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The Investigating of Computer Self-Efficacy on Learning Management System Use

Zulherman, Khoerul Umam*, Wati Sukmawati, Irdalisa, Supriansyah

***Abstract*—The development of learning-supporting technologies at the university is very diverse, with the benefits and ease of providing flexible and effective learning opportunities offline and online. Examples of Internet-based technology, such as learning management systems (LMS), have been widely used in advanced countries. However, developed countries such as Indonesia are still few to use LMS as a media support for learning at the university. Many factors support and also inhibit the successful use of LMS. Therefore, the aim of the research was to evaluate the factors affecting the successful use of LMS at the university using the Delone McLean model approach. (D&M). This model was modified and added a broad factor called Computer Self-Efficacy (CSE), which was tested with a questionnaire against 311 undergraduate students. From the test results, six hypotheses found that four was supported and two was rejected, so we concluded that this study had contributed to develop modifying the D&M model.**

***Index Terms*—learning management system, delone mclean model, computer self-efficacy**

I. Introduction

Internet technology affects education, especially digital learning. Online university learning affects teachers and students. [1]. Technology-based learning is also becoming more popular in developing countries, particularly in Southeast Asia.

Internal and external forces affect technology's development. In developing countries, LMS-based learning technology is popular [2]. The users of this LMS are mostly university lecturers and students. In evaluating the implementation, it will be seen that user satisfaction is an indicator of the success of the technology implementation. Therefore, using the model theory approach as the basis for measuring this success is necessary.

User characteristics such as self-efficacy are an interesting example of how each individual has distinct beliefs. Self-efficacy refers to a person's belief in their ability to complete tasks in order to increase work performance [3]. Previous study has shown that self-efficacy is frequently employed in different user technology subjects, but few have used it to evaluate the implementation of LMS technology.

This study tries to determine the factors that influence student satisfaction with the LMS at their university. Therefore, we employ the Delone McLean model theory approach, to which we add the computer self-efficacy (CSE) factor to assess the user's confidence in using the LMS, which has an impact on the likelihood of performance improvement.

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II. Literature Review

The Technology Acceptance Model (TAM) model by Davis (1989) and Unified Technology Acceptance and Use of Technology (UTAUT) by Venkatesh (2003) have been used in many LMS acceptance studies. According to the Delone McLean model (2003), technology users' behavioral attitudes are measured using internal and external elements using the TAM and UTAUT models. TAM and UTAUT models' flaws are restricted to user behavior, therefore they cannot evaluate technology utilization.

In the theory of this D&M model, the dimension of the information system (IS), which is the use of the system and satisfaction [4], is frequently employed because such a model has been extensively utilized in previous research. In previous research on the acceptance of technology, the most prevalent TAM and UTAUT models were used, and a variety of conceptual models were developed. Nonetheless, the UTAUT model is restricted to user gratification and the use of the system as an intervening variable against individual impact. Therefore, we endeavor to add another variable.

In previous research, the Delone McLean model was proposed because it was deemed superior to the TAM model and the UTAUT model due to its six-factor complexity: system quality, information quality, service quality, user satisfaction, system utilization, and institutional impact. The advantages of the Delone McLean model are therefore the most advantageous. In the sphere of education, developing nations such as Indonesia, Malaysia, and Thailand have adopted numerous technologies, such as learning management systems (LMS). The purpose of this study is to identify the significant factors that influence the use of university LMS in relation to student satisfaction, using LMS as the object and extending the Delone McLean model by testing the self-efficacy factor. Incorporating computer self-efficacy (CSE) variables into the conceptual framework was a modification we made following a review of the best available literature.

A. Information Qualtity (IQ) and Student Satisfaction (SS)

Information systems function to provide information to users. The quality of system information can be evaluated using measures such as timeliness, accuracy, completeness, consistency, and relevance [5]. If the level of information quality is higher, it will increase user satisfaction with the system [6]. According to Al-Samarraie (2018), to identify the quality of information, it will be seen how much the role of influence on student user satisfaction [7]. Furthermore, past

research has shown that information quality has a considerable beneficial influence on student LMS satisfaction [8]. Therefore, to investigate whether information quality affects student satisfaction with the university LMS, the first hypothesis states:
H1: Information quality (IQ) has a significant positive effect on student satisfaction (SS)

B. System Quality (SQ) and Student Satisfaction (SS)

System quality refers to the performance of the system as perceived by users [9]. According to Delone and Mclean (2003), user satisfaction, technical achievement, and organizational and individual impact are all good indicators of system quality. Specifically, system quality factors consist of usability, responsiveness, availability, adaptability, and dependability [5]. A number of studies have found that system quality has a significant influence on student satisfaction [8]–[12]. The more satisfied students are with the LMS, the more accessible and reliable they believe it to be. The following is the second hypothesis:
H2: System quality (SQ) has a significant positive effect on student satisfaction (SS)

C. Service Quality (SeQ) and Student Satisfaction (SS)

According to Noorman bin Masrek (2007), service quality is the overall quantity of support provided by a service provider. [13]. In recent studies, it refers to service characteristics including responsiveness, availability, and efficacy. Many studies have linked service quality to student satisfaction. Service quality predicts student satisfaction, according to other research [11]–[14]. However, service quality does not affect student satisfaction. Based on these results, evaluating universities' student satisfaction services. The third hypothesis:
H3: Service quality (SeQ) has a significant positive effect on Student Satisfaction (SS).

D. Computer Self-Efficacy (CSE) and Student Satisfaction (SS)

Self-efficacy is an individual's belief in his or her ability to finish a task and create a set degree of performance with the skills he or she possesses, so self-efficacy beliefs impact how people motivate themselves and behave [15].

The original definition of self-efficacy encompassed a person's confidence in his or her capacity to use skills, such as computers and information technology. Later researchers in management information systems (MIS) introduced computer self-efficacy (CSE) as an essential MIS research construct. Compeau and Higgins (1995) define it as "an individual's perception of his or her ability to perform a task using a computer" [16]. Computer self-efficacy is positively associated with e-learning outcomes, as measured by average test scores in e-learning [17]. Self-efficacy and perceived system utility are positively associated with perceived content value, course satisfaction, and course performance among E-learning learners [18].

Other studies have investigated the attitudes and behaviors that impact the utilization of course management systems. Self-efficacy and the intent to use e-learning systems were found to have a significant positive correlation. Significant predictors of individuals' intention to continue using web-based learning were computer self-efficacy, achievement value, utility value, and intrinsic value [19]. Self-efficacy, learner satisfaction, and perceived usefulness were all found to have significant positive connections with one another [20]. Therefore, we hypothesize as follows:
H4: Computer self-efficacy (CSE) has a significant positive effect on student satisfaction (SS)
H5: Computer self-efficacy (CSE) has a significant positive effect on LMS usage (LU)

E. Student Satisfaction (SS) and LMS Usage (LU)

There are many previous studies that examined the relationship between user satisfaction and individual impact [21], [22], and user satisfaction and learning outcomes [23]. These studies consistently demonstrate a positive correlation between user satisfaction and learning outcomes' efficacy. We hypothesize as follows:
H6: Student satisfaction (SS) has a positive effect on LMS usage (LU)

III. METHOD

A. Participants

The study was conducted among 311 undergraduate students at two private Islamic universities in Jakarta, Indonesia. The age of the responding students was between 18 and 24 years old, with a ratio of 36% male students and 64% female students, with random sampling. Respondents have answered the questionnaire distributed through a Google Form link from May to July 2023.

B. Data Collection

In this section, students shared their LMS learning experiences. This study's major goal is to assess how computer self-efficacy (CSE) affects LMS utilization and student happiness. The LMS's performance can be assessed and virtual learning improved using the research findings.

In our research, we worked with the university to help distribute the questionnaires to the students, and it only took 10–15 minutes for the respondents to complete the questionnaires. A total of 311 respondents met the criteria, as there were repeat respondents. The questionnaire used a Likert scale between 1 (strongly disagree) and 5 (strongly agree) to measure 21 items in the model constructs.

C. Measures

In this study, data analysis was carried out using the structural equation modeling (SEM) method with the Smart PLS version 3.0 program. [28]. PLS is a well-known method for evaluating structural model path coefficients that has gained popularity in marketing research in general over the last decade due to its ability to model latent structures under irregularity and small to medium sample sizes [29]. However, research employing PLS has been conducted and shown to be an appropriate component of this study. In addition, the PLS algorithm mechanism was used to evaluate the set, weights, and path coefficients and determine the significance of the hypothesis using the bootstrap method (5000 samples). This measurement model is accurate and

effective for empirical validation protocols [30].

IV. RESULTS

A. Measurement model evaluation

In this section, the evaluation of the measurement model (outer model) is carried out to determine the relationship between the latent variable and the indicators being studied and explain each indicator related to the latent variable. This is related to the validity and reliability of the instruments used [24]. The instruments' validity was evaluated using discriminant and convergent validity. On the basis of Table 1, the instruments' validity was evaluated using discriminant validity and convergent validity.

TABLE I: MEASUREMENT CONSTRUCTS

Construct	Item	Statement
Informaton Quality	IQ1	I can obtain accurate information from LMS.
	IQ2	The LMS can provide me with the necessary information to complete my duties.
	IQ3	LMS can provide updated task-related information.
	IQ4	The LMS can provide me with up-to-date task information.
System Quality	SQ1	The LMS features an intuitive user interface.
	SQ2	The LMS provides time and location flexibility.
	SQ3	The LMS contains effective communication language.
	SQ4	LMS is readily accessible whenever I need to use it.
Service Quality	SeQ1	Training on the LMS's operation is sufficient.
	SeQ2	Multiple channels are available for communicating with the technicians.
	SeQ3	The provided training can enhance my ability to utilize LMS.
	SeQ4	In general, the university provides sufficient support for LMS usage.
Computer Self-Efficacy	CSE1	I'm comfortable using a web browser.
	CSE2	I m confident completing tests online.
	CSE3	I'm comfortable uploading/downloading files.
Students Satisfaction	SS1	The LMS applications have met my expectations.
	SS2	The LMS application is of good quality.
	SS3	The LMS application meets my requirements.
LMS Usage	LU1	Utilizing LMS is a wise decision.
	LU2	Working with the LMS is enjoyable.
	LU3	I enjoy working with LMS.

B. Construct Reliability, Convergent Validity, Discriminant Validity

Results of previous studies [25], evaluated by evaluating the loading factor value of each indicator in the displayed structure.

According to table 2, convergent validity is implied if all indicators have loading factor values that satisfy the validity requirements and the value is more than 0.70 (>0.70). Both the IQ1 and CSE3 indicator loadings are below the threshold value (> 0.70), necessitating their elimination. This is consistent with the claim made by Ali (2018) that each indicator is a good one if its loading factor is more than 0.70 [26].

After analyzing the loading factor results, we move on to the interpretation of composite reliability (CR). A limit value > 0.6 is appropriate, while a value > 0.7 is acceptable. Another indicator of convergent validity is the average occurrence (AVE) value. The degree of variation or set of manifest variables that a latent construct may have is defined by the AVE value. As a result, the manifest variable will be more fully represented in its latent construct the wider the variance or range of manifest variables that a latent partner can incorporate.

AVE is recommended for use when evaluating convergent validity parameters. A minimum AVE of at least 0.5 indicates that convergent validity is a reliable indicator. That is, on average, the latent variable can explain more than half of the predictor variance. The AVE value is derived from the sum of the loading factor's squares, minus the error.

TABLE II: MEASUREMENT MODEL

Construct	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Informaton Quality	IQ2	0.773	0.888	0.727
	IQ3	0.887		
	IQ4	0.892		
System Quality	SQ1	0.831	0.872	0.630
	SQ2	0.736		
	SQ3	0.812		
	SQ4	0.793		
Service Quality	SeQ1	0.759	0.890	0.670
	SeQ2	0.804		
	SeQ3	0.872		
	SeQ4	0.836		
Computer Self-Efficacy	CSE1	0.917	0.912	0.838
	CSE2	0.913		
Students Satisfaction	SS1	0.904	0.917	0.787
	SS2	0.890		
	SS3	0.867		
LMS Usage	LU1	0.752	0.890	0.731
	LU2	0.907		
	LU3	0.897		

The composite reliability and AVE values presented in table 2 indicate that the values exceed the resultant AVE

value for each latent variable is greater than 0.5. This finding indicates that the reliability of these two factors is high.

The discriminant validity of the heterotrait-monotrait ratio (HTMT) was used to validate the measurement model. A value of 0.90 has been used in previous studies for the maximum threshold of the HTMT ratio construct [27], [28]. With respect to this threshold value, the results given in Table 3 show the validation of the measurement model.

TABLE III: DISCRIMINANT VALIDITY OF HETEROTRAIT-MONOTRAIT RATIO (HTMT)

Construct	Computer Self Efficacy_	Information Quality	LMS Usage	Service Quality	Student Satisfaction	System Quality
Computer Self Efficacy						
Information Quality	0.772					
LMS Usage	0.904	0.902				
Service Quality	0.916	0.864	1.092			
Student Satisfaction	0.632	0.976	0.836	0.729		
System Quality	0.795	0.833	0.959	0.832	0.973	

C. Structural model evaluation

The second step of the two-step statistical strategy to modeling the PLS-SEM model is to build the structural model after establishing the measurement model. The structural model includes the path coefficients and the explained variance. The regression coefficients (or beta values) have been refined using a bootstrapping approach by generating bootstrap standard errors after extracting 5000 random sub-samples with replacement from one original sample. There must be 5000 iterations of the method repeated continuously [27]. These subsamples have then been used to estimate the PLS path model.

The results relating to the significance of the paths corresponding to hypotheses H1, H2, H3, H4, H5, and H6 are tabulated in Table 4. It can be seen that the 5% and 95% confidence interval values obtained for these paths indicate that hypotheses H1, H2, H5, and H6 are supported. However, H3 and H4 are rejected because the confidence interval values are below zero with p values 0.05 for one-tailed testing.

TABLE IV: HYPOTHESIS TESTING

Hypothesis	Path	Std.Beta	Std.Eror	T-value	Bias	Confidence Interval		Decision
						5.0%	95.0%	
H1	Information Quality -> Student Satisfaction	0.581	0.051	11.406	0.002	0.490	0.658	Supported
H2	System Quality -> Student Satisfaction	0.586	0.050	11.824	-0.003	0.506	0.668	Supported
H3	Service Quality -> Student Satisfaction	-0.087	0.045	1.933	0.002	-0.162	-0.012	Rejected
H4	Computer Self Efficacy -> Student Satisfaction	-0.130	0.042	3.088	0.001	-0.198	-0.060	Rejected
H5	Computer Self Efficacy -> LMS Usage	0.501	0.052	9.570	-0.001	0.416	0.588	Supported
H6	Student Satisfaction -> LMS Usage	0.441	0.057	7.788	-0.000	0.344	0.529	Supported

Note: p <0.05 (1-tailed test)

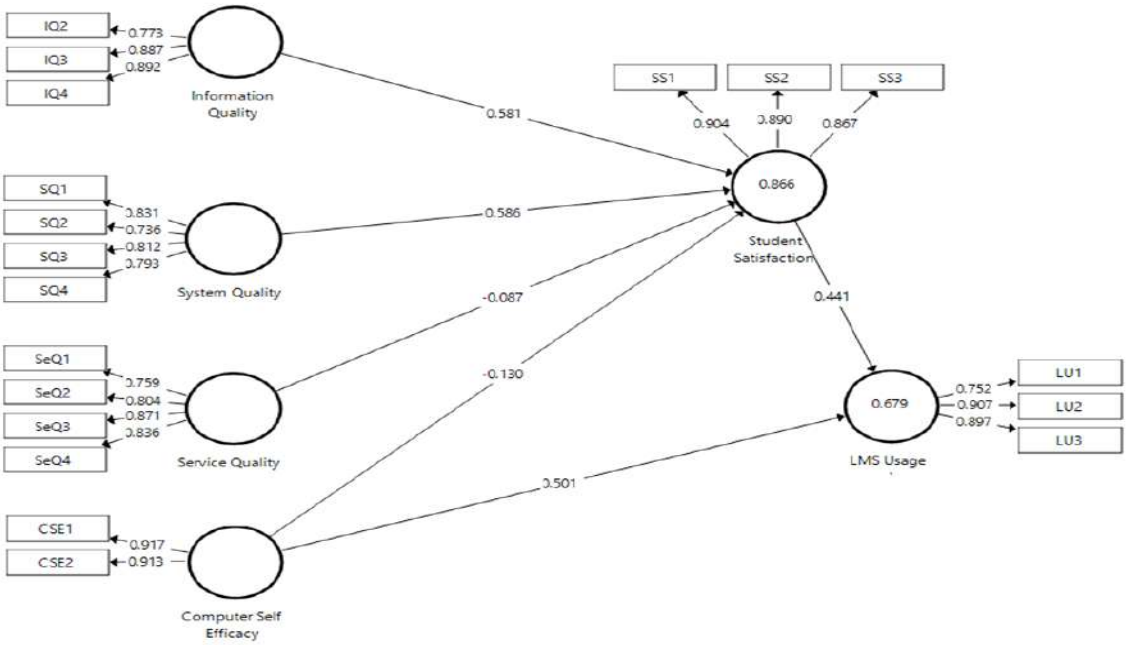

Fig. 1. Path analysis

The coefficient of determination (R square) is commonly used to assess the model's predictive capacity and structural model. It is the squared correlation between an endogenous building's actual and expected values. The coefficient represents the exogenous variables' cumulative effect on the latent endogenous variables. It is difficult to develop an exact rule of thumb for R Square because its range is 0-1, with greater values indicating higher prediction points. This is due to the fact that the value of student satisfaction and LMS usage is dependent on the model's complexity and the research discipline.

TABLE V: R SQUARE

	R Square	R Square Adjusted
LMS Usage	0.679	0.677
Student Satisfaction	0.866	0.864

In figure 1 and table 5, the coefficient of determination (R2) confirms the research model. This coefficient measures the predictive ability of the model and is computed as the squared correlation between the actual and predicted values of a specific endogenous construct [29]. Additionally, the R2 value quantifies the proportion of variance explained by each model construct. In general, R2 values of 0.75, 0.50, and 0.25 for endogenous constructs can be described as substantial, moderate, and insignificant, respectively [30].

In Figure 1 and Table V, the R2 values of the dependent constructs, student satisfaction and LMS usage, are shown. The model explains 86.6% of the variance in student satisfaction and 67.9% of the variance in LMS usage. The R2 values of the two dependent constructs (student satisfaction and LMS usage) are 0.866 and 0.679, respectively, which are considered sufficient [29]. Figure 1 also depicts the structural model with path coefficients for each path (hypothesized relationship) with a significant level and coefficient of determination (R2).

V. DISCUSSION

To assess the accuracy of the PLS-SEM-derived measurement model. Tests of model validity and reliability demonstrate that the defined constructs are reliable and valid. In the meantime, the structural model's validation demonstrates that the derived model is not only a good fit, but also has an exceptional predictive relevance.

Based on the results of the established structural model with respect to direct effects, hypotheses H1, H2, H5, and H6 are supported. However, H3 and H4 were rejected. The results prove that information quality and system quality have a direct positive effect on student satisfaction. Computer self-efficacy and student satisfaction also have a positive effect on LMS usage.

For testing the first hypothesis (H1), the value obtained is above zero at a confidence interval of 5% (0.490) and 95% (0.658), so the results are supported. The positive effect of information quality on student satisfaction is an impact that occurs with the use of university LMS. Previous studies by Alkhateeb and Abdall (2021) prove the same thing [31]. Likewise, the study by Ohliati and Abbas (2019) found that information quality affects student satisfaction [32]. However, the results of a study by Togar (2021) show that information quality has no effect on student satisfaction due to internal user factors [33].

For testing the second hypothesis (H2), the value above zero is obtained at a confidence interval of 5% (0.506) and 95% (0.668), so the results are supported. System quality was found to have an influence on student satisfaction. The same results were obtained by Ghazal (2018), showing that a good system quality of LMS technology has a positive effect on user satisfaction [10]. In other studies, it is also known that system quality affects student satisfaction [34]. But different results were found by Mtebe and Raisamo (2014), who found that system quality has no effect on student satisfaction [35]. Quality feasibility factors largely determine user satisfaction outcomes.

For testing the third hypothesis (H3), the value above zero is obtained at a confidence interval of 5% (-0.612) and 95% (-0.012), so the results are rejected. According to Mtebe and Raisamo (2014), service quality has no effect on user satisfaction because user knowledge of using the LMS is not maximized [35]. The same thing was also found by Ghazal (2018): the limited menu of supporting services made users dissatisfied with using the LMS. However, according to Alzahrani and Seth (2021), it turns out that student satisfaction using LMS technology is determined by the skill factor of using LMS technology. Generally, in some universities, holding training for these users is important. The same thing was shown by Ohliati & Abbas (2019): a person's knowledge attitude affects satisfaction with using technology [32].

For testing the fourth hypothesis (H4), the value above zero is obtained at a confidence interval of 5% (-0.198) and 95% (-0.060), so the results are rejected. According to Ghazal (2018), computer self-efficacy affects student satisfaction using the LMS due to the ease of communication access services with operators and training to use the LMS, thus increasing student skills to operate the LMS [14], [36]. The same thing was also found by Prifti (2022) and Aldholay (2018): the factors of understanding and skills in mastering technology directly affect one's behavior in using the LMS, which has an impact on the level of satisfaction [37], [38]. However, according to Eom (2014), one's self-efficacy factor has no effect on satisfaction using the LMS [39].

For testing the fifth hypothesis (H5), the value above zero is obtained at a confidence interval of 5% (0.418) and 95% (0.588), so the results are supported. The result is that computer self-efficacy (CSE) affects the use of LMS. In the findings by Aldholay (2018), students' confidence in using the LMS determines their continued use of the LMS [40].

For testing the sixth hypothesis (H6), the value above zero is obtained at a confidence interval of 5% (0.344) and 95% (0.529), so the results are supported. User satisfaction affects the use of LMS. According to Aldholay (2020), in online learning, learner satisfaction determines the continued use of the LMS [37], [41].

VI. Conclusion

Based on the literature review and the findings of the research conducted, we see that there are many factors that influence learner satisfaction with using an LMS. From the direct testing of six hypotheses, it is evident that four hypotheses are supported. The results prove that information quality, system quality, and quality have an effect on student satisfaction. While CSE and satisfaction also affect the use of LMS. We conclude that this research was successful. However, the rejected results also need further study to prove the impact of service quality and CSE on student satisfaction.

Conflict of Interest

This article's authors report no conflicts of interest.

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The Investigating of Computer Self-Efficacy on Learning Management System Use

***Abstract*—The development of learning-supporting technologies at the university is very diverse, with the benefits and ease of providing flexible and effective learning opportunities offline and online. Examples of Internet-based technology, such as learning management systems (LMS), have been widely used in advanced countries. However, developed countries such as Indonesia are still few to use LMS as a media support for learning at the university. Many factors support and also inhibit the successful use of LMS. Therefore, the aim of the research was to evaluate the factors affecting the successful use of LMS at the university using the Delone McLean model approach. (D&M). This model was modified and added a broad factor called Computer Self-Efficacy (CSE), which was tested with a questionnaire against 311 undergraduate students. From the test results, six hypotheses found that four was supported and two was rejected, so we concluded that this study had contributed to develop modifying the D&M model.**

***Index Terms*—learning management system, delone mclean model, computer self-efficacy**

I. Introduction

Internet technology affects education, especially digital learning. Online university learning affects teachers and students. [1]. Technology-based learning is also becoming more popular in developing countries, particularly in Southeast Asia.

Internal and external forces affect technology's development. In developing countries, LMS-based learning technology is popular [2]. The users of this LMS are mostly university lecturers and students. In evaluating the implementation, it will be seen that user satisfaction is an indicator of the success of the technology implementation. Therefore, using the model theory approach as the basis for measuring this success is necessary.

User characteristics such as self-efficacy are an interesting example of how each individual has distinct beliefs. Self-efficacy refers to a person's belief in their ability to complete tasks in order to increase work performance [3]. Previous study has shown that self-efficacy is frequently employed in different user technology subjects, but few have used it to evaluate the implementation of LMS technology.

This study tries to determine the factors that influence student satisfaction with the LMS at their university. Therefore, we employ the Delone McLean model theory approach, to which we add the computer self-efficacy (CSE) factor to assess the user's confidence in using the LMS, which has an impact on the likelihood of performance improvement.

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II. Literature Review

The Technology Acceptance Model (TAM) model by Davis (1989) and Unified Technology Acceptance and Use of Technology (UTAUT) by Venkatesh (2003) have been used in many LMS acceptance studies. According to the Delone McLean model (2003), technology users' behavioral attitudes are measured using internal and external elements using the TAM and UTAUT models. TAM and UTAUT models' flaws are restricted to user behavior, therefore they cannot evaluate technology utilization.

In the theory of this D&M model, the dimension of the information system (IS), which is the use of the system and satisfaction [4], is frequently employed because such a model has been extensively utilized in previous research. In previous research on the acceptance of technology, the most prevalent TAM and UTAUT models were used, and a variety of conceptual models were developed. Nonetheless, the UTAUT model is restricted to user gratification and the use of the system as an intervening variable against individual impact. Therefore, we endeavor to add another variable.

In previous research, the Delone McLean model was proposed because it was deemed superior to the TAM model and the UTAUT model due to its six-factor complexity: system quality, information quality, service quality, user satisfaction, system utilization, and institutional impact. The advantages of the Delone McLean model are therefore the most advantageous. In the sphere of education, developing nations such as Indonesia, Malaysia, and Thailand have adopted numerous technologies, such as learning management systems (LMS). The purpose of this study is to identify the significant factors that influence the use of university LMS in relation to student satisfaction, using LMS as the object and extending the Delone McLean model by testing the self-efficacy factor. Incorporating computer self-efficacy (CSE) variables into the conceptual framework was a modification we made following a review of the best available literature.

A. Information Quality (IQ) and Student Satisfaction (SS)

Information systems function to provide information to users. The quality of system information can be evaluated using measures such as timeliness, accuracy, completeness, consistency, and relevance [5]. If the level of information quality is higher, it will increase user satisfaction with the system [6]. According to Al-Samarraie (2018), to identify the quality of information, it will be seen how much the role of influence on student user satisfaction [7]. Furthermore, past research has shown that information quality has a considerable beneficial influence on student LMS satisfaction [8]. Therefore, to investigate whether

information quality affects student satisfaction with the university LMS, the first hypothesis states:
H1: Information quality (IQ) has a significant positive effect on student satisfaction (SS)

B. System Quality (SQ) and Student Satisfaction (SS)

System quality refers to the performance of the system as perceived by users [9]. According to Delone and Mclean (2003), user satisfaction, technical achievement, and organizational and individual impact are all good indicators of system quality. Specifically, system quality factors consist of usability, responsiveness, availability, adaptability, and dependability [5]. A number of studies have found that system quality has a significant influence on student satisfaction [8]–[12]. The more satisfied students are with the LMS, the more accessible and reliable they believe it to be. The following is the second hypothesis:
H2: System quality (SQ) has a significant positive effect on student satisfaction (SS)

C. Service Quality (SeQ) and Student Satisfaction (SS)

According to Noorman bin Masrek (2007), service quality is the overall quantity of support provided by a service provider. [13]. In recent studies, it refers to service characteristics including responsiveness, availability, and efficacy. Many studies have linked service quality to student satisfaction. Service quality predicts student satisfaction, according to other research [11]–[14]. However, service quality does not affect student satisfaction. Based on these results, evaluating universities' student satisfaction services. The third hypothesis:
H3: Service quality (SeQ) has a significant positive effect on Student Satisfaction (SS).

D. Computer Self-Efficacy (CSE) and Student Satisfaction (SS)

Self-efficacy is an individual's belief in his or her ability to finish a task and create a set degree of performance with the skills he or she possesses, so self-efficacy beliefs impact how people motivate themselves and behave [15].

The original definition of self-efficacy encompassed a person's confidence in his or her capacity to use skills, such as computers and information technology. Later researchers in management information systems (MIS) introduced computer self-efficacy (CSE) as an essential MIS research construct. Compeau and Higgins (1995) define it as "an individual's perception of his or her ability to perform a task using a computer" [16]. Computer self-efficacy is positively associated with e-learning outcomes, as measured by average test scores in e-learning [17]. Self-efficacy and perceived system utility are positively associated with perceived content value, course satisfaction, and course performance among E-learning learners [18].

Other studies have investigated the attitudes and behaviors that impact the utilization of course management systems. Self-efficacy and the intent to use e-learning systems were found to have a significant positive correlation. Significant predictors of individuals' intention to continue using web-based learning were computer self-efficacy, achievement value, utility value, and intrinsic value [19]. Self-efficacy, learner satisfaction, and perceived usefulness were all found to have significant positive connections with one another [20]. Therefore, we hypothesize as follows:
H4: Computer self-efficacy (CSE) has a significant positive effect on student satisfaction (SS)
H5: Computer self-efficacy (CSE) has a significant positive effect on LMS usage (LU)

E. Student Satisfaction (SS) and LMS Usage (LU)

There are many previous studies that examined the relationship between user satisfaction and individual impact [21], [22], and user satisfaction and learning outcomes [23]. These studies consistently demonstrate a positive correlation between user satisfaction and learning outcomes' efficacy. We hypothesize as follows:
H6: Student satisfaction (SS) has a positive effect on LMS usage (LU)

III. METHOD

A. Participants

The study was conducted among 311 undergraduate students at two private Islamic universities in Jakarta, Indonesia. The age of the responding students was between 18 and 24 years old, with a ratio of 36% male students and 64% female students, with random sampling. Respondents have answered the questionnaire distributed through a Google Form link from May to July 2023.

B. Data Collection

In this section, students shared their LMS learning experiences. This study's major goal is to assess how computer self-efficacy (CSE) affects LMS utilization and student happiness. The LMS's performance can be assessed and virtual learning improved using the research findings.

In our research, we worked with the university to help distribute the questionnaires to the students, and it only took 10–15 minutes for the respondents to complete the questionnaires. A total of 311 respondents met the criteria, as there were repeat respondents. The questionnaire used a Likert scale between 1 (strongly disagree) and 5 (strongly agree) to measure 21 items in the model constructs.

C. Measures

In this study, data analysis was carried out using the structural equation modeling (SEM) method with the Smart PLS version 3.0 program. [28]. PLS is a well-known method for evaluating structural model path coefficients that has gained popularity in marketing research in general over the last decade due to its ability to model latent structures under irregularity and small to medium sample sizes [29]. However, research employing PLS has been conducted and shown to be an appropriate component of this study. In addition, the PLS algorithm mechanism was used to evaluate the set, weights, and path coefficients and determine the significance of the hypothesis using the bootstrap method (5000 samples). This measurement model is accurate and effective for empirical validation protocols [30].

IV. RESULTS

A. Measurement model evaluation

In this section, the evaluation of the measurement model (outer model) is carried out to determine the relationship between the latent variable and the indicators being studied and explain each indicator related to the latent variable. This is related to the validity and reliability of the instruments used [24]. The instruments' validity was evaluated using discriminant and convergent validity. On the basis of Table 1, the instruments' validity was evaluated using discriminant validity and convergent validity.

TABLE I: MEASUREMENT CONSTRUCTS

Construct	Item	Statement
Informaton Quality	IQ1	I can obtain accurate information from LMS.
	IQ2	The LMS can provide me with the necessary information to complete my duties.
	IQ3	LMS can provide updated task-related information.
	IQ4	The LMS can provide me with up-to-date task information.
System Quality	SQ1	The LMS features an intuitive user interface.
	SQ2	The LMS provides time and location flexibility.
	SQ3	The LMS contains effective communication language.
	SQ4	LMS is readily accessible whenever I need to use it.
Service Quality	SeQ1	Training on the LMS's operation is sufficient.
	SeQ2	Multiple channels are available for communicating with the technicians.
	SeQ3	The provided training can enhance my ability to utilize LMS.
	SeQ4	In general, the university provides sufficient support for LMS usage.
Computer Self-Efficacy	CSE1	I'm comfortable using a web browser.
	CSE2	I m confident completing tests online.
	CSE3	I'm comfortable uploading/downloading files.
Students Satisfaction	SS1	The LMS applications have met my expectations.
	SS2	The LMS application is of good quality.
	SS3	The LMS application meets my requirements.
LMS Usage	LU1	Utilizing LMS is a wise decision.
	LU2	Working with the LMS is enjoyable.
	LU3	I enjoy working with LMS.

B. Construct Reliability, Convergent Validity, Discriminant Validity

Results of previous studies [25], evaluated by evaluating the loading factor value of each indicator in the displayed structure.

According to table 2, convergent validity is implied if all indicators have loading factor values that satisfy the validity requirements and the value is more than 0.70 (>0.70). Both the IQ1 and CSE3 indicator loadings are below the threshold value (> 0.70), necessitating their elimination. This is consistent with the claim made by Ali (2018) that each indicator is a good one if its loading factor is more than 0.70 [26].

After analyzing the loading factor results, we move on to the interpretation of composite reliability (CR). A limit value > 0.6 is appropriate, while a value > 0.7 is acceptable. Another indicator of convergent validity is the average occurrence (AVE) value. The degree of variation or set of manifest variables that a latent construct may have is defined by the AVE value. As a result, the manifest variable will be more fully represented in its latent construct the wider the variance or range of manifest variables that a latent partner can incorporate.

AVE is recommended for use when evaluating convergent validity parameters. A minimum AVE of at least 0.5 indicates that convergent validity is a reliable indicator. That is, on average, the latent variable can explain more than half of the predictor variance. The AVE value is derived from the sum of the loading factor's squares, minus the error.

TABLE II: MEASUREMENT MODEL

Construct	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Informaton Quality	IQ2	0.773	0.888	0.727
	IQ3	0.887		
	IQ4	0.892		
System Quality	SQ1	0.831	0.872	0.630
	SQ2	0.736		
	SQ3	0.812		
	SQ4	0.793		
Service Quality	SeQ1	0.759	0.890	0.670
	SeQ2	0.804		
	SeQ3	0.872		
	SeQ4	0.836		
Computer Self-Efficacy	CSE1	0.917	0.912	0.838
	CSE2	0.913		
Students Satisfaction	SS1	0.904	0.917	0.787
	SS2	0.890		
	SS3	0.867		
LMS Usage	LU1	0.752	0.890	0.731
	LU2	0.907		
	LU3	0.897		

The composite reliability and AVE values presented in table 2 indicate that the values exceed the resultant AVE value for each latent variable is greater than 0.5. This finding

indicates that the reliability of these two factors is high.

The discriminant validity of the heterotrait-monotrait ratio (HTMT) was used to validate the measurement model. A value of 0.90 has been used in previous studies for the maximum threshold of the HTMT ratio construct [27], [28]. With respect to this threshold value, the results given in Table 3 show the validation of the measurement model.

TABLE III: DISCRIMINANT VALIDITY OF HETEROTRAIT-MONOTRAIT RATIO (HTMT)

Construct	Computer Self Efficacy_	Information Quality	LMS Usage	Service Quality	Student Satisfaction	System Quality
Computer Self Efficacy						
Information Quality	0.772					
LMS Usage	0.904	0.902				
Service Quality	0.916	0.864	1.092			
Student Satisfaction	0.632	0.976	0.836	0.729		
System Quality	0.795	0.833	0.959	0.832	0.973	

C. *Structural model evaluation*

The second step of the two-step statistical strategy to modeling the PLS-SEM model is to build the structural model after establishing the measurement model. The structural model includes the path coefficients and the explained variance. The regression coefficients (or beta values) have been refined using a bootstrapping approach by generating bootstrap standard errors after extracting 5000 random sub-samples with replacement from one original sample. There must be 5000 iterations of the method repeated continuously [27]. These subsamples have then been used to estimate the PLS path model.

The results relating to the significance of the paths corresponding to hypotheses H1, H2, H3, H4, H5, and H6 are tabulated in Table 4. It can be seen that the 5% and 95% confidence interval values obtained for these paths indicate that hypotheses H1, H2, H5, and H6 are supported. However, H3 and H4 are rejected because the confidence interval values are below zero with p values 0.05 for one-tailed testing.

TABLE IV: HYPOTHESIS TESTING

Hypothesis	Path	Std.Beta	Std.Eror	T-value	Bias	Confidence Interval		Decision
						5.0%	95.0%	
H1	Information Quality -> Student Satisfaction	0.581	0.051	11.406	0.002	0.490	0.658	Supported
H2	System Quality -> Student Satisfaction	0.586	0.050	11.824	-0.003	0.506	0.668	Supported
H3	Service Quality -> Student Satisfaction	-0.087	0.045	1.933	0.002	-0.162	-0.012	Rejected
H4	Computer Self Efficacy -> Student Satisfaction	-0.130	0.042	3.088	0.001	-0.198	-0.060	Rejected
H5	Computer Self Efficacy -> LMS Usage	0.501	0.052	9.570	-0.001	0.416	0.588	Supported
H6	Student Satisfaction -> LMS Usage	0.441	0.057	7.788	-0.000	0.344	0.529	Supported

Note: $p < 0.05$ (1-tailed test)

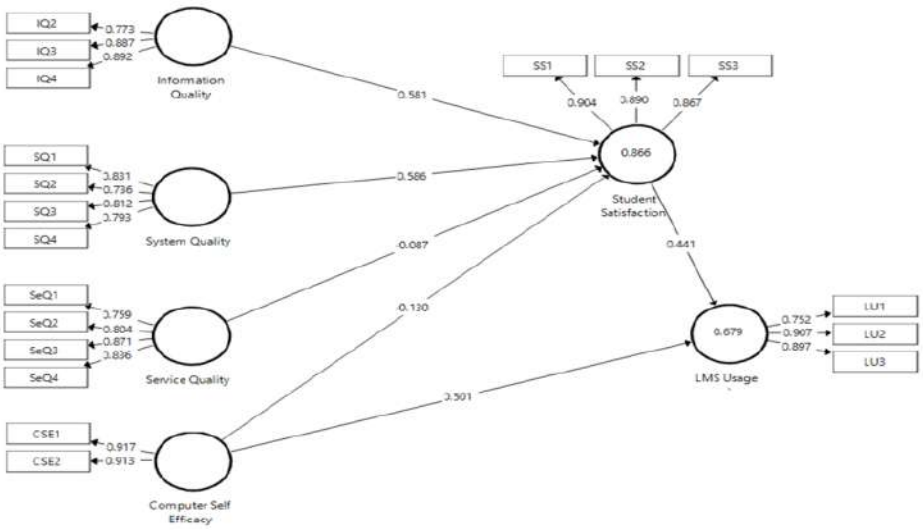

Fig. 1. Path analysis

The coefficient of determination (R square) is commonly used to assess the model's predictive capacity and structural model. It is the squared correlation between an endogenous building's actual and expected values. The coefficient represents the exogenous variables' cumulative effect on the latent endogenous variables. It is difficult to develop an exact rule of thumb for R Square because its range is 0-1, with greater values indicating higher prediction points. This is due to the fact that the value of student satisfaction and LMS usage is dependent on the model's complexity and the research discipline.

TABLE V: R SQUARE

	R Square	R Square Adjusted
LMS Usage	0.679	0.677
Student Satisfaction	0.866	0.864

In figure 1 and table 5, the coefficient of determination (R2) confirms the research model. This coefficient measures the predictive ability of the model and is computed as the squared correlation between the actual and predicted values of a specific endogenous construct [29]. Additionally, the R2 value quantifies the proportion of variance explained by each model construct. In general, R2 values of 0.75, 0.50, and 0.25 for endogenous constructs can be described as substantial, moderate, and insignificant, respectively [30].

In Figure 1 and Table V, the R2 values of the dependent constructs, student satisfaction and LMS usage, are shown. The model explains 86.6% of the variance in student satisfaction and 67.9% of the variance in LMS usage. The R2 values of the two dependent constructs (student satisfaction and LMS usage) are 0.866 and 0.679, respectively, which are considered sufficient [29]. Figure 1 also depicts the structural model with path coefficients for each path (hypothesized relationship) with a significant level and coefficient of determination (R2).

V. DISCUSSION

To assess the accuracy of the PLS-SEM-derived measurement model. Tests of model validity and reliability demonstrate that the defined constructs are reliable and valid. In the meantime, the structural model's validation demonstrates that the derived model is not only a good fit, but also has an exceptional predictive relevance.

Based on the results of the established structural model with respect to direct effects, hypotheses H1, H2, H5, and H6 are supported. However, H3 and H4 were rejected. The results prove that information quality and system quality have a direct positive effect on student satisfaction. Computer self-efficacy and student satisfaction also have a positive effect on LMS usage.

For testing the first hypothesis (H1), the value obtained is above zero at a confidence interval of 5% (0.490) and 95% (0.658), so the results are supported. The positive effect of information quality on student satisfaction is an impact that occurs with the use of university LMS. Previous studies by Alkhateeb and Abdall (2021) prove the same thing [31]. Likewise, the study by Ohliati and Abbas (2019) found that information quality affects student satisfaction [32]. However, the results of a study by Togar (2021) show that information quality has no effect on student satisfaction due to internal user factors [33].

For testing the second hypothesis (H2), the value above zero is obtained at a confidence interval of 5% (0.506) and 95% (0.668), so the results are supported. System quality was found to have an influence on student satisfaction. The same results were obtained by Ghazal (2018), showing that a good system quality of LMS technology has a positive effect on user satisfaction [10]. In other studies, it is also known that system quality affects student satisfaction [34]. But different results were found by Mtebe and Raisamo (2014), who found that system quality has no effect on student satisfaction [35]. Quality feasibility factors largely determine user satisfaction outcomes.

For testing the third hypothesis (H3), the value above zero is obtained at a confidence interval of 5% (-0.612) and 95% (-0.012), so the results are rejected. According to Mtebe and Raisamo (2014), service quality has no effect on user satisfaction because user knowledge of using the LMS is not maximized [35]. The same thing was also found by Ghazal (2018): the limited menu of supporting services made users dissatisfied with using the LMS. However, according to Alzahrani and Seth (2021), it turns out that student satisfaction using LMS technology is determined by the skill factor of using LMS technology. Generally, in some universities, holding training for these users is important. The same thing was shown by Ohliati & Abbas (2019): a person's knowledge attitude affects satisfaction with using technology [32].

For testing the fourth hypothesis (H4), the value above zero is obtained at a confidence interval of 5% (-0.198) and 95% (-0.060), so the results are rejected. According to Ghazal (2018), computer self-efficacy affects student satisfaction using the LMS due to the ease of communication access services with operators and training to use the LMS, thus increasing student skills to operate the LMS [14], [36]. The same thing was also found by Prifti (2022) and Aldholay (2018): the factors of understanding and skills in mastering technology directly affect one's behavior in using the LMS, which has an impact on the level of satisfaction [37], [38]. However, according to Eom (2014), one's self-efficacy factor has no effect on satisfaction using the LMS [39].

For testing the fifth hypothesis (H5), the value above zero is obtained at a confidence interval of 5% (0.418) and 95% (0.588), so the results are supported. The result is that computer self-efficacy (CSE) affects the use of LMS. In the findings by Aldholay (2018), students' confidence in using the LMS determines their continued use of the LMS [40].

For testing the sixth hypothesis (H6), the value above zero is obtained at a confidence interval of 5% (0.344) and 95% (0.529), so the results are supported. User satisfaction affects the use of LMS. According to Aldholay (2020), in online learning, learner satisfaction determines the continued use of the LMS [37], [41].

VI. Conclusion

Based on the literature review and the findings of the research conducted, we see that there are many factors that influence learner satisfaction with using an LMS. From the direct testing of six hypothe15s, it is evident that four hypotheses are supported. The results prove that information quality, system quality, and quality have an effect on student satisfaction. While CSE and satisfaction also affect the use of LMS. We conclude that this research was successful. 27wever, the rejected results also need further study to prove the impact of service quality and CSE on student satisfaction.

Conflict of Interest

This article's authors report no conflicts of interest.

Funding

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Acknowledgment

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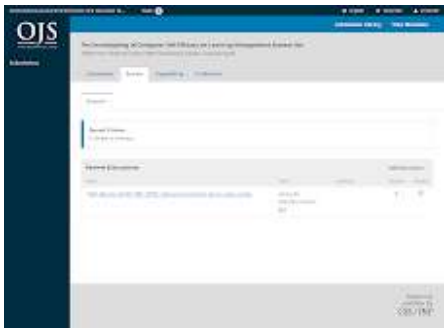

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Reviewer A:

Comments to Authors

The strength of the paper is on the modification of the model which promote new contribution to a body of knowledge along LMS.

To avoid superfluous words such as “The investigating of, I'd like to recommend that the title be recasted into: Computer Self-Efficacy on Learning Management System Use: From the lens of Undergraduate Students . The use of term, investigating of seemed syntactically incorrect.

There seems to be syntactical trap on the abstract part specifically in this sentence, "However, developed countries such as Indonesia are still few to use LMS as a media support for learning at the university.".. and the remaining sentences thereafter.
The abstract should clearly state the findings relevant to the purpose of the study.

In the intruduction part, it is suggested you to explain the contribution of the study.

Please check all references in the context. It is founded that some references are missed. For example: "The Technology Acceptance Model (TAM) model by Davis (1989) and Unified Technology Acceptance and Use of Technology (UTAUT) by Venkatesh (2003) have been used in many LMS acceptance studies,"; "According to the Delone McLean model (2003), technology users..." etc.

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Computer Self-efficacy on Using Learning Management System: From the Lens of Undergraduate Students

Khoerul Umam*, Zulherman, Wati Sukmawati, Irdalisa, and Supriansyah

Universitas Muhammadiyah Prof DR HAMKA, Indonesia
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Manuscript received June 11, 2023; revised July 21, 2023; accepted August 9, 2023

***Abstract*—The university's development of learning-supporting technology is diverse, with the benefits and ease of providing flexible and effective learning possibilities both offline and online. Learning Management Systems (LMS) are examples of Internet-based technology that are commonly employed in developed countries. However, developing countries such as Indonesia are still among the few that only employ LMS as media support for university study. Many factors both support and hinder the practical usage of LMS. As a result, the goal of the study was to assess the factors influencing the successful usage of LMS at the university using the Delone McLean model approach (D&M). This model was modified, and a broad factor called Computer Self-Efficacy (CSE) was introduced, which was tested using a questionnaire on 311 undergraduate students. Six hypotheses were tested, four of which were supported and two were rejected. Based on these findings, it concluded that this study had helped to modify the D&M model, which can improve the ability of students' services in online learning and encourage students' self-efficacy gradually.**

***Keywords*—Delone Mclean model, computer self-efficacy, learning management system**

I. Introduction

Internet technology, mainly digital learning, has an impact on education. Teachers and students are affected by online university learning [1]. Additionally, growing in popularity is technology-based education in emerging nations, notably in Southeast Asia.

Both internal and external causes influence technology development. LMS-based learning technology is common in developing nations [2]. Most of the users of LMS are university students and teachers. It will become clear from examining the implementation that user satisfaction shows how well the technology was implemented. As a result, the model theory method must serve as the foundation for evaluating this achievement.

Self-efficacy is a user trait that is a fascinating example of how everyone has different views. In order to improve job performance, a person must have self-efficacy, which is the belief in one's capacity to fulfill tasks [3]. Although self-efficacy is commonly utilized in various user technology issues, according to prior research, only some have used it to assess how well LMS technology has been implemented.

This study aims to identify the elements that affect university students' satisfaction with the LMS. In order to determine if a user has confidence using the LMS, which affects the chance that performance will increase, the researchers apply the Delone McLean (D&M) model theory method and add the computer self-efficacy (CSE) element.

Numerous LMS acceptance studies [4, 14] have used the Technology Acceptance Model (TAM) model and the Unified Technology Acceptance and Use of Technology (UTAUT) model. According to Jeyaraj [4], technology users' behavioral attitudes are measured using internal and external elements using the TAM and UTAUT models. Due to user behavior limitations, TAM and UTAUT models are unable to assess technology usage.

Because a similar model has been widely used in earlier research, the Information System (IS), which uses the system and satisfaction [4], is usually used in the theory of D&M model. The most popular TAM and UTAUT models were employed, and a number of conceptual models were created in earlier research on the adoption of technology. However, the UTAUT model can only account for user satisfaction and the usage of the system as a modifying factor to mitigate individual effects. As a result, researchers try to include another variable.

In previous research, the Delone McLean model [4] was proposed because of its six-factor complexity, which included system quality, information quality, service quality, user satisfaction, system utilization, and institutional effect. This model was seen to be superior to the TAM model and the UTAUT model. Therefore, the advantages of the Delone McLean model are the greatest [4]. In the sphere of education, developing nations such as Indonesia, Malaysia, and Thailand have adopted numerous technologies, such as learning management systems (LMS). The purpose of this study is to identify the significant factors that influence the use of university LMS in relation to student satisfaction, using LMS as the object and extending the Delone McLean model by testing the self-efficacy factor. Incorporating computer self-efficacy (CSE) variables into the conceptual framework was a modification we made following a review of the best available literature.

A. Information Qualtity (IQ) and Student Satisfaction (SS)

Users receive information from information systems. Measures such as timeliness, correctness, completeness, consistency, and relevance can be used to assess the quality of system information [5]. The higher the information quality, the greater the user satisfaction with the system [6]. According to Al-Samarraie (2017), to identify the quality of information, it will be seen how much the role of influence on student user satisfaction [7]. Furthermore, a previous study has demonstrated that information quality significantly impacts student LMS satisfaction [8]. To explore if the quality of information influences student satisfaction with the university LMS, the first hypothesis states:

H1: Information quality (IQ) significantly influences

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student satisfaction (SS).

B. System Quality (SQ) and Student Satisfaction (SS)

System quality refers to the performance of the system as perceived by users [9]. According to [4], user satisfaction, technological achievement, and organizational and individual impact are good system quality indicators. Usability, responsiveness, availability, adaptability, and dependability are specific system quality components [5]. A number of studies [8]–[12] have revealed that system quality significantly impacts student satisfaction. The more satisfied students are with the LMS, the more accessible and reliable they believe it to be. The second hypothesis is as follow:

H2: System quality (SQ) significantly influences student satisfaction (SS).

C. Service Quality (SeQ) and Student Satisfaction (SS)

According to Noorman bin Masrek (2007), service quality is the overall quantity of support provided by a service provider. [13]. According to recent research, it refers to service characteristics such as responsiveness, availability, and efficacy. Previous studies have found a correlation between service quality and student satisfaction. According to earlier studies [11]–[14], service quality predicts students' satisfaction. However, service quality has no bearing on student satisfaction. Based on these findings, universities' student satisfaction services are being evaluated. The third hypothesis is as follow:

H3: Service quality (SeQ) has a significant positive effect on Student Satisfaction (SS).

D. Computer Self-Efficacy (CSE) and Student Satisfaction (SS)

Self-efficacy is an individual's belief in students' ability to complete a task and achieve a certain level of performance with their talents; hence, self-efficacy beliefs influence how people motivate themselves and behave [15].

The original concept of self-efficacy included confidence in one's ability to use abilities such as computers and information technology. Later management information systems (MIS) researchers established computer self-efficacy (CSE) as a critical MIS study construct. It is defined as "an individual's perception of his or her ability to perform a task using a computer" [16]. Computer self-efficacy is positively associated with e-learning outcomes, as measured by average test scores in e-learning [17]. Among E-learners, self-efficacy and perceived system utility are positively related to perceived content value, course satisfaction, and course performance [18].

Other research has looked into the attitudes and behaviors that influence the use of course management systems. A significant positive link was discovered between self-efficacy and the intention to use e-learning technologies. Computer self-efficacy, achievement value, utility value, and intrinsic value were all significant predictors of persons' intention to continue utilizing web-based learning [19]. Self-efficacy, learner satisfaction, and perceived usefulness were discovered to have strong positive correlations [20]. Therefore, the fourth and fifth hypotheses are as follows:

H4: Computer self-efficacy (CSE) significantly influences student satisfaction (SS).

H5: Computer self-efficacy (CSE) significantly influences LMS usage (LU).

E. Student Satisfaction (SS) and LMS Usage (LU)

Many previous studies examined the relationship between user satisfaction and individual impact [21], [22], user satisfaction, and learning outcomes [23]. These studies consistently demonstrate a positive correlation between user satisfaction and learning outcomes' efficacy. Therefore, the sixth hypothesis is as follows:

H6: Student satisfaction (SS) has a positive effect on LMS usage (LU)

II. Method

A. Participants

The study involved 311 undergraduate students from two private Islamic universities in Jakarta, Indonesia. The responding students ranged in age from 18 to 24, with a 36% male to 64% female ratio based on random sampling. From May to July 2023, respondents completed the questionnaire via a Google Form link.

B. Data Collection

Students reported their LMS learning experiences in this section. The primary purpose of this research is to determine how Computer Self-Efficacy (CSE) affects LMS utilization and student satisfaction. Using the research findings, the performance of the LMS can be examined, and virtual learning can be improved.

In this study, researchers collaborated with the university to disseminate the questionnaires to the students, and it only took the respondents 10-15 minutes to complete the questions. Since there were repeat respondents, only 311 respondents matched the criteria. The questionnaire measured 21 model constructs using a Likert scale of 1 (strongly disagree) to 5 (strongly agree).

C. Measures

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This study analyzed data using the Structural Equation Modeling (SEM) approach and the Smart PLS version 3.0 program [28]. PLS is a well-known method for evaluating structural model path coefficients that have gained popularity in marketing research over the last decade due to its capacity to model latent structures under irregularity and small to medium sample sizes [29]. PLS research has been undertaken and found to be an appropriate component of this study. Furthermore, the PLS algorithm mechanism was utilized to evaluate the set, weights, and path coefficients and determine the significance of the hypothesis using the bootstrap method (5000 samples). This measurement model is accurate and effective for empirical validation processes [30].

III. Results

A. Measurement Model Evaluation

In this step, the measurement model (outer model) is evaluated to explain and discover the relationship between the latent variable and the indicators. This is related to the instrument's validity and reliability [24]. The validity of the instruments was assessed using discriminant and convergent validity. According to Table 1, the instruments' validity was assessed using discriminant and convergent validity.

Table 1. Measurement constructs

Construct	Item	Statement
Informaton Quality	IQ1	I can obtain accurate information from LMS.
	IQ2	The LMS can provide me with the information I need to accomplish my duties.
	IQ3	LMS can provide updated task-related information.
	IQ4	The LMS can provide me with up-to-date task information.
System Quality	SQ1	The LMS features an intuitive user interface.
	SQ2	The LMS provides time and location flexibility.
	SQ3	The LMS contains effective communication language.
	SQ4	LMS is readily accessible whenever I need to use it.
Service Quality	SeQ1	Training on the LMS's operation is sufficient.
	SeQ2	Multiple channels are available for communicating with the technicians.
	SeQ3	The provided training can enhance my ability to utilize LMS.
	SeQ4	In general, the university provides sufficient support for LMS usage.
Computer Self-Efficacy	CSE1	I am comfortable using a web browser.
	CSE2	I am confident completing tests online.
	CSE3	I am comfortable uploading/downloading files.
Students Satisfaction	SS1	The LMS applications have met my expectations.
	SS2	The LMS application is of good quality.
	SS3	The LMS application meets my requirements.
LMS Usage	LU1	Utilizing LMS is a wise decision.
	LU2	Working with the LMS is enjoyable.
	LU3	I enjoy working with LMS.

B. Construct Reliability, Convergent Validity, Discriminant Validity

Previous research results [25] were analyzed by calculating the loading factor value of each indicator in the displayed structure.

According to Table 2, convergent validity is inferred if all indicators have loading factor values that satisfy the validity requirements and the value is greater than 0.70 (>0.70). The IQ1 and CSE3 indicator loadings are less than the threshold value (> 0.70), requiring their elimination. This finding is consistent with Ali's (2018) argument that any indication is good if its loading factor is greater than 0.70 [26].

Following the analysis of the loading factor data, we proceed to the interpretation of Composite Reliability (CR). A limit value of more than 0.6 is appropriate, while a value >0.7 is acceptable. The average occurrence (AVE) value is another indicator of convergent validity. The AVE value defines the degree of variation or set of manifest variables that a latent concept may have. As a result, the wider the variance or range of manifest variables that a latent partner can incorporate, the more thoroughly reflected the manifest variable will be in its latent construct.

When examining convergent validity parameters, AVE is recommended. A minimum AVE of 0.5 implies that convergent validity is a reliable indication. On average, the latent variable can explain more than half of the predictor variance. The AVE value is derived from the sum of the loading factor's squares minus the error.

Table 2 shows that the composite reliability and AVE values exceed the resultant AVE value for each latent variable by more than 0.5. This finding implies that both of these factors are highly reliable.

Table 2. Measurement model

Construct	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Information Quality	IQ2	0.773	0.888	0.727
	IQ3	0.887		
	IQ4	0.892		
System Quality	SQ1	0.831	0.872	0.630
	SQ2	0.736		
	SQ3	0.812		
	SQ4	0.793		
Service Quality	SeQ1	0.759	0.890	0.670
	SeQ2	0.804		
	SeQ3	0.872		
	SeQ4	0.836		
Computer Self-Efficacy	CSE1	0.917	0.912	0.838
	CSE2	0.913		
Students Satisfaction	SS1	0.904	0.917	0.787
	SS2	0.890		
	SS3	0.867		
LMS Usage	LU1	0.752	0.890	0.731
	LU2	0.907		
	LU3	0.897		

The discriminant validity of the heterotrait-monotrait ratio (HTMT) was applied to validate the measurement model. Previous research has used 0.90 as the maximum threshold of the HTMT ratio constructs [27], [28]. Table 3 shows the validation of the measurement model concerning this threshold value.

Table 3. Discriminant validity of Heterotrait-Monotrait Ratio (HTMT)

Construct	Computer Self	Information Quality	LMS Usage	Service Quality	Student Satisfaction	System Quality

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	Efficacy_					
Computer Self Efficacy						
Information Quality	0.772					
LMS Usage	0.904	0.902				
Service Quality	0.916	0.864	1.092			
Student Satisfaction	0.632	0.976	0.836	0.729		
System Quality	0.795	0.833	0.959	0.832	0.973	

C. *Structural Model Evaluation*

After establishing the measurement model, the second stage in the two-step statistical technique for modeling the PLS-SEM model is to build the structural model. The path coefficients and explained variance are included in the structural model. After selecting 5000 random sub-samples with replacement from one original sample, the regression coefficients (or beta values) were refined using a bootstrapping method by generating bootstrap standard errors. The process must be run constantly 5000 times [27]. The PLS path model was then estimated using these subsamples.

Table 4 summarizes the findings concerning the relevance of the routes corresponding to hypotheses H1, H2, H3, H4, H5, and H6. The data reveal that these pathways' 5% and 95% confidence interval values support hypotheses H1, H2, H5, and H6. However, H3 and H4 are rejected since the confidence interval values are less than zero for one-tailed testing with p-values of 0.05.

Table 4. Hypothesis testing

Hypothesis	Path	Std.Beta	Std.Eror	T-value	Bias	Confidence Interval		Decision
						5.0%	95.0%	
H1	Information Quality → Student Satisfaction	0.581	0.051	11.406	0.002	0.490	0.658	Supported
H2	System Quality → Student Satisfaction	0.586	0.050	11.824	−0.003	0.506	0.668	Supported
H3	Service Quality → Student Satisfaction	−0.087	0.045	1.933	0.002	−0.162	−0.012	Rejected
H4	Computer Self Efficacy → Student Satisfaction	−0.130	0.042	3.088	0.001	−0.198	−0.060	Rejected
H5	Computer Self Efficacy → LMS Usage	0.501	0.052	9.570	−0.001	0.416	0.588	Supported
H6	Student Satisfaction → LMS Usage	0.441	0.057	7.788	−0.000	0.344	0.529	Supported

Note: p <0.05 (1-tailed test)

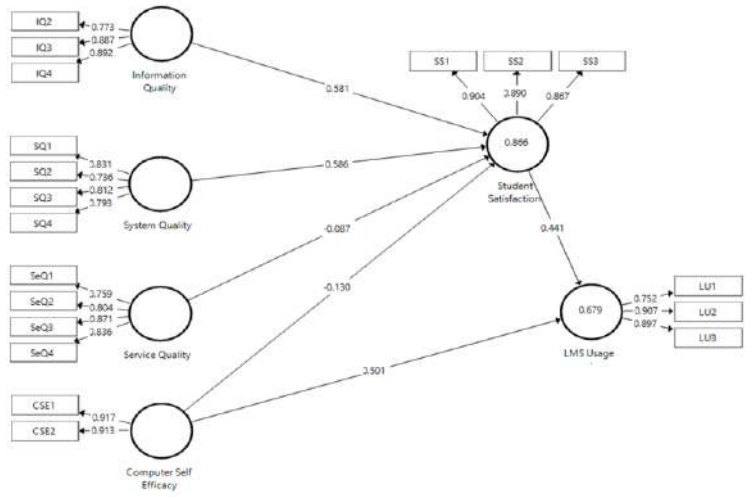

Fig. 1. Path analysis.

The coefficient of determination (R^2) is frequently used to analyze the model's predictive capacity and structural model. It is the squared correlation between the actual and expected values of an endogenous building. The coefficient represents the sum of the exogenous variables' effects on the latent endogenous variables. Because R^2 has a range of 0–1, it is difficult to construct an exact rule of thumb. Higher numbers indicate higher prediction points. As a result, the value of student satisfaction and LMS usage is determined by the complexity of the model and the research discipline.

Table 5. R^2

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Commented [621R20]: The coefficient of determination (R2)

	R^2	R^2 Adjusted
LMS Usage	0.679	0.677
Student Satisfaction	0.866	0.864

The coefficient of determination (R^2) in Fig. 1 and Table 5 verifies the research's model. This coefficient measures the model's predictive ability and is computed as the squared correlation between the actual and predicted values of a specific endogenous construct [29]. Furthermore, the R^2 value indicates the percentage of variation explained by each model construct. R^2 values of 0.75, 0.50, and 0.25 for endogenous constructs can be classified as significant, moderate, and insignificant [30].

The R^2 values of the dependent constructs, student satisfaction, and LMS usage, are displayed in Fig. 1 and Table 5. The model explains 86.6% of the variance in student satisfaction and 67.9% of the variance in LMS usage. The R^2 values of the two dependent constructs (student satisfaction and LMS usage) are 0.866 and 0.679, respectively, which are considered sufficient [29]. Fig. 1 also depicts the structural model with path coefficients for each path (hypothesized relationship) with a significant level and coefficient of determination (R^2).

IV. Discussion

Model validity and reliability tests show that the established constructs are reliable and valid, which helps to verify the accuracy of the PLS-SEM-derived measurement model. Meanwhile, validation of the structural model shows that the generated model is not only a strong fit but also has exceptional predictive significance.

Hypotheses H1, H2, H5, and H6 are supported by the established structural model's results in direct effects. H3 and H4 were, however, rejected. The findings demonstrate that information and system quality have a direct positive impact on student happiness. LMS utilization is also influenced by computer self-efficacy and student satisfaction.

The value obtained for testing the first hypothesis (H1) is greater than zero within a confidence interval of 5% (0.490) and 95% (0.658), indicating that the results are supported. The beneficial influence of information quality on student satisfaction happens when university LMS is used. Previous research supports this finding [31]. Similarly, the other study discovered that information quality influences student satisfaction [32]. However, according to the findings of another study, information quality does not affect student satisfaction due to internal user variables [33].

The value above zero is achieved at a confidence interval of 5% (0.506) and 95% (0.668) for testing the second hypothesis (H2), indicating that the results are supported. Student satisfaction was found to be influenced by system quality. Johnson *et al*. [18] produced similar results, demonstrating that good system quality of LMS technology benefits user satisfaction [10]. Other research has found that system quality influences student satisfaction [34]. However, a study by Mtebe and Raisamo [35] found that system quality does not affect student satisfaction. Quality feasibility aspects heavily influence user satisfaction outcomes.

The third hypothesis (H3) is rejected since a value above zero is obtained at a confidence interval of 5% (−0.612) and 95% (−0.012). According to Mtebe and Raisamo [35], service quality has little effect on user satisfaction because user understanding of utilizing the LMS is inadequate [35]. Johnson *et al*. [18] discovered the same thing: the limited menu of supporting services dissatisfied people with the LMS. However, according to Alzahrani and Seth (2021), the skill component of using LMS technology determines student happiness with LMS technology. In general, training for these users is significant in some universities. The same study found that a person's knowledge attitude influences their satisfaction with technology [32].

The fourth hypothesis (H4) is rejected when a value greater than zero is achieved at a confidence interval of 5% (−0.198) and 95% (−0.060). According to Ghazal *et al.* [10], computer self-efficacy influences student satisfaction with the LMS because it facilitates communication with operators and instruction to use the LMS, hence enhancing student skills to operate the LMS is needed [14], [36]. The same thing was also found by Prifti (2022) and [14 the factors of comprehension and skills in mastering technology immediately affect one's behavior in using the LMS, which has an impact on the level of satisfaction [37], [38]. However, according to Eom [34], self-efficacy factor has no effect on satisfaction using the LMS [39].

The value above zero is achieved at a confidence interval of 5% (0.418) and 95% (0.588) for testing the fifth hypothesis (H5), indicating that the results are supported. As a result, Computer Self-Efficacy (CSE) influences LMS utilization. According to Ghazal *et al*. [14], students' confidence in using the LMS impacts whether or not they continue to utilize the LMS [40].

The value above zero is achieved at a confidence interval of 5% (0.344) and 95% (0.529) for testing the sixth hypothesis (H6), indicating that the results are supported. LMS usage is influenced by user satisfaction. Learner satisfaction, according to Aldholay *et al.* [41], determines continuous usage of the LMS in online learning [37], [41].

V. Conclusion

Based on the review of the literature and the findings of the research, it is concluded that there are numerous elements that influence learner satisfaction with using an LMS. The direct testing of six hypotheses reveals that four of them are supported. The findings show that information quality, system quality, and quality all have an impact on student satisfaction. While CSE and satisfaction have an impact on LMS utilization. We conclude that this study was a success. However, the rejected results require further investigation to demonstrate the impact of service quality and CSE on student satisfaction.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Please state each author's contribution to this work, it can be up to several sentences long and should briefly describe the tasks of individual authors. e.g., AB conducted the research; CD analyzed the data; AB wrote the paper; ...; all authors had approved the final version.

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Commented [a26]: Please add author contributions.

Commented [627R26]: Khoerul Umam and Zulherman conducted research, and write the papers, Irdalisa, Wati Sukmawati analyzed data, Supriyansyah adding some references.

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Bukti Revision Reminder

4 Agustus 2023

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UNIVERSITAS MUHAMMADIYAH PROF. DR. HAMKA

Khoerul Umam <khoerul.umam@uhamka.ac.id>

[ijiet] Manuscript ID: IJIET-10053 – Revision Reminder

1 message

Ms. Nancy Liu <nancy.liu@ejournal.net> Fri, Aug 4, 2023 at 10:16 AM
Reply-To: "Ms. Nancy Liu" <nancy.liu@ejournal.net>
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Dear Khoerul Umam,

The following paper had been sent to you for revision, may we kindly ask you to update us on the progress of your revisions?

Manuscript ID: IJIET-10053
Title: The Investigating of Computer Self-Efficacy on Learning Management System Use
Submission URL: https://ojs.ejournal.net/index.php/ijiet/authorDashboard/submission/10053

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Please note that any revisions should be clearly highlighted in the revised version, for example using the "Track Changes" function in Microsoft Word, so that changes are easily visible to the editors and reviewers. Please provide a cover letter to explain point-by-point the details of the revisions in the manuscript and your responses to the reviewers' comments.

Thank you in advance for your kind cooperation and we look forward to hearing from you soon.

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COVER LETTER

Khoerul Umam*, Zulherman, Wati Sukmawati, Irdalisa, Supriansyah

Universitas Muhammadiyah Prof DR HAMKA
Limau II Street, Kebayoran Baru, South Jakarta, Indonesi

August 8, 2023

Dear Ms. Nancy Liu,

We wish to submit an original research article entitled **"Computer Self-Efficacy on Learning Management System Use: From the lens of Undergraduate Students"** for consideration by International Journal of Information and Education Technology. We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

In this paper, we report on students' higher education experiences using LMS. This is significant because students computer self-efficacy are highly influenced by the quality of Learning Managements system.

We believe that this manuscript is appropriate for publication by **International Journal of Information and Education Technology** because it is suitable for topic technology in education discussing the students experiences using LMS in higher education, the quality of LMS influence students computer self efficacy.

We have no conflicts of interest to disclose.

Please address all correspondence concerning this manuscript to me at khoerul.umam@uhamka.ac.id

Thank you for your consideration of this manuscript.

Sincerely,

Khoerul Umam

Computer Self-Efficacy on Using Learning Management System: From the Lens of Undergraduate Students

Khoerul Umam*, Zulherman, Wati Sukmawati, Irdalisa, Supriansyah,

***Abstract*—The university's development of learning-supporting technology is diverse, with the benefits and ease of providing flexible and effective learning possibilities both offline and online. Learning management systems (LMS) are examples of Internet-based technology that are commonly employed in developed countries. However, developing countries such as Indonesia are still among the few that only employ LMS as media support for university study. Many factors both support and hinder the practical usage of LMS. As a result, the goal of the study was to assess the factors influencing the successful usage of LMS at the university using the Delone McLean model approach (D&M). This model was modified, and a broad factor called Computer Self-Efficacy (CSE) was introduced, which was tested using a questionnaire on 311 undergraduate students. Six hypotheses were tested, and the results showed that four were supported and two were rejected. Based on these findings, it concluded that this study had helped to modify the D&M model, which can improve the ability of students' services in online learning and encourage students' self-efficacy gradually.**

***Index Terms*— delone mclean model, computer self-efficacy, learning management system,**

I. Introduction

Internet technology, mainly digital learning, has an impact on education. Teachers and students are affected by online university learning [1]. Additionally, growing in popularity is technology-based education in emerging nations, notably in Southeast Asia.

Both internal and external causes influence technology development. LMS-based learning technology is common in developing nations [2]. Most of the users of LMS are university students and teachers. It will become clear from examining the implementation that user satisfaction shows how well the technology was implemented. As a result, the model theory method must serve as the foundation for evaluating this achievement.

Self-efficacy is a user trait that is a fascinating example of how everyone has different views. In order to improve job performance, a person must have self-efficacy, which is the belief in one's capacity to fulfill tasks [3]. Although self-efficacy is commonly utilized in various user technology issues, according to prior research, only some have used it to assess how well LMS technology has been implemented.

This study aims to identify the elements that affect university students' satisfaction with the LMS. In order to determine if a user has confidence using the LMS, which affects the chance that performance will increase, the researchers apply the Delone McLean model theory method and add the computer self-efficacy (CSE) element.

II. Literature Review

Numerous LMS acceptance studies [4,14] have used the Technology Acceptance Model (TAM) model and the Unified Technology Acceptance and Use of Technology (UTAUT) model. According to the [4], technology users' behavioral attitudes are measured using internal and external elements using the TAM and UTAUT models. Due to user behavior limitations, TAM and UTAUT models are unable to assess technology usage.

Because a similar model has been widely used in earlier research, the information system (IS), which uses the system and satisfaction [4], is usually used in the theory of D&M model. The most popular TAM and UTAUT models were employed, and a number of conceptual models were created in earlier research on the adoption of technology. However, the UTAUT model can only account for user satisfaction and the usage of the system as a modifying factor to mitigate individual effects. As a result, researchers try to include another variable.

In previous research, the Delone McLean model [4] was proposed because of its six-factor complexity, which included system quality, information quality, service quality, user satisfaction, system utilization, and institutional effect. This model was seen to be superior to the TAM model and the UTAUT model. Therefore, the advantages of the Delone McLean model are the greatest [4]. In the sphere of education, developing nations such as Indonesia, Malaysia, and Thailand have adopted numerous technologies, such as learning management systems (LMS). The purpose of this study is to identify the significant factors that influence the use of university LMS in relation to student satisfaction, using LMS as the object and extending the Delone McLean model by testing the self-efficacy factor. Incorporating computer self-efficacy (CSE) variables into the conceptual framework was a modification we made following a review of the best available literature.

A. Information Qualtity (IQ) and Student Satisfaction (SS)

Users receive information from information systems. Measures such as timeliness, correctness, completeness, consistency, and relevance can be used to assess the quality of system information [5]. The higher the information quality, the greater the user satisfaction with the system [6].

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According to Al-Samarraie (2018), to identify the quality of information, it will be seen how much the role of influence on student user satisfaction [7]. Furthermore, a previous study has demonstrated that information quality significantly impacts student LMS satisfaction [8]. To explore if the quality of information influences student satisfaction with the university LMS, the first hypothesis states:
H1: Information quality (IQ) significantly influences student satisfaction (SS).

B. *System Quality (SQ) and Student Satisfaction (SS)*

System quality refers to the performance of the system as perceived by users [9]. According to [4], user satisfaction, technological achievement, and organizational and individual impact are good system quality indicators. Usability, responsiveness, availability, adaptability, and dependability are specific system quality components [5]. A number of studies [8]–[12] have revealed that system quality significantly impacts student satisfaction. The more satisfied students are with the LMS, the more accessible and reliable they believe it to be. The second hypothesis is as follow:
H2: System quality (SQ) significantly influences student satisfaction (SS).

C. *Service Quality (SeQ) and Student Satisfaction (SS)*

According to Noorman bin Masrek (2007), service quality is the overall quantity of support provided by a service provider. [13]. According to recent research, it refers to service characteristics such as responsiveness, availability, and efficacy. Previous studies have found a correlation between service quality and student satisfaction. According to earlier studies [11]–[14], service quality predicts students' satisfaction. However, service quality has no bearing on student satisfaction. Based on these findings, universities' student satisfaction services are being evaluated. The third hypothesis is as follow:
H3: Service quality (SeQ) has a significant positive effect on Student Satisfaction (SS).

D. *Computer Self-Efficacy (CSE) and Student Satisfaction (SS)*

Self-efficacy is an individual's belief in students' ability to complete a task and achieve a certain level of performance with their talents; hence, self-efficacy beliefs influence how people motivate themselves and behave [15].

The original concept of self-efficacy included confidence in one's ability to use abilities such as computers and information technology. Later management information systems (MIS) researchers established computer self-efficacy (CSE) as a critical MIS study construct. It is defined as "an individual's perception of his or her ability to perform a task using a computer" [16]. Computer self-efficacy is positively associated with e-learning outcomes, as measured by average test scores in e-learning [17]. Among E-learners, self-efficacy and perceived system utility are positively related to perceived content value, course satisfaction, and course performance [18].

Other research has looked into the attitudes and behaviors that influence the use of course management systems. A significant positive link was discovered between self-efficacy and the intention to use e-learning technologies. Computer self-efficacy, achievement value, utility value, and intrinsic value were all significant predictors of persons' intention to continue utilizing web-based learning [19]. Self-efficacy, learner satisfaction, and perceived usefulness were discovered to have strong positive correlations [20]. Therefore, the fourth and fifth hypotheses are as follows:
H4: Computer self-efficacy (CSE) significantly influences student satisfaction (SS).
H5: Computer self-efficacy (CSE) significantly influences LMS usage (LU).

E. *Student Satisfaction (SS) and LMS Usage (LU)*

Many previous studies examined the relationship between user satisfaction and individual impact [21], [22], user satisfaction, and learning outcomes [23]. These studies consistently demonstrate a positive correlation between user satisfaction and learning outcomes' efficacy. Therefore, the sixth hypothesis is as follows:
H6: Student satisfaction (SS) has a positive effect on LMS usage (LU)

III. METHOD

A. *Participants*

The study involved 311 undergraduate students from two private Islamic universities in Jakarta, Indonesia. The responding students ranged in age from 18 to 24, with a 36% male to 64% female ratio based on random sampling. From May to July 2023, respondents completed the questionnaire via a Google Form link.

B. *Data Collection*

Students reported their LMS learning experiences in this section. The primary purpose of this research is to determine how computer self-efficacy (CSE) affects LMS utilization and student satisfaction. Using the research findings, the performance of the LMS can be examined, and virtual learning can be improved.

In this study, researchers collaborated with the university to disseminate the questionnaires to the students, and it only took the respondents 10-15 minutes to complete the questions. Since there were repeat respondents, only 311 respondents matched the criteria. The questionnaire measured 21 model constructs using a Likert scale of 1 (strongly disagree) to 5 (strongly agree).

C. *Measures*

This study analyzed data using the structural equation modeling (SEM) approach and the Smart PLS version 3.0 program [28]. PLS is a well-known method for evaluating structural model path coefficients that have gained popularity in marketing research over the last decade due to its capacity to model latent structures under irregularity and small to medium sample sizes [29]. PLS research has been undertaken and found to be an appropriate component of this study. Furthermore, the PLS algorithm mechanism was utilized to evaluate the set, weights, and path coefficients and determine the significance of the hypothesis using the bootstrap method (5000 samples). This measurement model

is accurate and effective for empirical validation processes [30].

IV. RESULTS

A. Measurement model evaluation

In this step, the measurement model (outer model) is evaluated to explain and discover the relationship between the latent variable and the indicators. This is related to the instrument's validity and reliability [24]. The validity of the instruments was assessed using discriminant and convergent validity. According to Table I, the instruments' validity was assessed using discriminant and convergent validity.

TABLE I: MEASUREMENT CONSTRUCTS

Construct	Item	Statement
Informaton Quality	IQ1	I can obtain accurate information from LMS.
	IQ2	The LMS can provide me with the information I need to accomplish my duties.
	IQ3	LMS can provide updated task-related information.
	IQ4	The LMS can provide me with up-to-date task information.
System Quality	SQ1	The LMS features an intuitive user interface.
	SQ2	The LMS provides time and location flexibility.
	SQ3	The LMS contains effective communication language.
	SQ4	LMS is readily accessible whenever I need to use it.
Service Quality	SeQ1	Training on the LMS's operation is sufficient.
	SeQ2	Multiple channels are available for communicating with the technicians.
	SeQ3	The provided training can enhance my ability to utilize LMS.
	SeQ4	In general, the university provides sufficient support for LMS usage.
Computer Self-Efficacy	CSE1	I am comfortable using a web browser.
	CSE2	I am confident completing tests online.
	CSE3	I am comfortable uploading/downloading files.
Students Satisfaction	SS1	The LMS applications have met my expectations.
	SS2	The LMS application is of good quality.
	SS3	The LMS application meets my requirements.
LMS Usage	LU1	Utilizing LMS is a wise decision.
	LU2	Working with the LMS is enjoyable.
	LU3	I enjoy working with LMS.

B. Construct Reliability, Convergent Validity, Discriminant Validity

Previous research results [25] were analyzed by calculating the loading factor value of each indicator in the displayed structure.

According to Table II, convergent validity is inferred if all indicators have loading factor values that satisfy the validity requirements and the value is greater than 0.70 (>0.70). The IQ1 and CSE3 indicator loadings are less than the threshold value (> 0.70), requiring their elimination. This finding is consistent with Ali's (2018) argument that any indication is good if its loading factor is greater than 0.70 [26].

Following the analysis of the loading factor data, we proceed to the interpretation of composite reliability (CR). A limit value of more than 0.6 is appropriate, while a value > 0.7 is acceptable. The average occurrence (AVE) value is another indicator of convergent validity. The AVE value defines the degree of variation or set of manifest variables that a latent concept may have. As a result, the wider the variance or range of manifest variables that a latent partner can incorporate, the more thoroughly reflected the manifest variable will be in its latent construct.

When examining convergent validity parameters, AVE is recommended. A minimum AVE of 0.5 implies that convergent validity is a reliable indication. On average, the latent variable can explain more than half of the predictor variance. The AVE value is derived from the sum of the loading factor's squares minus the error.

TABLE II: MEASUREMENT MODEL

Construct	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Information Quality	IQ2	0.773	0.888	0.727
	IQ3	0.887		
	IQ4	0.892		
System Quality	SQ1	0.831	0.872	0.630
	SQ2	0.736		
	SQ3	0.812		
	SQ4	0.793		
Service Quality	SeQ1	0.759	0.890	0.670
	SeQ2	0.804		
	SeQ3	0.872		
	SeQ4	0.836		
Computer Self-Efficacy	CSE1	0.917	0.912	0.838
	CSE2	0.913		
Students Satisfaction	SS1	0.904	0.917	0.787
	SS2	0.890		
	SS3	0.867		
LMS Usage	LU1	0.752	0.890	0.731
	LU2	0.907		
	LU3	0.897		

Table II shows that the composite reliability and AVE values exceed the resultant AVE value for each latent variable by more than 0.5. This finding implies that both of these factors are highly reliable.

The discriminant validity of the heterotrait-monotrait ratio (HTMT) was applied to validate the measurement model. Previous research has used 0.90 as the maximum threshold of the HTMT ratio constructs [27], [28]. Table III shows the validation of the measurement model concerning this threshold value.

TABLE III: DISCRIMINANT VALIDITY OF HETEROTRAIT-MONOTRAIT RATIO (HTMT)

Construct	Computer Self Efficacy	Information Quality	LMS Usage	Service Quality	Student Satisfaction	System Quality
Computer Self Efficacy						
Information Quality	0.772					
LMS Usage	0.904	0.902				
Service Quality	0.916	0.864	1.092			
Student Satisfaction	0.632	0.976	0.836	0.729		
System Quality	0.795	0.833	0.959	0.832	0.973	

C. Structural model evaluation

After establishing the measurement model, the second stage in the two-step statistical technique for modeling the PLS-SEM model is to build the structural model. The path coefficients and explained variance are included in the structural model. After selecting 5000 random sub-samples with replacement from one original sample, the regression coefficients (or beta values) were refined using a bootstrapping method by generating bootstrap standard errors. The process must be run constantly 5000 times [27]. The PLS path model was then estimated using these subsamples.

Table IV summarizes the findings concerning the relevance of the routes corresponding to hypotheses H1, H2, H3, H4, H5, and H6. The data reveal that these pathways' 5% and 95% confidence interval values support hypotheses H1, H2, H5, and H6. However, H3 and H4 are rejected since the confidence interval values are less than zero for one-tailed testing with p-values of 0.05.

TABLE IV: HYPOTHESIS TESTING

Hypothesis	Path	Std.Beta	Std.Eror	T-value	Bias	Confidence Interval		Decision
						5.0%	95.0%	
H1	Information Quality -> Student Satisfaction	0.581	0.051	11.406	0.002	0.490	0.658	Supported
H2	System Quality -> Student Satisfaction	0.586	0.050	11.824	-0.003	0.506	0.668	Supported
H3	Service Quality -> Student Satisfaction	-0.087	0.045	1.933	0.002	-0.162	-0.012	Rejected
H4	Computer Self Efficacy -> Student Satisfaction	-0.130	0.042	3.088	0.001	-0.198	-0.060	Rejected
H5	Computer Self Efficacy -> LMS Usage	0.501	0.052	9.570	-0.001	0.416	0.588	Supported
H6	Student Satisfaction -> LMS Usage	0.441	0.057	7.788	-0.000	0.344	0.529	Supported

Note: $p < 0.05$ (1-tailed test)

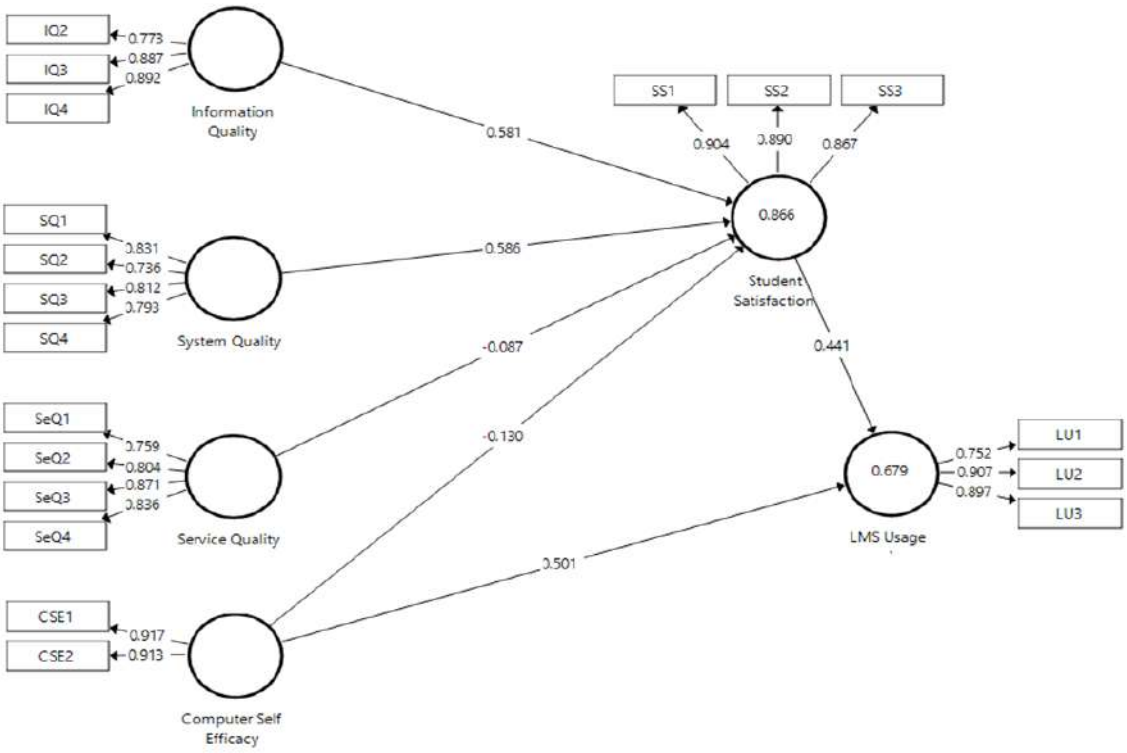

Fig. 1. Path analysis

The coefficient of determination (R square) is frequently used to analyze the model's predictive capacity and structural model. It is the squared correlation between the actual and expected values of an endogenous building. The coefficient represents the sum of the exogenous variables' effects on the latent endogenous variables. Because R Square has a range of 0-1, it is difficult to construct an exact rule of thumb. Higher numbers indicate higher prediction points. As a result, the value of student satisfaction and LMS usage is determined by the complexity of the model and the research discipline.

TABLE V: R SQUARE

	R Square	R Square Adjusted
LMS Usage	0.679	0.677
Student Satisfaction	0.866	0.864

The coefficient of determination (R2) in Figure 1 and Table V verifies the research's model. This coefficient measures the model's predictive ability and is computed as the squared correlation between the actual and predicted values of a specific endogenous construct [29]. Furthermore, the R2 value indicates the percentage of variation explained by each model construct. R2 values of 0.75, 0.50, and 0.25 for endogenous constructs can be classified as significant, moderate, and insignificant [30].

The R2 values of the dependent constructs, student satisfaction, and LMS usage, are displayed in Figure 1 and Table V. The model explains 86.6% of the variance in student satisfaction and 67.9% of the variance in LMS usage. The R2 values of the two dependent constructs (student satisfaction and LMS usage) are 0.866 and 0.679, respectively, which are considered sufficient [29]. Figure 1 also depicts the structural model with path coefficients for each path (hypothesized relationship) with a significant level and coefficient of determination (R2).

V. DISCUSSION

Model validity and reliability tests show that the established constructs are reliable and valid, which helps to verify the accuracy of the PLS-SEM-derived measurement model. Meanwhile, validation of the structural model shows that the generated model is not only a strong fit but also has exceptional predictive significance.

Hypotheses H1, H2, H5, and H6 are supported by the established structural model's results in direct effects. H3 and H4 were, however, rejected. The findings demonstrate that information and system quality have a direct positive impact on student happiness. LMS utilization is also influenced by computer self-efficacy and student satisfaction.

The value obtained for testing the first hypothesis (H1) is greater than zero within a confidence interval of 5% (0.490) and 95% (0.658), indicating that the results are supported. The beneficial influence of information quality on student satisfaction happens when university LMS is used. Previous research supports this finding [31]. Similarly, the other study discovered that information quality influences student satisfaction [32]. However, according to the findings of another study, information quality does not affect student satisfaction due to internal user variables [33].

The value above zero is achieved at a confidence interval of 5% (0.506) and 95% (0.668) for testing the second hypothesis (H2), indicating that the results are supported. Student satisfaction was found to be influenced by system quality. [18] produced similar results, demonstrating that good system quality of LMS technology benefits user satisfaction [10]. Other research has found that system quality influences student satisfaction [34]. However, a study by [35] found that system quality does not affect student satisfaction.

Quality feasibility aspects heavily influence user satisfaction outcomes.

The third hypothesis (H3) is rejected since a value above zero is obtained at a confidence interval of 5% (-0.612) and 95% (-0.012). According to [35], service quality has little effect on user satisfaction because user understanding of utilizing the LMS is inadequate [35]. [18] discovered the same thing: the limited menu of supporting services dissatisfied people with the LMS. However, according to Alzahrani and Seth (2021), the skill component of using LMS technology determines student happiness with LMS technology. In general, training for these users is significant in some universities. The same study found that a person's knowledge attitude influences their satisfaction with technology [32].

The fourth hypothesis (H4) is rejected when a value greater than zero is achieved at a confidence interval of 5% (-0.198) and 95% (-0.060). According to [10], computer self-efficacy influences student satisfaction with the LMS because it facilitates communication with operators and instruction to use the LMS, hence enhancing student skills to operate the LMS is needed [14], [36]. The same thing was also found by Prifti (2022) and [14 the factors of comprehension and skills in mastering technology immediately affect one's behavior in using the LMS, which has an impact on the level of satisfaction [37], [38]. However, according to [34], self-efficacy factor has no effect on satisfaction using the LMS [39].

The value above zero is achieved at a confidence interval of 5% (0.418) and 95% (0.588) for testing the fifth hypothesis (H5), indicating that the results are supported. As a result, computer self-efficacy (CSE) influences LMS utilization. According to [14], students' confidence in using the LMS impacts whether or not they continue to utilize the LMS [40].

The value above zero is achieved at a confidence interval of 5% (0.344) and 95% (0.529) for testing the sixth hypothesis (H6), indicating that the results are supported. LMS usage is influenced by user satisfaction. Learner satisfaction, according to [41], determines continuous usage of the LMS in online learning [37], [41].

VI. Conclusion

Based on the review of the literature and the findings of the research, it is concluded that there are numerous elements that influence learner satisfaction with using an LMS. The direct testing of six hypotheses reveals that four of them are supported. The findings show that information quality, system quality, and quality all have an impact on student satisfaction. While CSE and satisfaction have an impact on LMS utilization. We conclude that this study was a success. However, the rejected results require further investigation to demonstrate the impact of service quality and CSE on student satisfaction.

Conflict of Interest

This article's authors report no conflicts of interest.

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(Periodical style)

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Thank you very much for your information. Hopefully, you can fulfill our requests before a payment is made.

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KHOERUL UMAM
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Khoerul Umam <khoerul.umam@uhamka.ac.id> Wed, Aug 16, 2023 at 1:20 PM
To: "kcpciracas@gmail.com" <kcpciracas@gmail.com>

[Quoted text hidden]

Khoerul Umam <khoerul.umam@uhamka.ac.id> Wed, Aug 16, 2023 at 1:51 PM
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Harap dilakukan transaksi berikut *Please do this transaction:*

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Cabang *Branch* Ciracas Tanggal *Date* 11

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Bank *Bank*: 054-902037-0 DBS BANK, Singapore
Alamat & Nomor Telepon *Address & Telephone Number*: 6 Shenton Way, DBS Building Singapore

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☑ Penduduk *Resident* ☐ Bukan Penduduk *Non-Resident* ☑ Nasabah *Customer*
Nama *Name*: Khoerul Umam
Nomor Identitas *Identity Number*: 3 2 7 5 0 1 2 3 0 4 8 9
Alamat & Nomor Telepon *Address & Telephone Number*:

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To: Khoerul Umam <khoerul.umam@uhamka.ac.id>

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AC84  K  USD1341300010261    Outgoing TT                   USD  450.00
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PENERIMA *Beneficiary*
☐ Penduduk *Resident* ☐ Bukan Penduduk *Non-Resident*
Nama *Name*: International Association of Computer Scientist
Bank *Bank*: 054-902037-0 DBS BANK, Singapore
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Nama *Name*: Khoerul Umam
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BIAYA TRANSAKSI *Handling Charge*
☐ Tunai *Cash* ☑ Debet Rekening: *Debet Account:* 7 1 8 7 9 9 3 6 4 9

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Total	

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Khoerul Umam <khoerul.umam@uhamka.ac.id> Fri, Sep 22, 2023 at 10:56 AM
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nancy.liu <nancy.liu@ejournal.net> Fri, Sep 22, 2023 at 11:24 AM
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Khoerul Umam <khoerul.umam@uhamka.ac.id> Fri, Sep 22, 2023 at 12:43 PM
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Khoerul Umam <khoerul.umam@uhamka.ac.id> Sun, Sep 24, 2023 at 12:23 PM
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To: Khoerul Umam <khoerul.umam@uhamka.ac.id>

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Original:

- From：Khoerul Umam <khoerul.umam@uhamka.ac.id>
- Date：2024-02-01 16:38:47(China(GMT+08:00))
- To：nancy.liu<nancy.liu@ejournal.net>
- Cc：
- Subject：Re: Re: Re: [ijiet] Manuscript ID: IJIET-10053 - Proofreading

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Computer Self-Efficacy on Using Learning Management System: From the Lens of Undergraduate Students

Khoerul Umam*, Zulherman, Wati Sukmawati, Irdalisa, Supriansyah,

***Abstract*—The university's development of learning-supporting technology is diverse, with the benefits and ease of providing flexible and effective learning possibilities both offline and online. Learning management systems (LMS) are examples of Internet-based technology that are commonly employed in developed countries. However, developing countries such as Indonesia are still among the few that only employ LMS as media support for university study. Many factors both support and hinder the practical usage of LMS. As a result, the goal of the study was to assess the factors influencing the successful usage of LMS at the university using the Delone McLean model approach (D&M). This model was modified, and a broad factor called Computer Self-Efficacy (CSE) was introduced, which was tested using a questionnaire on 311 undergraduate students. Six hypotheses were tested, and the results showed that four were supported and two were rejected. Based on these findings, it concluded that this study had helped to modify the D&M model, which can improve the ability of students' services in online learning and encourage students' self-efficacy gradually.**

***Index Terms*— delone mclean model, computer self-efficacy, learning management system,**

I. Introduction

Internet technology, mainly digital learning, has an impact on education. Teachers and students are affected by online university learning [1]. Additionally, growing in popularity is technology-based education in emerging nations, notably in Southeast Asia.

Both internal and external causes influence technology development. LMS-based learning technology is common in developing nations [2]. Most of the users of LMS are university students and teachers. It will become clear from examining the implementation that user satisfaction shows how well the technology was implemented. As a result, the model theory method must serve as the foundation for evaluating this achievement.

Self-efficacy is a user trait that is a fascinating example of how everyone has different views. In order to improve job performance, a person must have self-efficacy, which is the belief in one's capacity to fulfill tasks [3]. Although self-efficacy is commonly utilized in various user technology issues, according to prior research, only some have used it to assess how well LMS technology has been implemented.

This study aims to identify the elements that affect university students' satisfaction with the LMS. In order to determine if a user has confidence using the LMS, which affects the chance that performance will increase, the researchers apply the Delone McLean model theory method and add the computer self-efficacy (CSE) element.

II. Literature Review

Numerous LMS acceptance studies [4,14] have used the Technology Acceptance Model (TAM) model and the Unified Technology Acceptance and Use of Technology (UTAUT) model. According to the [4], technology users' behavioral attitudes are measured using internal and external elements using the TAM and UTAUT models. Due to user behavior limitations, TAM and UTAUT models are unable to assess technology usage.

Because a similar model has been widely used in earlier research, the information system (IS), which uses the system and satisfaction [4], is usually used in the theory of D&M model. The most popular TAM and UTAUT models were employed, and a number of conceptual models were created in earlier research on the adoption of technology. However, the UTAUT model can only account for user satisfaction and the usage of the system as a modifying factor to mitigate individual effects. As a result, researchers try to include another variable.

In previous research, the Delone McLean model [4] was proposed because of its six-factor complexity, which included system quality, information quality, service quality, user satisfaction, system utilization, and institutional effect. This model was seen to be superior to the TAM model and the UTAUT model. Therefore, the advantages of the Delone McLean model are the greatest [4]. In the sphere of education, developing nations such as Indonesia, Malaysia, and Thailand have adopted numerous technologies, such as learning management systems (LMS). The purpose of this study is to identify the significant factors that influence the use of university LMS in relation to student satisfaction, using LMS as the object and extending the Delone McLean model by testing the self-efficacy factor. Incorporating computer self-efficacy (CSE) variables into the conceptual framework was a modification we made following a review of the best available literature.

A. Information Qualtity (IQ) and Student Satisfaction (SS)

Users receive information from information systems. Measures such as timeliness, correctness, completeness, consistency, and relevance can be used to assess the quality of system information [5]. The higher the information quality, the greater the user satisfaction with the system [6].

Manuscript received XXX; revised XXX; accepted XXX.

F. A. Author and T. C. Author are with the National Institute of Standards and Technology, Boulder, CO 80305 USA.

S. B. Author was with Rice University, Houston, TX 77005 USA. He is now with the Department of Physics, Colorado State University, Fort Collins, CO 80523 USA.

*Correspondence: khoerul.umam@uhamka.ac.id

According to Al-Samarraie (2018), to identify the quality of information, it will be seen how much the role of influence on student user satisfaction [7]. Furthermore, a previous study has demonstrated that information quality significantly impacts student LMS satisfaction [8]. To explore if the quality of information influences student satisfaction with the university LMS, the first hypothesis states:
H1: Information quality (IQ) significantly influences student satisfaction (SS).

B. *System Quality (SQ) and Student Satisfaction (SS)*

System quality refers to the performance of the system as perceived by users [9]. According to [4], user satisfaction, technological achievement, and organizational and individual impact are good system quality indicators. Usability, responsiveness, availability, adaptability, and dependability are specific system quality components [5]. A number of studies [8]–[12] have revealed that system quality significantly impacts student satisfaction. The more satisfied students are with the LMS, the more accessible and reliable they believe it to be. The second hypothesis is as follow:
H2: System quality (SQ) significantly influences student satisfaction (SS).

C. *Service Quality (SeQ) and Student Satisfaction (SS)*

According to Noorman bin Masrek (2007), service quality is the overall quantity of support provided by a service provider. [13]. According to recent research, it refers to service characteristics such as responsiveness, availability, and efficacy. Previous studies have found a correlation between service quality and student satisfaction. According to earlier studies [11]–[14], service quality predicts students' satisfaction. However, service quality has no bearing on student satisfaction. Based on these findings, universities' student satisfaction services are being evaluated. The third hypothesis is as follow:
H3: Service quality (SeQ) has a significant positive effect on Student Satisfaction (SS).

D. *Computer Self-Efficacy (CSE) and Student Satisfaction (SS)*

Self-efficacy is an individual's belief in students' ability to complete a task and achieve a certain level of performance with their talents; hence, self-efficacy beliefs influence how people motivate themselves and behave [15].

The original concept of self-efficacy included confidence in one's ability to use abilities such as computers and information technology. Later management information systems (MIS) researchers established computer self-efficacy (CSE) as a critical MIS study construct. It is defined as "an individual's perception of his or her ability to perform a task using a computer" [16]. Computer self-efficacy is positively associated with e-learning outcomes, as measured by average test scores in e-learning [17]. Among E-learners, self-efficacy and perceived system utility are positively related to perceived content value, course satisfaction, and course performance [18].

Other research has looked into the attitudes and behaviors that influence the use of course management systems. A significant positive link was discovered between self-efficacy and the intention to use e-learning technologies. Computer self-efficacy, achievement value, utility value, and intrinsic value were all significant predictors of persons' intention to continue utilizing web-based learning [19]. Self-efficacy, learner satisfaction, and perceived usefulness were discovered to have strong positive correlations [20]. Therefore, the fourth and fifth hypotheses are as follows:
H4: Computer self-efficacy (CSE) significantly influences student satisfaction (SS).
H5: Computer self-efficacy (CSE) significantly influences LMS usage (LU).

E. *Student Satisfaction (SS) and LMS Usage (LU)*

Many previous studies examined the relationship between user satisfaction and individual impact [21], [22], user satisfaction, and learning outcomes [23]. These studies consistently demonstrate a positive correlation between user satisfaction and learning outcomes' efficacy. Therefore, the sixth hypothesis is as follows:
H6: Student satisfaction (SS) has a positive effect on LMS usage (LU)

III. METHOD

A. *Participants*

The study involved 311 undergraduate students from two private Islamic universities in Jakarta, Indonesia. The responding students ranged in age from 18 to 24, with a 36% male to 64% female ratio based on random sampling. From May to July 2023, respondents completed the questionnaire via a Google Form link.

B. *Data Collection*

Students reported their LMS learning experiences in this section. The primary purpose of this research is to determine how computer self-efficacy (CSE) affects LMS utilization and student satisfaction. Using the research findings, the performance of the LMS can be examined, and virtual learning can be improved.

In this study, researchers collaborated with the university to disseminate the questionnaires to the students, and it only took the respondents 10-15 minutes to complete the questions. Since there were repeat respondents, only 311 respondents matched the criteria. The questionnaire measured 21 model constructs using a Likert scale of 1 (strongly disagree) to 5 (strongly agree).

C. *Measures*

This study analyzed data using the structural equation modeling (SEM) approach and the Smart PLS version 3.0 program [28]. PLS is a well-known method for evaluating structural model path coefficients that have gained popularity in marketing research over the last decade due to its capacity to model latent structures under irregularity and small to medium sample sizes [29]. PLS research has been undertaken and found to be an appropriate component of this study. Furthermore, the PLS algorithm mechanism was utilized to evaluate the set, weights, and path coefficients and determine the significance of the hypothesis using the bootstrap method (5000 samples). This measurement model

is accurate and effective for empirical validation processes [30].

IV. RESULTS

A. Measurement model evaluation

In this step, the measurement model (outer model) is evaluated to explain and discover the relationship between the latent variable and the indicators. This is related to the instrument's validity and reliability [24]. The validity of the instruments was assessed using discriminant and convergent validity. According to Table I, the instruments' validity was assessed using discriminant and convergent validity.

TABLE I: MEASUREMENT CONSTRUCTS

Construct	Item	Statement
Informaton Quality	IQ1	I can obtain accurate information from LMS.
	IQ2	The LMS can provide me with the information I need to accomplish my duties.
	IQ3	LMS can provide updated task-related information.
	IQ4	The LMS can provide me with up-to-date task information.
System Quality	SQ1	The LMS features an intuitive user interface.
	SQ2	The LMS provides time and location flexibility.
	SQ3	The LMS contains effective communication language.
	SQ4	LMS is readily accessible whenever I need to use it.
Service Quality	SeQ1	Training on the LMS's operation is sufficient.
	SeQ2	Multiple channels are available for communicating with the technicians.
	SeQ3	The provided training can enhance my ability to utilize LMS.
	SeQ4	In general, the university provides sufficient support for LMS usage.
Computer Self-Efficacy	CSE1	I am comfortable using a web browser.
	CSE2	I am confident completing tests online.
	CSE3	I am comfortable uploading/downloading files.
Students Satisfaction	SS1	The LMS applications have met my expectations.
	SS2	The LMS application is of good quality.
	SS3	The LMS application meets my requirements.
LMS Usage	LU1	Utilizing LMS is a wise decision.
	LU2	Working with the LMS is enjoyable.
	LU3	I enjoy working with LMS.

B. Construct Reliability, Convergent Validity, Discriminant Validity

Previous research results [25] were analyzed by calculating the loading factor value of each indicator in the displayed structure.

According to Table II, convergent validity is inferred if all indicators have loading factor values that satisfy the validity requirements and the value is greater than 0.70 (>0.70). The IQ1 and CSE3 indicator loadings are less than the threshold value (> 0.70), requiring their elimination. This finding is consistent with Ali's (2018) argument that any indication is good if its loading factor is greater than 0.70 [26].

Following the analysis of the loading factor data, we proceed to the interpretation of composite reliability (CR). A limit value of more than 0.6 is appropriate, while a value > 0.7 is acceptable. The average occurrence (AVE) value is another indicator of convergent validity. The AVE value defines the degree of variation or set of manifest variables that a latent concept may have. As a result, the wider the variance or range of manifest variables that a latent partner can incorporate, the more thoroughly reflected the manifest variable will be in its latent construct.

When examining convergent validity parameters, AVE is recommended. A minimum AVE of 0.5 implies that convergent validity is a reliable indication. On average, the latent variable can explain more than half of the predictor variance. The AVE value is derived from the sum of the loading factor's squares minus the error.

TABLE II: MEASUREMENT MODEL

Construct	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Information Quality	IQ2	0.773	0.888	0.727
	IQ3	0.887		
	IQ4	0.892		
System Quality	SQ1	0.831	0.872	0.630
	SQ2	0.736		
	SQ3	0.812		
	SQ4	0.793		
Service Quality	SeQ1	0.759	0.890	0.670
	SeQ2	0.804		
	SeQ3	0.872		
	SeQ4	0.836		
Computer Self-Efficacy	CSE1	0.917	0.912	0.838
	CSE2	0.913		
Students Satisfaction	SS1	0.904	0.917	0.787
	SS2	0.890		
	SS3	0.867		
LMS Usage	LU1	0.752	0.890	0.731
	LU2	0.907		
	LU3	0.897		

Table II shows that the composite reliability and AVE values exceed the resultant AVE value for each latent variable by more than 0.5. This finding implies that both of these factors are highly reliable.

The discriminant validity of the heterotrait-monotrait ratio (HTMT) was applied to validate the measurement model. Previous research has used 0.90 as the maximum threshold of the HTMT ratio constructs [27], [28]. Table III shows the validation of the measurement model concerning this threshold value.

TABLE III: DISCRIMINANT VALIDITY OF HETEROTRAIT-MONOTRAIT RATIO (HTMT)

Construct	Computer Self Efficacy	Information Quality	LMS Usage	Service Quality	Student Satisfaction	System Quality
Computer Self Efficacy						
Information Quality	0.772					
LMS Usage	0.904	0.902				
Service Quality	0.916	0.864	1.092			
Student Satisfaction	0.632	0.976	0.836	0.729		
System Quality	0.795	0.833	0.959	0.832	0.973	

C. Structural model evaluation

After establishing the measurement model, the second stage in the two-step statistical technique for modeling the PLS-SEM model is to build the structural model. The path coefficients and explained variance are included in the structural model. After selecting 5000 random sub-samples with replacement from one original sample, the regression coefficients (or beta values) were refined using a bootstrapping method by generating bootstrap standard errors. The process must be run constantly 5000 times [27]. The PLS path model was then estimated using these subsamples.

Table IV summarizes the findings concerning the relevance of the routes corresponding to hypotheses H1, H2, H3, H4, H5, and H6. The data reveal that these pathways' 5% and 95% confidence interval values support hypotheses H1, H2, H5, and H6. However, H3 and H4 are rejected since the confidence interval values are less than zero for one-tailed testing with p-values of 0.05.

TABLE IV: HYPOTHESIS TESTING

Hypothesis	Path	Std.Beta	Std.Eror	T-value	Bias	Confidence Interval		Decision
						5.0%	95.0%	
H1	Information Quality -> Student Satisfaction	0.581	0.051	11.406	0.002	0.490	0.658	Supported
H2	System Quality -> Student Satisfaction	0.586	0.050	11.824	-0.003	0.506	0.668	Supported
H3	Service Quality -> Student Satisfaction	-0.087	0.045	1.933	0.002	-0.162	-0.012	Rejected
H4	Computer Self Efficacy -> Student Satisfaction	-0.130	0.042	3.088	0.001	-0.198	-0.060	Rejected
H5	Computer Self Efficacy -> LMS Usage	0.501	0.052	9.570	-0.001	0.416	0.588	Supported
H6	Student Satisfaction -> LMS Usage	0.441	0.057	7.788	-0.000	0.344	0.529	Supported

Note: $p < 0.05$ (1-tailed test)

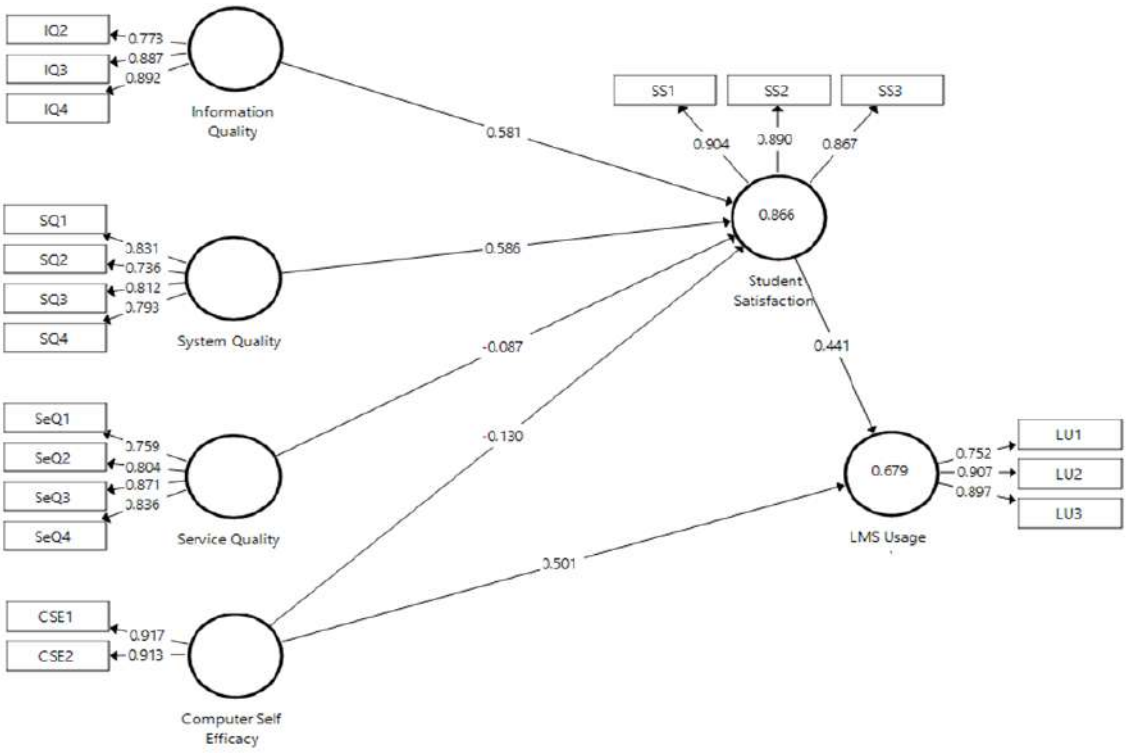

Fig. 1. Path analysis

The coefficient of determination (R square) is frequently used to analyze the model's predictive capacity and structural model. It is the squared correlation between the actual and expected values of an endogenous building. The coefficient represents the sum of the exogenous variables' effects on the latent endogenous variables. Because R Square has a range of 0-1, it is difficult to construct an exact rule of thumb. Higher numbers indicate higher prediction points. As a result, the value of student satisfaction and LMS usage is determined by the complexity of the model and the research discipline.

TABLE V: R SQUARE

	R Square	R Square Adjusted
LMS Usage	0.679	0.677
Student Satisfaction	0.866	0.864

The coefficient of determination (R2) in Figure 1 and Table V verifies the research's model. This coefficient measures the model's predictive ability and is computed as the squared correlation between the actual and predicted values of a specific endogenous construct [29]. Furthermore, the R2 value indicates the percentage of variation explained by each model construct. R2 values of 0.75, 0.50, and 0.25 for endogenous constructs can be classified as significant, moderate, and insignificant [30].

The R2 values of the dependent constructs, student satisfaction, and LMS usage, are displayed in Figure 1 and Table V. The model explains 86.6% of the variance in student satisfaction and 67.9% of the variance in LMS usage. The R2 values of the two dependent constructs (student satisfaction and LMS usage) are 0.866 and 0.679, respectively, which are considered sufficient [29]. Figure 1 also depicts the structural model with path coefficients for each path (hypothesized relationship) with a significant level and coefficient of determination (R2).

V. DISCUSSION

Model validity and reliability tests show that the established constructs are reliable and valid, which helps to verify the accuracy of the PLS-SEM-derived measurement model. Meanwhile, validation of the structural model shows that the generated model is not only a strong fit but also has exceptional predictive significance.

Hypotheses H1, H2, H5, and H6 are supported by the established structural model's results in direct effects. H3 and H4 were, however, rejected. The findings demonstrate that information and system quality have a direct positive impact on student happiness. LMS utilization is also influenced by computer self-efficacy and student satisfaction.

The value obtained for testing the first hypothesis (H1) is greater than zero within a confidence interval of 5% (0.490) and 95% (0.658), indicating that the results are supported. The beneficial influence of information quality on student satisfaction happens when university LMS is used. Previous research supports this finding [31]. Similarly, the other study discovered that information quality influences student satisfaction [32]. However, according to the findings of another study, information quality does not affect student satisfaction due to internal user variables [33].

The value above zero is achieved at a confidence interval of 5% (0.506) and 95% (0.668) for testing the second hypothesis (H2), indicating that the results are supported. Student satisfaction was found to be influenced by system quality. [18] produced similar results, demonstrating that good system quality of LMS technology benefits user satisfaction [10]. Other research has found that system quality influences student satisfaction [34]. However, a study by [35] found that system quality does not affect student satisfaction.

Quality feasibility aspects heavily influence user satisfaction outcomes.

The third hypothesis (H3) is rejected since a value above zero is obtained at a confidence interval of 5% (-0.612) and 95% (-0.012). According to [35], service quality has little effect on user satisfaction because user understanding of utilizing the LMS is inadequate [35]. [18] discovered the same thing: the limited menu of supporting services dissatisfied people with the LMS. However, according to Alzahrani and Seth (2021), the skill component of using LMS technology determines student happiness with LMS technology. In general, training for these users is significant in some universities. The same study found that a person's knowledge attitude influences their satisfaction with technology [32].

The fourth hypothesis (H4) is rejected when a value greater than zero is achieved at a confidence interval of 5% (-0.198) and 95% (-0.060). According to [10], computer self-efficacy influences student satisfaction with the LMS because it facilitates communication with operators and instruction to use the LMS, hence enhancing student skills to operate the LMS is needed [14], [36]. The same thing was also found by Prifti (2022) and [14 the factors of comprehension and skills in mastering technology immediately affect one's behavior in using the LMS, which has an impact on the level of satisfaction [37], [38]. However, according to [34], self-efficacy factor has no effect on satisfaction using the LMS [39].

The value above zero is achieved at a confidence interval of 5% (0.418) and 95% (0.588) for testing the fifth hypothesis (H5), indicating that the results are supported. As a result, computer self-efficacy (CSE) influences LMS utilization. According to [14], students' confidence in using the LMS impacts whether or not they continue to utilize the LMS [40].

The value above zero is achieved at a confidence interval of 5% (0.344) and 95% (0.529) for testing the sixth hypothesis (H6), indicating that the results are supported. LMS usage is influenced by user satisfaction. Learner satisfaction, according to [41], determines continuous usage of the LMS in online learning [37], [41].

VI. Conclusion

Based on the review of the literature and the findings of the research, it is concluded that there are numerous elements that influence learner satisfaction with using an LMS. The direct testing of six hypotheses reveals that four of them are supported. The findings show that information quality, system quality, and quality all have an impact on student satisfaction. While CSE and satisfaction have an impact on LMS utilization. We conclude that this study was a success. However, the rejected results require further investigation to demonstrate the impact of service quality and CSE on student satisfaction.

Conflict of Interest

This article's authors report no conflicts of interest.

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Computer Self-Efficacy on Using Learning Management System: From the Lens of Undergraduate Students

Khoerul Umam*, Zulherman, Wati Sukmawati, Irdalisa, Supriansyah,

***Abstract*—The university's development of learning-supporting technology is diverse, with the benefits and ease of providing flexible and effective learning possibilities both offline and online. Learning management systems (LMS) are examples of Internet-based technology that are commonly employed in developed countries. However, developing countries such as Indonesia are still among the few that only employ LMS as media support for university study. Many factors both support and hinder the practical usage of LMS. As a result, the goal of the study was to assess the factors influencing the successful usage of LMS at the university using the Delone McLean model approach (D&M). This model was modified, and a broad factor called Computer Self-Efficacy (CSE) was introduced, which was tested using a questionnaire on 311 undergraduate students. Six hypotheses were tested, and the results showed that four were supported and two were rejected. Based on these findings, it concluded that this study had helped to modify the D&M model, which can improve the ability of students' services in online learning and encourage students' self-efficacy gradually.**

***Index Terms*— delone mclean model, computer self-efficacy, learning management system,**

I. Introduction

Internet technology, mainly digital learning, has an impact on education. Teachers and students are affected by online university learning [1]. Additionally, growing in popularity is technology-based education in emerging nations, notably in Southeast Asia.

Both internal and external causes influence technology development. LMS-based learning technology is common in developing nations [2]. Most of the users of LMS are university students and teachers. It will become clear from examining the implementation that user satisfaction shows how well the technology was implemented. As a result, the model theory method must serve as the foundation for evaluating this achievement.

Self-efficacy is a user trait that is a fascinating example of how everyone has different views. In order to improve job performance, a person must have self-efficacy, which is the belief in one's capacity to fulfill tasks [3]. Although self-efficacy is commonly utilized in various user technology issues, according to prior research, only some have used it to assess how well LMS technology has been implemented.

This study aims to identify the elements that affect university students' satisfaction with the LMS. In order to determine if a user has confidence using the LMS, which affects the chance that performance will increase, the researchers apply the Delone McLean model theory method and add the computer self-efficacy (CSE) element.

II. Literature Review

Numerous LMS acceptance studies [4,14] have used the Technology Acceptance Model (TAM) model and the Unified Technology Acceptance and Use of Technology (UTAUT) model. According to the [4], technology users' behavioral attitudes are measured using internal and external elements using the TAM and UTAUT models. Due to user behavior limitations, TAM and UTAUT models are unable to assess technology usage.

Because a similar model has been widely used in earlier research, the information system (IS), which uses the system and satisfaction [4], is usually used in the theory of D&M model. The most popular TAM and UTAUT models were employed, and a number of conceptual models were created in earlier research on the adoption of technology. However, the UTAUT model can only account for user satisfaction and the usage of the system as a modifying factor to mitigate individual effects. As a result, researchers try to include another variable.

In previous research, the Delone McLean model [4] was proposed because of its six-factor complexity, which included system quality, information quality, service quality, user satisfaction, system utilization, and institutional effect. This model was seen to be superior to the TAM model and the UTAUT model. Therefore, the advantages of the Delone McLean model are the greatest [4]. In the sphere of education, developing nations such as Indonesia, Malaysia, and Thailand have adopted numerous technologies, such as learning management systems (LMS). The purpose of this study is to identify the significant factors that influence the use of university LMS in relation to student satisfaction, using LMS as the object and extending the Delone McLean model by testing the self-efficacy factor. Incorporating computer self-efficacy (CSE) variables into the conceptual framework was a modification we made following a review of the best available literature.

A. Information Qualtity (IQ) and Student Satisfaction (SS)

Users receive information from information systems. Measures such as timeliness, correctness, completeness, consistency, and relevance can be used to assess the quality of system information [5]. The higher the information quality, the greater the user satisfaction with the system [6].

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According to Al-Samarraie (2018), to identify the quality of information, it will be seen how much the role of influence on student user satisfaction [7]. Furthermore, a previous study has demonstrated that information quality significantly impacts student LMS satisfaction [8]. To explore if the quality of information influences student satisfaction with the university LMS, the first hypothesis states:
H1: Information quality (IQ) significantly influences student satisfaction (SS).

B. System Quality (SQ) and Student Satisfaction (SS)

System quality refers to the performance of the system as perceived by users [9]. According to [4], user satisfaction, technological achievement, and organizational and individual impact are good system quality indicators. Usability, responsiveness, availability, adaptability, and dependability are specific system quality components [5]. A number of studies [8]–[12] have revealed that system quality significantly impacts student satisfaction. The more satisfied students are with the LMS, the more accessible and reliable they believe it to be. The second hypothesis is as follow:
H2: System quality (SQ) significantly influences student satisfaction (SS).

C. Service Quality (SeQ) and Student Satisfaction (SS)

According to Noorman bin Masrek (2007), service quality is the overall quantity of support provided by a service provider. [13]. According to recent research, it refers to service characteristics such as responsiveness, availability, and efficacy. Previous studies have found a correlation between service quality and student satisfaction. According to earlier studies [11]–[14], service quality predicts students' satisfaction. However, service quality has no bearing on student satisfaction. Based on these findings, universities' student satisfaction services are being evaluated. The third hypothesis is as follow:
H3: Service quality (SeQ) has a significant positive effect on Student Satisfaction (SS).

D. Computer Self-Efficacy (CSE) and Student Satisfaction (SS)

Self-efficacy is an individual's belief in students' ability to complete a task and achieve a certain level of performance with their talents; hence, self-efficacy beliefs influence how people motivate themselves and behave [15].

The original concept of self-efficacy included confidence in one's ability to use abilities such as computers and information technology. Later management information systems (MIS) researchers established computer self-efficacy (CSE) as a critical MIS study construct. It is defined as "an individual's perception of his or her ability to perform a task using a computer" [16]. Computer self-efficacy is positively associated with e-learning outcomes, as measured by average test scores in e-learning [17]. Among E-learners, self-efficacy and perceived system utility are positively related to perceived content value, course satisfaction, and course performance [18].

Other research has looked into the attitudes and behaviors that influence the use of course management systems. A significant positive link was discovered between self-efficacy and the intention to use e-learning technologies. Computer self-efficacy, achievement value, utility value, and intrinsic value were all significant predictors of persons' intention to continue utilizing web-based learning [19]. Self-efficacy, learner satisfaction, and perceived usefulness were discovered to have strong positive correlations [20]. Therefore, the fourth and fifth hypotheses are as follows:
H4: Computer self-efficacy (CSE) significantly influences student satisfaction (SS).
H5: Computer self-efficacy (CSE) significantly influences LMS usage (LU).

E. Student Satisfaction (SS) and LMS Usage (LU)

Many previous studies examined the relationship between user satisfaction and individual impact [21], [22], user satisfaction, and learning outcomes [23]. These studies consistently demonstrate a positive correlation between user satisfaction and learning outcomes' efficacy. Therefore, the sixth hypothesis is as follows:
H6: Student satisfaction (SS) has a positive effect on LMS usage (LU)

III. METHOD

A. Participants

The study involved 311 undergraduate students from two private Islamic universities in Jakarta, Indonesia. The responding students ranged in age from 18 to 24, with a 36% male to 64% female ratio based on random sampling. From May to July 2023, respondents completed the questionnaire via a Google Form link.

B. Data Collection

Students reported their LMS learning experiences in this section. The primary purpose of this research is to determine how computer self-efficacy (CSE) affects LMS utilization and student satisfaction. Using the research findings, the performance of the LMS can be examined, and virtual learning can be improved.

In this study, researchers collaborated with the university to disseminate the questionnaires to the students, and it only took the respondents 10-15 minutes to complete the questions. Since there were repeat respondents, only 311 respondents matched the criteria. The questionnaire measured 21 model constructs using a Likert scale of 1 (strongly disagree) to 5 (strongly agree).

C. Measures

This study analyzed data using the structural equation modeling (SEM) approach and the Smart PLS version 3.0 program [28]. PLS is a well-known method for evaluating structural model path coefficients that have gained popularity in marketing research over the last decade due to its capacity to model latent structures under irregularity and small to medium sample sizes [29]. PLS research has been undertaken and found to be an appropriate component of this study. Furthermore, the PLS algorithm mechanism was utilized to evaluate the set, weights, and path coefficients and determine the significance of the hypothesis using the bootstrap method (5000 samples). This measurement model

is accurate and effective for empirical validation processes [30].

IV. RESULTS

A. Measurement model evaluation

In this step, the measurement model (outer model) is evaluated to explain and discover the relationship between the latent variable and the indicators. This is related to the instrument's validity and reliability [24]. The validity of the instruments was assessed using discriminant and convergent validity. According to Table I, the instruments' validity was assessed using discriminant and convergent validity.

TABLE I: MEASUREMENT CONSTRUCTS

Construct	Item	Statement
Informaton Quality	IQ1	I can obtain accurate information from LMS.
	IQ2	The LMS can provide me with the information I need to accomplish my duties.
	IQ3	LMS can provide updated task-related information.
	IQ4	The LMS can provide me with up-to-date task information.
System Quality	SQ1	The LMS features an intuitive user interface.
	SQ2	The LMS provides time and location flexibility.
	SQ3	The LMS contains effective communication language.
	SQ4	LMS is readily accessible whenever I need to use it.
Service Quality	SeQ1	Training on the LMS's operation is sufficient.
	SeQ2	Multiple channels are available for communicating with the technicians.
	SeQ3	The provided training can enhance my ability to utilize LMS.
	SeQ4	In general, the university provides sufficient support for LMS usage.
Computer Self-Efficacy	CSE1	I am comfortable using a web browser.
	CSE2	I am confident completing tests online.
	CSE3	I am comfortable uploading/downloading files.
Students Satisfaction	SS1	The LMS applications have met my expectations.
	SS2	The LMS application is of good quality.
	SS3	The LMS application meets my requirements.
LMS Usage	LU1	Utilizing LMS is a wise decision.
	LU2	Working with the LMS is enjoyable.
	LU3	I enjoy working with LMS.

B. Construct Reliability, Convergent Validity, Discriminant Validity

Previous research results [25] were analyzed by calculating the loading factor value of each indicator in the displayed structure.

According to Table II, convergent validity is inferred if all indicators have loading factor values that satisfy the validity requirements and the value is greater than 0.70 (>0.70). The IQ1 and CSE3 indicator loadings are less than the threshold value (> 0.70), requiring their elimination. This finding is consistent with Ali's (2018) argument that any indication is good if its loading factor is greater than 0.70 [26].

Following the analysis of the loading factor data, we proceed to the interpretation of composite reliability (CR). A limit value of more than 0.6 is appropriate, while a value > 0.7 is acceptable. The average occurrence (AVE) value is another indicator of convergent validity. The AVE value defines the degree of variation or set of manifest variables that a latent concept may have. As a result, the wider the variance or range of manifest variables that a latent partner can incorporate, the more thoroughly reflected the manifest variable will be in its latent construct.

When examining convergent validity parameters, AVE is recommended. A minimum AVE of 0.5 implies that convergent validity is a reliable indication. On average, the latent variable can explain more than half of the predictor variance. The AVE value is derived from the sum of the loading factor's squares minus the error.

TABLE II: MEASUREMENT MODEL

Construct	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Information Quality	IQ2	0.773	0.888	0.727
	IQ3	0.887		
	IQ4	0.892		
System Quality	SQ1	0.831	0.872	0.630
	SQ2	0.736		
	SQ3	0.812		
	SQ4	0.793		
Service Quality	SeQ1	0.759	0.890	0.670
	SeQ2	0.804		
	SeQ3	0.872		
	SeQ4	0.836		
Computer Self-Efficacy	CSE1	0.917	0.912	0.838
	CSE2	0.913		
Students Satisfaction	SS1	0.904	0.917	0.787
	SS2	0.890		
	SS3	0.867		
LMS Usage	LU1	0.752	0.890	0.731
	LU2	0.907		
	LU3	0.897		

Table II shows that the composite reliability and AVE values exceed the resultant AVE value for each latent variable by more than 0.5. This finding implies that both of these factors are highly reliable.

The discriminant validity of the heterotrait-monotrait ratio (HTMT) was applied to validate the measurement model. Previous research has used 0.90 as the maximum threshold of the HTMT ratio constructs [27], [28]. Table III shows the validation of the measurement model concerning this threshold value.

TABLE III: DISCRIMINANT VALIDITY OF HETEROTRAIT-MONOTRAIT RATIO (HTMT)

Construct	Computer Self Efficacy	Information Quality	LMS Usage	Service Quality	Student Satisfaction	System Quality
Computer Self Efficacy						
Information Quality	0.772					
LMS Usage	0.904	0.902				
Service Quality	0.916	0.864	1.092			
Student Satisfaction	0.632	0.976	0.836	0.729		
System Quality	0.795	0.833	0.959	0.832	0.973	

C. *Structural model evaluation*

After establishing the measurement model, the second stage in the two-step statistical technique for modeling the PLS-SEM model is to build the structural model. The path coefficients and explained variance are included in the structural model. After selecting 5000 random sub-samples with replacement from one original sample, the regression coefficients (or beta values) were refined using a bootstrapping method by generating bootstrap standard errors. The process must be run constantly 5000 times [27]. The PLS path model was then estimated using these subsamples.

Table IV summarizes the findings concerning the relevance of the routes corresponding to hypotheses H1, H2, H3, H4, H5, and H6. The data reveal that these pathways' 5% and 95% confidence interval values support hypotheses H1, H2, H5, and H6. However, H3 and H4 are rejected since the confidence interval values are less than zero for one-tailed testing with p-values of 0.05.

TABLE IV: HYPOTHESIS TESTING

Hypothesis	Path	Std.Beta	Std.Eror	T-value	Bias	Confidence Interval		Decision
						5.0%	95.0%	
H1	Information Quality -> Student Satisfaction	0.581	0.051	11.406	0.002	0.490	0.658	Supported
H2	System Quality -> Student Satisfaction	0.586	0.050	11.824	-0.003	0.506	0.668	Supported
H3	Service Quality -> Student Satisfaction	-0.087	0.045	1.933	0.002	-0.162	-0.012	Rejected
H4	Computer Self Efficacy -> Student Satisfaction	-0.130	0.042	3.088	0.001	-0.198	-0.060	Rejected
H5	Computer Self Efficacy -> LMS Usage	0.501	0.052	9.570	-0.001	0.416	0.588	Supported
H6	Student Satisfaction -> LMS Usage	0.441	0.057	7.788	-0.000	0.344	0.529	Supported

Note: $p < 0.05$ (1-tailed test)

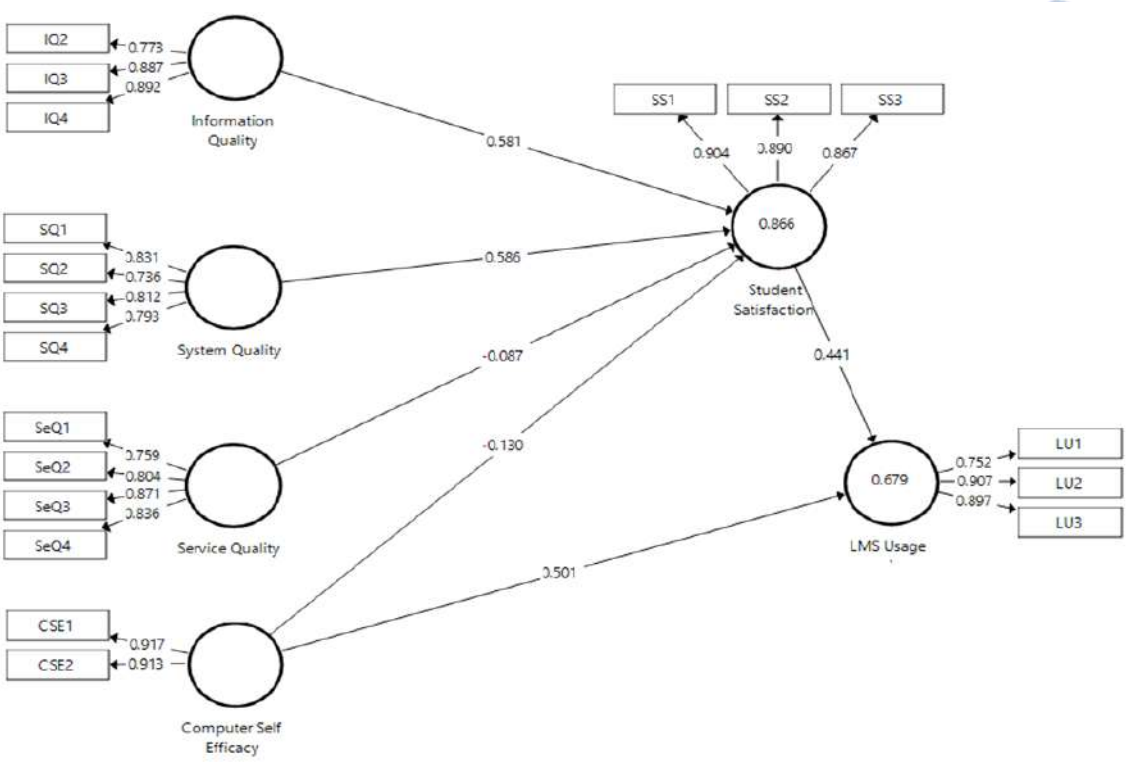

Fig. 1. Path analysis

The coefficient of determination (R square) is frequently used to analyze the model's predictive capacity and structural model. It is the squared correlation between the actual and expected values of an endogenous building. The coefficient represents the sum of the exogenous variables' effects on the latent endogenous variables. Because R Square has a range of 0-1, it is difficult to construct an exact rule of thumb. Higher numbers indicate higher prediction points. As a result, the value of student satisfaction and LMS usage is determined by the complexity of the model and the research discipline.

TABLE V: R SQUARE

	R Square	R Square Adjusted
LMS Usage	0.679	0.677
Student Satisfaction	0.866	0.864

The coefficient of determination (R2) in Figure 1 and Table V verifies the research's model. This coefficient measures the model's predictive ability and is computed as the squared correlation between the actual and predicted values of a specific endogenous construct [29]. Furthermore, the R2 value indicates the percentage of variation explained by each model construct. R2 values of 0.75, 0.50, and 0.25 for endogenous constructs can be classified as significant, moderate, and insignificant [30].

The R2 values of the dependent constructs, student satisfaction, and LMS usage, are displayed in Figure 1 and Table V. The model explains 86.6% of the variance in student satisfaction and 67.9% of the variance in LMS usage. The R2 values of the two dependent constructs (student satisfaction and LMS usage) are 0.866 and 0.679, respectively, which are considered sufficient [29]. Figure 1 also depicts the structural model with path coefficients for each path (hypothesized relationship) with a significant level and coefficient of determination (R2).

V. DISCUSSION

Model validity and reliability tests show that the established constructs are reliable and valid, which helps to verify the accuracy of the PLS-SEM-derived measurement model. Meanwhile, validation of the structural model shows that the generated model is not only a strong fit but also has exceptional predictive significance.

Hypotheses H1, H2, H5, and H6 are supported by the established structural model's results in direct effects. H3 and H4 were, however, rejected. The findings demonstrate that information and system quality have a direct positive impact on student happiness. LMS utilization is also influenced by computer self-efficacy and student satisfaction.

The value obtained for testing the first hypothesis (H1) is greater than zero within a confidence interval of 5% (0.490) and 95% (0.658), indicating that the results are supported. The beneficial influence of information quality on student satisfaction happens when university LMS is used. Previous research supports this finding [31]. Similarly, the other study discovered that information quality influences student satisfaction [32]. However, according to the findings of another study, information quality does not affect student satisfaction due to internal user variables [33].

The value above zero is achieved at a confidence interval of 5% (0.506) and 95% (0.668) for testing the second hypothesis (H2), indicating that the results are supported. Student satisfaction was found to be influenced by system quality. [18] produced similar results, demonstrating that good system quality of LMS technology benefits user satisfaction [10]. Other research has found that system quality influences student satisfaction [34]. However, a study by [35] found that system quality does not affect student satisfaction.

Quality feasibility aspects heavily influence user satisfaction outcomes.

The third hypothesis (H3) is rejected since a value above zero is obtained at a confidence interval of 5% (-0.612) and 95% (-0.012). According to [35], service quality has little effect on user satisfaction because user understanding of utilizing the LMS is inadequate [35]. [18] discovered the same thing: the limited menu of supporting services dissatisfied people with the LMS. However, according to Alzahrani and Seth (2021), the skill component of using LMS technology determines student happiness with LMS technology. In general, training for these users is significant in some universities. The same study found that a person's knowledge attitude influences their satisfaction with technology [32].

The fourth hypothesis (H4) is rejected when a value greater than zero is achieved at a confidence interval of 5% (-0.198) and 95% (-0.060). According to [10], computer self-efficacy influences student satisfaction with the LMS because it facilitates communication with operators and instruction to use the LMS, hence enhancing student skills to operate the LMS is needed [14], [36]. The same thing was also found by Prifti (2022) and [14 the factors of comprehension and skills in mastering technology immediately affect one's behavior in using the LMS, which has an impact on the level of satisfaction [37], [38]. However, according to [34], self-efficacy factor has no effect on satisfaction using the LMS [39].

The value above zero is achieved at a confidence interval of 5% (0.418) and 95% (0.588) for testing the fifth hypothesis (H5), indicating that the results are supported. As a result, computer self-efficacy (CSE) influences LMS utilization. According to [14], students' confidence in using the LMS impacts whether or not they continue to utilize the LMS [40].

The value above zero is achieved at a confidence interval of 5% (0.344) and 95% (0.529) for testing the sixth hypothesis (H6), indicating that the results are supported. LMS usage is influenced by user satisfaction. Learner satisfaction, according to [41], determines continuous usage of the LMS in online learning [37], [41].

VI. Conclusion

Based on the review of the literature and the findings of the research, it is concluded that there are numerous elements that influence learner satisfaction with using an LMS. The direct testing of six hypotheses reveals that four of them are supported. The findings show that information quality, system quality, and quality all have an impact on student satisfaction. While CSE and satisfaction have an impact on LMS utilization. We conclude that this study was a success. However, the rejected results require further investigation to demonstrate the impact of service quality and CSE on student satisfaction.

Conflict of Interest

This article's authors report no conflicts of interest.

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Computer Self-efficacy on Using Learning Management System: From the Lens of Undergraduate Students

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Abstract—The development of technological shapes to support learning process both online and offline becoming more diverse to achieve the learning quality with ease, flexible and effective. Learning Management Systems (LMS) are examples of Internet-based technology that are commonly employed in developed countries. However, the number university using LMS as media learning support in developing countries such as Indonesia are limited Many factors both support and hinder the practical usage of LMS. As a result, the goal of the study was to assess the factors influencing the successful usage of LMS at the university using the Delone McLean model approach (D&M). This model was modified, and a broad factor called Computer Self-Efficacy (CSE) was introduced, which was tested using a questionnaire on 311 undergraduate students. Six hypotheses were tested, four of which were supported and two were rejected. Based on these findings, it concluded that this study had helped to modify the D&M model, which can improve the ability of students' services in online learning and encourage students' self-efficacy gradually.

Keywords—Delone Mclean model, computer self-efficacy, learning management system
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I. Introduction

Internet technology has significant influenced to the quality of digital learning process in the classroom. Teachers and students are affected by online university learning [1]. Additionally, growing in popularity is technology-based education in emerging nations, notably in Southeast Asia.

Both internal and external causes influence technology development. LMS-based learning technology is common in developing nations [2]. Most of the users of LMS are university students and teachers. It will become clear from examining the implementation that user satisfaction shows how well the technology was implemented. As a result, the model theory method must serve as the foundation for evaluating this achievement.

Self-efficacy is a user trait that is a fascinating example of how everyone has different views. In order to improve job performance, a person must have self-efficacy, which is the belief in one's capacity to fulfill tasks [3]. Although self-efficacy is commonly utilized in various user technology issues, according to prior research, only some have used it to assess how well LMS technology has been implemented.

This study aims to identify the elements that affect university students' satisfaction with the LMS. In order to determine if a user has confidence using the LMS, which affects the chance that performance will increase, the researchers apply the Delone McLean (D&M) model theory method and add the computer self-efficacy (CSE) element.

Numerous LMS acceptance studies [4, 5] have used the Technology Acceptance Model (TAM) model and the Unified Technology Acceptance and Use of Technology (UTAUT) model. According to Jeyaraj [4], technology users' behavioral attitudes are measured using internal and external elements using the TAM and UTAUT models. Due to user behavior limitations, TAM and UTAUT models are unable to assess technology usage.

Because a similar model has been widely used in earlier research, the Information System (IS), which uses the system and satisfaction [4], is usually used in the theory of D&M model. The most popular TAM and UTAUT models were employed, and a number of conceptual models were created in earlier research on the adoption of technology. However, the UTAUT model can only account for user satisfaction and the usage of the system as a modifying factor to mitigate individual effects. As a result, researchers try to include another variable.

In previous research, the Delone McLean model [4] was proposed because of its six-factor complexity, which included system quality, information quality, service quality, user satisfaction, system utilization, and institutional effect. This model was seen to be superior to the TAM model and the UTAUT model. Therefore, the advantages of the Delone McLean model are the greatest [4]. In the sphere of education, developing nations such as Indonesia, Malaysia, and Thailand have adopted numerous technologies, such as learning management systems (LMS). The purpose of this study is to identify the significant factors that influence the use of university LMS in relation to student satisfaction, using LMS as the object and extending the Delone McLean model by testing the self-efficacy factor. Incorporating computer self-efficacy (CSE) variables into the conceptual framework was a modification we made following a review of the best available literature.

A. Information Qualtity (IQ) and Student Satisfaction (SS)

Users receive information from information systems. Measures such as timeliness, correctness, completeness, consistency, and relevance can be used to assess the quality of system information [6]. The higher the information quality, the greater the user satisfaction with the system [7]. According to [8], to identify the quality of information, it will be seen how much the role of influence on student user satisfaction [8]. Furthermore, a previous study has demonstrated that information quality significantly impacts student LMS satisfaction [9]. To explore if the quality of information influences student satisfaction with the university

LMS, the first hypothesis states:

H1: Information quality (IQ) significantly influences student satisfaction (SS).

B. System Quality (SQ) and Student Satisfaction (SS)

System quality refers to the performance of the system as perceived by users [10]. According to [4] user satisfaction, technological achievement, and organizational and individual impact are good system quality indicators. Usability, responsiveness, availability, adaptability, and dependability are specific system quality components [5, 11]. A number of studies [8–10, 12] have revealed that system quality significantly impacts student satisfaction. The more satisfied students are with the LMS, the more accessible and reliable they believe it to be. The second hypothesis is as follow [12]:

H2: System quality (SQ) significantly influences student satisfaction (SS).

C. Service Quality (SeQ) and Student Satisfaction (SS)

According to [13] Noorman bin Masrek (2007), service quality is the overall quantity of support provided by a service provider.. According to [14] recent research, it refers to service characteristics such as responsiveness, availability, and efficacy. Previous studies [15] have found a correlation between service quality and student satisfaction. According to earlier studies [13], service quality predicts students' satisfaction. However, service quality has no bearing on student satisfaction. Based on these findings, universities' student satisfaction services are being evaluated. The third hypothesis is as follow:

H3: Service quality (SeQ) has a significant positive effect on Student Satisfaction (SS).

D. Computer Self-Efficacy (CSE) and Student Satisfaction (SS)

Self-efficacy is an individual's belief in students' ability to complete a task and achieve a certain level of performance with their talents; hence, self-efficacy beliefs influence how people motivate themselves and behave [16].

The original concept of self-efficacy included confidence in one's ability to use abilities such as computers and information technology. Later management information systems (MIS) researchers established computer self-efficacy (CSE) as a critical MIS study construct. It is defined as "an individual's perception of his or her ability to perform a task using a computer" [17]. Computer self-efficacy is positively associated with e-learning outcomes, as measured by average test scores in e-learning [18]. Among E-learners, self-efficacy and perceived system utility are positively related to perceived content value, course satisfaction, and course performance [19].

Other research has looked into the attitudes and behaviors that influence the use of course management systems. A significant positive link was discovered between self-efficacy and the intention to use e-le=arning technologies. Computer self-efficacy, achievement value, utility value, and intrinsic value were all significant predictors of persons' intention to continue utilizing web-based learning [20]. Self-efficacy, learner satisfaction, and perceived usefulness were discovered to have strong positive correlations [21]. Therefore, the fourth and fifth hypotheses are as follows:

H4: Computer self-efficacy (CSE) significantly influences student satisfaction (SS).

H5: Computer self-efficacy (CSE) significantly influences LMS usage (LU).

E. Student Satisfaction (SS) and LMS Usage (LU)

Many previous studies examined the relationship between user satisfaction and individual impact [22, 23], user satisfaction, and learning outcomes [24, 25]. These studies consistently demonstrate a positive correlation between user satisfaction and learning outcomes' efficacy. Therefore, the sixth hypothesis is as follows [26]:

H6: Student satisfaction (SS) has a positive effect on LMS usage (LU)

II. Method

A. Participants

The study involved 311 undergraduate students from two private Islamic universities in Jakarta, Indonesia. The responding students ranged in age from 18 to 24, with a 36% male to 64% female ratio based on random sampling. From May to July 2023, respondents completed the questionnaire via a Google Form link [27].

B. Data Collection

Students reported their LMS learning experiences in this section. The primary purpose of this research is to determine how Computer Self-Efficacy (CSE) affects LMS utilization and student satisfaction. Using the research findings, the performance of the LMS can be examined, and virtual learning can be improved [28].

In this study, researchers collaborated with the university to disseminate the questionnaires to the students, and it only took the respondents 10-15 minutes to complete the questions. Since there were repeat respondents, only 311 respondents matched the criteria. The questionnaire measured 21 model constructs using a Likert scale of 1 (strongly disagree) to 5 (strongly agree) [29].

C. Measurementss

This study analyzed data using the Structural Equation Modeling (SEM) approach and the Smart PLS version 3.0 program [30]. PLS is a well-known method for evaluating structural model path coefficients that have gained popularity in marketing research over the last decade due to its capacity to model latent structures under irregularity and small to medium sample sizes [31]. PLS research has been undertaken and found to be an appropriate component of this study. Furthermore, the PLS algorithm mechanism was utilized to evaluate the set, weights, and path coefficients and determine the significance of the hypothesis using the bootstrap method (5000 samples). This measurement model is accurate and effective for empirical validation processes [31].

III. Results

A. Measurement Model Evaluation

In this step, the measurement model (outer model) is evaluated to explain and discover the relationship between the latent variable and the indicators. This is related to the

instrument's validity and reliability [26]. The validity of the instruments was assessed using discriminant and convergent validity. According to Table 1, the instruments' validity was assessed using discriminant and convergent validity.

Table 1. Measurement constructs

Construct	Item	Statement
Informaton Quality	IQ1	I can obtain accurate information from LMS.
	IQ2	The LMS can provide me with the information I need to accomplish my duties.
	IQ3	LMS can provide updated task-related information.
	IQ4	The LMS can provide me with up-to-date task information.
System Quality	SQ1	The LMS features an intuitive user interface.
	SQ2	The LMS provides time and location flexibility.
	SQ3	The LMS contains effective communication language.
	SQ4	LMS is readily accessible whenever I need to use it.
Service Quality	SeQ1	Training on the LMS's operation is sufficient.
	SeQ2	Multiple channels are available for communicating with the technicians.
	SeQ3	The provided training can enhance my ability to utilize LMS.
	SeQ4	In general, the university provides sufficient support for LMS usage.
Computer Self-Efficacy	CSE1	I am comfortable using a web browser.
	CSE2	I am confident completing tests online.
	CSE3	I am comfortable uploading/downloading files.
Students Satisfaction	SS1	The LMS applications have met my expectations.
	SS2	The LMS application is of good quality.
	SS3	The LMS application meets my requirements.
LMS Usage	LU1	Utilizing LMS is a wise decision.
	LU2	Working with the LMS is enjoyable.
	LU3	I enjoy working with LMS.

B. Construct Reliability, Convergent Validity, Discriminant Validity

Previous research results [27] were analyzed by calculating the loading factor value of each indicator in the displayed structure.

According to Table 2, convergent validity is inferred if all indicators have loading factor values that satisfy the validity requirements and the value is greater than 0.70 (>0.70). The IQ1 and CSE3 indicator loadings are less than the threshold value (<0.70), requiring their elimination. This finding is consistent with Ali's (2018) argument that any indication is good if its loading factor is greater than 0.70 [28].

Following the analysis of the loading factor data, we proceed to the interpretation of Composite Reliability (CR). A limit value of more than 0.6 is appropriate, while a value >0.7 is acceptable. The average occurrence (AVE) value is another indicator of convergent validity. The AVE value defines the degree of variation or set of manifest variables that a latent concept may have. As a result, the wider the variance or range of manifest variables that a latent partner can incorporate, the more thoroughly reflected the manifest variable will be in its latent construct.

When examining convergent validity parameters, AVE is recommended. A minimum AVE of 0.5 implies that convergent validity is a reliable indication. On average, the latent variable can explain more than half of the predictor variance. The AVE value is derived from the sum of the loading factor's squares minus the error.

Table 2 shows that the composite reliability and AVE values exceed the resultant AVE value for each latent variable by more than 0.5. This finding implies that both of these factors are highly reliable.

Table 2. Measurement model

Construct	Item	Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
Information Quality	IQ2	0.773	0.888	0.727
	IQ3	0.887		
	IQ4	0.892		
System Quality	SQ1	0.831	0.872	0.630
	SQ2	0.736		
	SQ3	0.812		
	SQ4	0.793		
Service Quality	SeQ1	0.759	0.890	0.670
	SeQ2	0.804		
	SeQ3	0.872		
	SeQ4	0.836		
Computer Self-Efficacy	CSE1	0.917	0.912	0.838
	CSE2	0.913		
Students Satisfaction	SS1	0.904	0.917	0.787
	SS2	0.890		
	SS3	0.867		
LMS Usage	LU1	0.752	0.890	0.731
	LU2	0.907		
	LU3	0.897		

The discriminant validity of the heterotrait-monotrait ratio (HTMT) was applied to validate the measurement model. Previous research has used 0.90 as the maximum threshold of the HTMT ratio constructs [29, 30]. Table 3 shows the validation of the measurement model concerning this threshold value.

Table 3. Discriminant validity of Heterotrait-Monotrait Ratio (HTMT)

Construct	Computer Self Efficacy_	Information Quality	LMS Usage	Service Quality	Student Satisfaction	System Quality
Computer Self Efficacy						
Information Quality	0.772					
LMS Usage	0.904	0.902				
Service Quality	0.916	0.864	1.092			
Student Satisfaction	0.632	0.976	0.836	0.729		
System Quality	0.795	0.833	0.959	0.832	0.973	

C. Structural Model Evaluation

After establishing the measurement model, the second stage in the two-step statistical technique for modeling the PLS-SEM model is to build the structural model. The path coefficients and explained variance are included in the structural model. After selecting 5000 random sub-samples with replacement from one original sample, the regression coefficients (or beta values) were refined using a bootstrapping method by generating bootstrap standard errors. The process must be run constantly 5000 times [29]. The PLS path model was then estimated using these subsamples.

Table 4 summarizes the findings concerning the relevance of the routes corresponding to hypotheses H1, H2, H3, H4, H5, and H6. The data reveal that these pathways' 5% and 95% confidence interval values support hypotheses H1, H2, H5, and H6. However, H3 and H4 are rejected since the confidence interval values are less than zero for one-tailed testing with p-values of 0.05.

Table 4. Hypothesis testing

Hypothesis	Path	Std.Beta	Std.Eror	T-value	Bias	Confidence Interval		Decision
						5.0%	95.0%	
H1	Information Quality → Student Satisfaction	0.581	0.051	11.406	0.002	0.490	0.658	Supported
H2	System Quality → Student Satisfaction	0.586	0.050	11.824	−0.003	0.506	0.668	Supported
H3	Service Quality → Student Satisfaction	−0.087	0.045	1.933	0.002	−0.162	−0.012	Rejected
H4	Computer Self Efficacy → Student Satisfaction	−0.130	0.042	3.088	0.001	−0.198	−0.060	Rejected
H5	Computer Self Efficacy → LMS Usage	0.501	0.052	9.570	−0.001	0.416	0.588	Supported
H6	Student Satisfaction → LMS Usage	0.441	0.057	7.788	−0.000	0.344	0.529	Supported

Note: p <0.05 (1-tailed test)

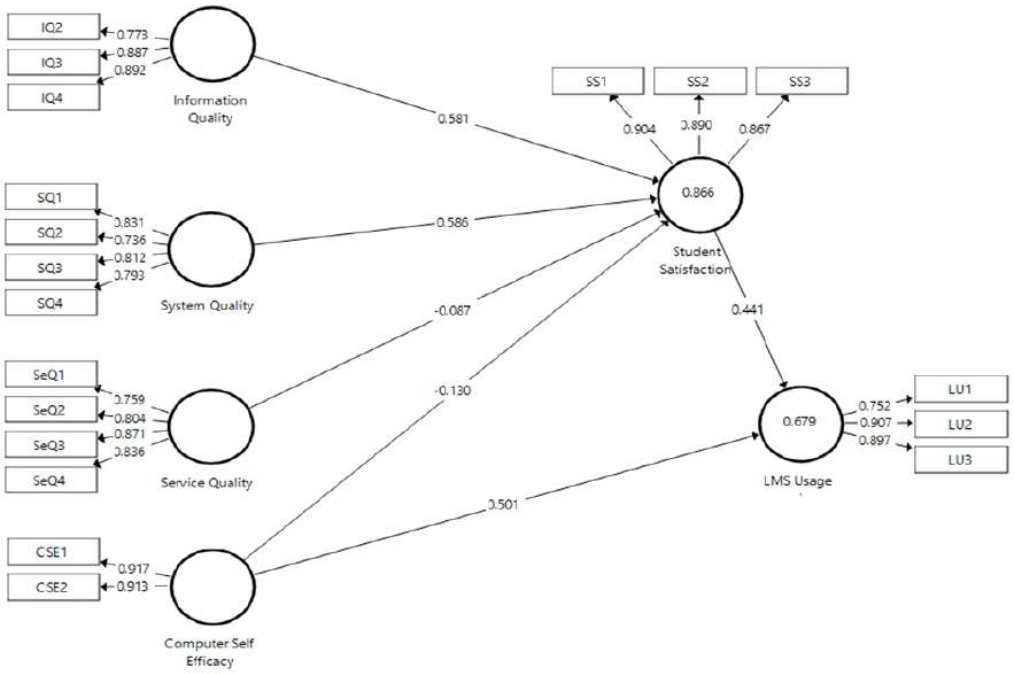

Fig. 1. Path analysis.

The coefficient of determination (R^2) is frequently used to analyze the model's predictive capacity and structural model. It is the squared correlation between the actual and expected values of an endogenous building. The coefficient represents the sum of the exogenous variables' effects on the latent endogenous variables. Because R^2 has a range of 0–1, it is

difficult to construct an exact rule of thumb. Higher numbers indicate higher prediction points. As a result, the value of student satisfaction and LMS usage is determined by the complexity of the model and the research discipline.

Table 5. The coefficient of determination (R^2)

	R^2	R^2 Adjusted
LMS Usage	0.679	0.677
Student Satisfaction	0.866	0.864

The coefficient of determination (R^2) in Fig. 1 and Table 5 verifies the research's model. This coefficient measures the model's predictive ability and is computed as the squared correlation between the actual and predicted values of a specific endogenous construct [31]. Furthermore, the R^2 value indicates the percentage of variation explained by each model construct. R^2 values of 0.75, 0.50, and 0.25 for endogenous constructs can be classified as significant, moderate, and insignificant [32].

The R^2 values of the dependent constructs, student satisfaction, and LMS usage, are displayed in Fig. 1 and Table 5. The model explains 86.6% of the variance in student satisfaction and 67.9% of the variance in LMS usage. The R^2 values of the two dependent constructs (student satisfaction and LMS usage) are 0.866 and 0.679, respectively, which are considered sufficient [31]. Fig. 1 also depicts the structural model with path coefficients for each path (hypothesized relationship) with a significant level and coefficient of determination (R^2).

IV. Discussion

Model validity and reliability tests show that the established constructs are reliable and valid, which helps to verify the accuracy of the PLS-SEM-derived measurement model. Meanwhile, validation of the structural model shows that the generated model is not only a strong fit but also has exceptional predictive significance.

Hypotheses H1, H2, H5, and H6 are supported by the established structural model's results in direct effects. H3 and H4 were, however, rejected. The findings demonstrate that information and system quality have a direct positive impact on student happiness. LMS utilization is also influenced by computer self-efficacy and student satisfaction.

The value obtained for testing the first hypothesis (H1) is greater than zero within a confidence interval of 5% (0.490) and 95% (0.658), indicating that the results are supported. The beneficial influence of information quality on student satisfaction happens when university LMS is used. Previous research supports this finding [33]. Similarly, the other study discovered that information quality influences student satisfaction [34, 35]. However, according to the findings of another study, information quality does not affect student satisfaction due to internal user variables [36].

The value above zero is achieved at a confidence interval of 5% (0.506) and 95% (0.668) for testing the second hypothesis (H2), indicating that the results are supported. Student satisfaction was found to be influenced by system quality. Johnson *et al*. [19] produced similar results, demonstrating that good system quality of LMS technology benefits user satisfaction [12]. Other research has found that system quality influences student satisfaction [37]. However, a study by Mtebe and Raisamo [38] found that system quality does not affect student satisfaction. Quality feasibility aspects heavily influence user satisfaction outcomes.

The third hypothesis (H3) is rejected since a value above zero is obtained at a confidence interval of 5% (−0.612) and 95% (−0.012). According to Mtebe and Raisamo [38], service quality has little effect on user satisfaction because user understanding of utilizing the LMS is inadequate [38]. Johnson *et al*. [19] discovered the same thing: the limited menu of supporting services dissatisfied people with the LMS. However, according to Alzahrani and Seth [3], the skill component of using LMS technology determines student happiness with LMS technology. In general, training for these users is significant in some universities. The same study found that a person's knowledge attitude influences their satisfaction with technology [34].

The fourth hypothesis (H4) is rejected when a value greater than zero is achieved at a confidence interval of 5% (−0.198) and 95% (−0.060). According to Ghazal *et al.* [12], computer self-efficacy influences student satisfaction with the LMS because it facilitates communication with operators and instruction to use the LMS, hence enhancing student skills to operate the LMS is needed [5, 39]. The same thing was also found by [40] and [5] the factors of comprehension and skills in mastering technology immediately affect one's behavior in using the LMS, which has an impact on the level of satisfaction [41]. However, according to Eom [34], self-efficacy factor has no effect on satisfaction using the LMS [42].

The value above zero is achieved at a confidence interval of 5% (0.418) and 95% (0.588) for testing the fifth hypothesis (H5), indicating that the results are supported. As a result, Computer Self-Efficacy (CSE) influences LMS utilization. According to Ghazal *et al*. [5], students' confidence in using the LMS impacts whether or not they continue to utilize the LMS [43–45].

The value above zero is achieved at a confidence interval of 5% (0.344) and 95% (0.529) for testing the sixth hypothesis (H6), indicating that the results are supported. LMS usage is influenced by user satisfaction. Learner satisfaction, according to Aldholay *et al.* [46], determines continuous usage of the LMS in online learning [40, 46].

V. Conclusion

Based on the review of the literature and the findings of the research, it is concluded that there are numerous elements that influence learner satisfaction with using an LMS. The direct testing of six hypotheses reveals that four of them are supported. The findings show that information quality, system quality, and quality all have an impact on student satisfaction. While CSE and satisfaction have an impact on LMS utilization. We conclude that this study was a success. However, the rejected results require further investigation to demonstrate the impact of service quality and CSE on student satisfaction.

Conflict of Interest

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Khoerul Umam and Zulherman conducted research, and write the papers, Irdalisa, Wati Sukmawati analyzed data, Supriyansyah adding some references. All authors had approved the final version.

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