, learning facilities, course management understanding, and time constraints [3]. Additionally, lack of commitment from institutions in preparing infrastructure [4], the demand for online learning activities and limitations in human resources' ability to use technology [5] are significant barriers. The absence of evaluations for the quality parameters of the education ecosystem is influenced by factors such as awareness, satisfaction, participation, and accessibility for sustainable improvement. Conversely, factors such as laziness have a negative impact [6]. The research conducted by [7] indicates that information systems are designed to collect, create, and distribute useful data within an organization. Includes technology acceptance, system quality, and perceived usefulness [8]. E-learning success encompasses information, service, usage, user satisfaction, and overall benefits [9]. The availability of infrastructure strongly supports e-learning systems. Technology is considered successfully

implemented when it meets needs quickly, improves performance, and satisfy stakeholder requirements [10]. Effective technology and systems can provide an engaging user interface to motivate users. However, the limitations of capabilities are often influenced by insufficient mastery, high effort expectations, and anxiety about new technology [11]. Communication usage, knowledge, and satisfaction significantly influence users' behavior and intentions [12]. Technology acceptance is more prevalent with the availability and quality of facilities [13]. User interest in adopting the technology is driven by cost requirements and interest intentions in information system acceptance [14], [15].

Many institutions face challenges in supporting learning, including data security, system integration and maintenance, accuracy and management, resistance to change and technological evolution. These challenges drive information providers to require careful, effective planning as well as good communication between stakeholders and users. Educational providers need to consider learning management systems such as platforms and content that align with user needs. Moreover, the scarcity of infrastructure and different economic levels pose obstacles in online learning [16]. DeLone dan McLean's theory explains that a website must meet six main dimensions [17]. The effectiveness of multidimensional is enhanced when there is a consistent and sustainable intention to use them. Different levels of success are required to align with user needs [8], [18]. There is a drive for system usage, perceived benefits, anxiety, social influence, system quality, and human resource capabilities [19]. The quality of educational system is a significant resource for user satisfaction [20]. User satisfaction and the sustainable usage of systems are greatly influenced by attitudes. Therefore, it is necessary to improve technology availability, utility, regulatory measures, and the capabilities of system providers in developing system applications [21]. Based on literature studies, individuals' beliefs and cognitive influence play a crucial role in their intentions to continue experiencing perceived benefits through sustainable information system usage [22]. Additionally, the enjoyment derived from online learning significantly impacts performance expectations and effort expectations [23]. Factors related to pleasure contribute to the satisfaction of information system users and improve learning experiences when utilizing technology [24].

Online learning is influenced by various facility, intention, satisfaction, interactivity, flexibility, and quality. Indicators of acceptance include changes in user behavior and satisfaction [25]. Blended learning system yield the highest satisfaction levels, and technological device support can influence users' intentions. The UTAUT model parameters significantly influence users' intentions and behaviors [26]. The five TAM constructs for evaluating regarding new technology are: usefulness, benefits, ease of use, attitude, and interest [27]. Research results indicate that psychological factors determine users intentions to use technology, both directly and indirectly [28]. Service quality (SVQ) dimensions includes tangible evidence such as facilities and personnel appearance. Reliability refers to the ability to accurately. Responsiveness entails a willingness to provide appropriate attention. Assurance involves providing comfort and instilling trust and confidence in users. Empathy includes individual concern and attention [29]. This statement is supported by research [30], which indicated the five sub-factors of SVQ positively correlate with technology and information system acceptance. Furthermore, higher empathy with SVQ corresponds to performance expectations and intentions in e-learning system acceptance by 97% in field condition [31].

Based on the literature review above with reference to previous research, there is an opportunity for researchers to develop a technology acceptance model. The author maps the root of the problem through an analytical identification process by combining eight variables that interact between the extended unified theory of acceptance and use of technology, technology acceptance model and SVQ. This research aims to measure satisfaction of users in using systems. This research adopts micro-level satisfaction to assess users' perceptions of enjoyable experiences, performance, and ease of use. The sustained use of the system is explained by users' continuous intention to use based on satisfaction and attitudes toward user behavior. This research analyzed post-adoption factors in the context of e-learning systems in higher education institutions. The parameters used include SVQ, enjoyment system, academic achievement and accuracy of information. The contribution of this research as a recommendation for a framework in to enhance the quality of educational systems and the success of information systems.

2 METHOD

This research employs a deductive quantitative approach that establishes a theoretical relationship between concepts and develops hypotheses tested in empirical studies. Data is obtained through surveys, considering the observed condition factors. Participants' criteria are specifically targeted at educators who are engaged in online learning at a university in Central Java, Indonesia. The questionnaire is constructed based on the Likert scale. Variables used as indicators in instrument formulation consist of statements or questions. For analysis purposes, responses are scored from 1 to 5, defined as follows: strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5). The data analysis technique utilizes structural modeling with

partial least squares software. Hypothesis testing is conducted using due to its robust nature [32]. The research stages consist of four main phases: planning, model evaluation, data analysis and interpretation of result, as shown in Figure 1. These steps aim to achieve the research goals and answer the questions in the background.

Figure 1. Research methodology

Stage (1) identification, observation and formative study to identify problems and obtain constructs. (2) preparing research models, preparing and designing instruments, collecting data and distributing questionnaires. (3) analysis by validating internal consistency, checking data normality, and testing the level of validity through hypothesis testing. (4) presenting the results and measurements that produce a model for achieving success in sustainable user satisfaction of the e-learning system. This research adopts the continuous intention use (CIU) construct [33]. The attitude toward behavior (ATB) is taken from the technology acceptance model [28] and SVQ dimensions [34]. Furthermore, the researcher developed a research model by combining quality and social factors such as independent and user acceptance as dependent variable. Meanwhile, three external variables include system enjoyment (SE), use satisfaction (USAT), perceived academic performance (APPC) dan actual system use (AS). The novelty of this research maintains the main factors of the UTAUT and TAM models [35] which have a significant effect on the success of information systems in the e learning context. The research model is illustrated in Figure 2

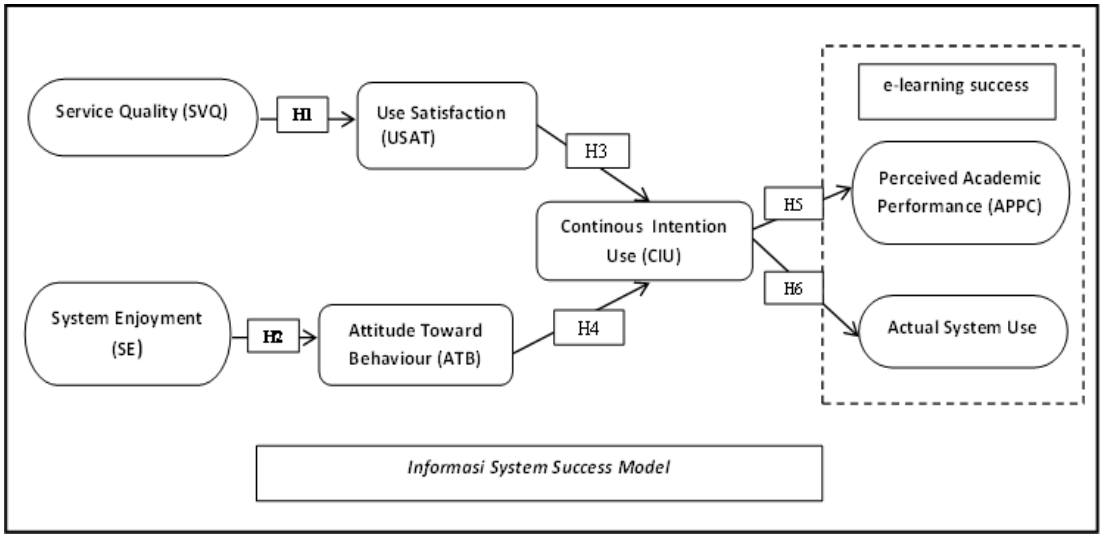

Figure 2. Research model

To answer the research objectives, several questions were prepared, as follows:

1. How cooperative is the service when handling errors and receiving information?
2. Does e- learning can improve my knowledge and skills in using technological devices?
3. Did I find the experience very enjoyable and satisfying.
4. Do I intend to use the system on an ongoing basis in carrying out performance-based activities?
5. What factors influence e-learning system user satisfaction?

Hypothesis testing is based on the following questions:

H1: Service quality influences user satisfaction
H2: System enjoyment influences the attitude toward behavior
H3: Use satisfaction influences the continuous intention to use

H4: Attitude toward behavior influences the continuous intention to use
H5: Continuous intention to use influences the perceived academic performance in using an e-learning system.
H6: Continuous intention to use influences the actual system use in using e-learning system.

3 RESULTS AND DISCUSSION

3.1. Descriptive statistical analysis

This study utilizes data from the respondents, specifically educators who use e-learning applications as supplementary learning media. Data dissemination was conducted through an online questionnaire. In total, 139 responses were obtained, but 28 respondents submitted duplicate entries. Thus, data from 111 respondents were deemed suitable for the research criteria. The respondent's profile data consists of 66% male and 34% female. In terms of age distribution, 45% fall between 26 and 35 years old, 33% between 36 and 45 years old, 19% between 46 and 55 years old, and 3% above 56 years old. Regarding educational qualifications, 85% of participants hold a master's degree, while 15% hold a doctoral. In this study, post-adoption using information system is the primary focus. The survey results indicate that 19% of respondents have less than 1 year of experience using e-learning applications, 29% have been using them for 1-2 years, and 52% have been using them for over 2 years. In terms of the frequency of e-learning usage, there are three categories: 75% use it every day, 23% use it every two weeks, and 2% use it once a month. As for the duration of e-learning access time, 43% spend less than one hour, 44% access it for 2-3 hours, and 13% spend over 4 hours. Demographic profile are shown in Table 1:

Table 1. Characteristics of respondents

Characteristic	Frequency	Percentage (%)
Gender		
Male	73	66%
Female	38	34%
Age (years)		
26-35	50	45%
36-45	37	33%
46-55	21	19%
>56	3	3%
Level og education		
Master	94	85%
Doctoral	17	15%
Long time using the Internet		
< 1 year	21	19%
1-2 year	32	29%
>2 year	58	52%
Internet usage frequency		
Everyday	83	75%
Once every 2 weeks	26	23%
Once a month	2	25
Duration of time to access the e-learning website		
<1 hours	48	43%
2-3 hours	49	44%
4 hours	14	13%

3.2. Model testing

The testing phase is utilized to validate and ensure reliability. The quality of constructs is measured on the evaluation of the model testing. Testing quality criteria begins with evaluating factor loadings, construct reliability, and construct validity.

Factor loadings indicate the strength of the relationship between an item and its construct, range from -1 to +1. The closer it is to +1 or -1, the stronger the correlation. Loading above 0.7 are considered high or strong, while those below 0.4 are considered weak. Variables with high factor loadings on a construct indicate that they contribute significantly in shaping that construct. The analysis obtained values between 0.729 – 0.880, except for ATB4, which only reached 0.283, a very low value. Consequently, data cleaning was carried out. The final results are as shown in Table 2. The common methods used to measure reliability are Cronbach's alpha and composite reliability (CR). Both reliability indicators have a threshold value of 0.7. In this study, Cronbach's Alpha values range from 0.780 to 0.867, and CR Values range from 0.851 to 0.904. Both reliability indicators have values above the threshold, indicating that construct reliability has been met.

Convergent validity is a type of construct validity that measures the extent to which a measurement of a construct correlates with other measurements expected to measure the same construct. Average variance extracted (AVE) is used to assess convergent validity. The recommended AVE ranges from 0.534 to 0.670, indicating that convergent validity in this study meets the criteria. Meanwhile, the variance inflation factor in this study ranges from 1.320 to 2.817, which are below the threshold of 5. Thus, the multicollinearity value has already met the criteria. The results of testing are shown in Table 2.

Table 2. Factor loading, validity, and reliability

	factor loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)	VIF
APC1	0.830	0.853	0.895	0.631	2.130
APC2	0.717				1.906
APC3	0.766				1.993
APC4	0.866				2.817
APC5	0.784				2.167
AS1	0.854	0.852	0.894	0.630	2.479
AS2	0.777				1.808
AS3	0.810				2.012
AS4	0.810				2.013
AS5	0.709				1.533
ATB1	0.824	0.835	0.890	0.670	1.957
ATB2	0.864				2.181
ATB3	0.856				2.130
ATB5	0.721				1.588
CUI1	0.766	0.835	0.883	0.603	1.748
CUI2	0.739				1.605
CUI3	0.783				1.774
CUI4	0.722				1.582
CUI5	0.865				2.409
SE1	0.771	0.808	0.867	0.568	1.821
SE2	0.807				1.810
SE3	0.742				1.763
SE4	0.797				1.752
SE5	0.639				1.398
SVQ1	0.788	0.780	0.851	0.534	1.744
SVQ2	0.639				1.320
SVQ3	0.796				1.714
SVQ4	0.708				1.558
SVQ5	0.711				1.344
USAT1	0.738	0.867	0.904	0.653	2.208
USAT2	0.814				2.254
USAT3	0.844				2.369
USAT4	0.787				2.023
USAT5	0.851				2.242

The HTMT ratio is analyzed to assess the extent to which different constructs actually have a lower correlation compared to the correlation between indicators within the same construct. A good HTMT recommendation has a value of 0.90 or below. Table 3 shows that the HTMT ratio according to the criteria.

Table 3. The HTMT test results

	APC	AS	ATB	CIU	SE	SVQ	USAT
APC	0						
AS	0.845						
ATB	0.853	0.852					
CIU	0.647	0.78	0.897				
SE	0.81	0.839	0.754	0.644			
SVQ	0.687	0.889	0.735	0.685	0.844		
USAT	0.82	0.824	0.829	0.632	0.859	0852	0

3.3. Structural model

In the context of structural equation modeling, regression analysis and goodness-of-fit tests are carried out to assess the suitability of the relationship patterns between variables. The structural model testing is used to test hypotheses and evaluate the relationship between constructs, can be seen in Table 4.

Table 4. The hypothesis testing results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics	P values	Description
H1: SVQ → USAT	0.633	0.624	0.105	6.038	0	Accepted
H2: SE → ATB	0.612	0.622	0.052	11.721	0	Accepted
H3: USAT → CIU	0.206	0.105	0.155	0.388	0	Accepted
H4: ATB → CIU	0.573	0.578	0.118	4.863	0	Accepted
H5: CIU → APC	0.556	0.563	0.071	7.814	0	Accepted
H6: CIU → AS	0.659	0.664	0.056	11.791	0	Accepted

This study utilizes t-statistics and p-values to measure the significance level of the model. The t-value used is 1.96 (at a 5%) and the p-value is less than 0.05, which is considered. The test results indicate that hypotheses have relationship (probability of error) at level (p or sig). The distribution of error probabilities (sig) is divided into three groups. First, if $p < 0.01$, the correlation or difference is considered highly significant, and the hypothesis is accepted. Secondly, if $p < 0{,}050$ (between 0,011 – 0,050), the hypothesis is considered significant and accepted. Third, if $p > 0{,}05$, the hypothesis is considered not significant and is rejected.

Mediation testing in statistical analysis to understand the independent variable (X) influences the dependent (Y) through one or more intermediaries called mediators (M). Significance is carried out through bootstrapping on a variance-based partial least squares equation. This stage aims to determine whether the effects of the two variables will have an impact on the proposed model. The calculation results can be seen in Table 5.

Table 5. Mediation testing

Paths	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics
ATB → CIU → APC	0.319	0.325	0.078	4.09
SE → ATB → CIU → APC	0.195	0.203	0.055	3.529
USAT → CIU →APC	-0.033	-0.026	0.087	0.384
SVQ → USAT →CIU →APC	-0.021	-0.015	0.056	0.381
ATB → CIU →AS	0.378	0.384	0.088	4.311
SE → ATB → CIU → AS	0.231	0.24	0.062	3.753
USAT → CIU →AS	-0.04	-0.035	0.104	0.381
SVQ → USAT →CIU →AS	-0.025	-0.02	0.065	0.384
SE → ATB → CIU	0.351	0.359	0.08	4.389
SVQ → USAT → CIU	-0.038	-0.03	0.097	0.391

4 DISCUSSION

The results of the analysis show that the average perception assessment of e-learning system users for each attribute can be vary from high to low. Approaches related to the measured variables and the impact of information system success on perceived academic performance and correct use of the system were considered. The success of a multidimensional digital application is more comprehensive based on the intention to use continuously and sustainably, with different level of success depending on various determinants according to needs [8]. The interpretation of the mediation test results in Table 5 is explained in each construct below.

SVQ is the level of satisfaction users feel with the services provided by the organization. The determining factor in maintaining and improving quality is by understanding user needs and expectations. This construct measures the attributes of facilities and appearance, accuracy, appropriate attention, confidence and concern. The survey results showed that the good category, through mediation testing, obtained an average value of 0.058 for user sustainability and academic performance. Meanwhile, the lowest attribute is still in the good category due to the accuracy of the data. Enjoyment systems have a significant impact on technology adoption, retention, and satisfaction. Users tend to return to applications that provide a pleasant experience, influencing and attracting more new users. Satisfaction is crucial for the long-term success of an information technology. The main indicator in evaluating the success of the system reflects how well the experience meets needs and expectations, and can recommend it to others.

Attitude toward behavior is the main factor that influences a person's intention to carry out a behavior, along with subjective norms and perceived behavioral control. Continuous intention use (CIU) is a concept in information systems regarding the user's ongoing intention or desire to continue using technology after initial use. Influencing factors include satisfaction, perceived value, experience, habits, benefits, trust, ease of using digital devices and social influence [36]. Mediation testing obtained an average value of 0.359 for the system attributes enjoyment and attitude toward behavior. Perceived academic performance is the

belief of system users in the context of academic performance. This perception is influenced by motivation, decisions and academic achievement goals. Actual system use refers to the measurable and observable use of application systems and technological devices [37]. The results of the research recommend that the e-learning system built should emphasize both external and internal aspects of user perception to enhance information system user satisfaction. This approach can provide direct simulation and benefits.

5 CONCLUSION

This study contributes to measuring the success of information systems and the impact on user satisfaction. The proposed research model demonstrates a significant and positive relationship with users' sustainability intentions and behavioral attitudes. The results of the analysis show that the proposed model's suitability aligns with the observed pattern of construct relationships. To assess the model's appropriateness, this study uses coefficients of determination (R^2), effect size (F^2), and relevant predictive measure (Q^2). The R^2 value is interpreted as follows: 0.19 indicates a low level, 0.33 a medium level and 0.67 a high level. The F^2 value is categorized as 0.02 for low, 0.15 for medium and 0.35 for high. Meanwhile, the heterotrait-monotrait ratio is analysed to determine the extent to which different constructs have lower correlations compared to indicators within the same construct. A recommended HTMT value is 0.90 or below. The research findings indicate that the HTMT ratio ranges 0.68 – 0.889, meeting the criteria. Further research is needed to explore additional variables that may influence the relationship between SVQ and continuous intention.

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