The Role of Schemata in the Information Systems Success Model in Bridging Online Learning Equity

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Abstract
Initial cognitive structures (schemata) play a crucial role in the success of Information Systems (IS) in online learning environments, particularly in efforts to support conditions associated with learning equity. However, the IS Success Model has yet to define the role of schemata clearly. This study investigates the influence and position of schemata within the DeLone and McLean framework in the context of online learning equity, with the focus on system-related benefits that may support equitable learning conditions. While learning equity is not measured directly, the model examines perceived benefits, such as accessibility, flexibility, and participation, that are theoretically linked to fair learning opportunities. Data were collected via questionnaires administered to 252 students from two state universities, all of whom had at least one year of online learning experience. The instrument was based on the IS Success Model, which includes system quality, information quality, service quality, intention to use, user satisfaction, net benefits, and schemata. Structural Equation Modeling (SEM) was used to analyze the model. The findings show that key components of the IS Success Model are positively and significantly related to perceived system-related benefits associated with conditions that may support equitable online learning, with schemata functioning as a moderating variable. It is suggested that IS implementations should incorporate support strategies such as scaffolding, personalized guidance, and introductory content to enhance the positive impact of schemata.

Keywords: Schemata theory; online learning; IS Success Model; learning equity; quality education

Rahmi, U., & Azrul, A. (2026). The role of schemata in the information systems success model in bridging online learning equity. *Online Learning, 30*(3), 156–183. https://doi.org/10.24059/olj.v30i3.5294

The transformation of online learning has emerged as a key solution in the educational process and it continues to evolve. It offers opportunities to deliver instructional content more flexibly and broadly through digital media (Chen et al., 2022; Roddy et al., 2017). Today, most universities have adopted online learning in some form. However, research on its implementation reveals considerable variation in student experiences. While some students actively engage and report meaningful learning experiences (Cole et al., 2021), others express concerns about limited interaction among students and between students and lecturers (Chaku et al., 2021). These contrasting experiences influence student satisfaction and their intention to continue and complete courses on online learning platforms. As online learning becomes a permanent component of higher education rather than an emergency response, understanding not only whether systems function effectively, but also for whom and under what cognitive conditions they generate meaningful benefits, has become an increasingly urgent scholarly concern. In this context, it is essential to assess and ensure the quality and success of online learning systems.

Against this backdrop, the Information Systems (IS) Success Model developed by DeLone and McLean (2003) serves as a suitable framework for evaluating how online learning systems support educational goals. The model provides a comprehensive approach to system evaluation by focusing on system quality, information quality, service quality, intention to use, user satisfaction, and net benefits. In this study, the system under review is a Learning Management System (LMS), which supports both fully online and blended learning formats. This focus aligns with previous research positioning LMSs as integral to blended learning environments (Rahmi & Azrul, 2022). Nevertheless, the DeLone and McLean model does not fully capture the influence of other underlying factors that may indirectly affect learning outcomes (Lutfi, 2023).

Findings from an internal, exploratory review conducted over six semesters prior to the present study suggested that, despite occasional technical issues, students generally reported satisfaction with online learning implementation. This preliminary review was descriptive in nature and aimed to identify recurring patterns in students’ experiences with online learning systems over time. Thus, these data were not included in the empirical analysis reported in this study and did not form part of the dataset used for model testing. Instead, the insights gained from this exploratory review served to motivate the present research by highlighting the need to better understand how system qualities translate into perceived benefits under varying cognitive conditions. Notably, satisfaction with system quality and the information provided plays a significant role in determining whether students comprehend learning materials (Li & Zhu, 2022). Students’ perceptions of usefulness and ease of use directly shape their attitudes toward using these systems (Malureanu et al., 2021). Overall satisfaction with the learning process, including content and instructor performance, has an indirect but important impact on achieving learning outcomes (Duke, 2002; James, 2021). However, due to the diverse backgrounds of students, the benefits gained from LMS usage vary, leading to disparities in online learning implementation, which raises concerns related to online learning equity. As highlighted by UNESCO and the Sustainable Development Goals (SDGs) (UNESCO, 2016), achieving learning equity is a critical first step toward ensuring quality education.

In this study, learning equity serves as a guiding conceptual framework rather than a directly measured outcome. While equity is commonly defined as fairness, adequacy of support, and the reduction of learning barriers, the present research does not operationalize equity as an independent construct. Rather, it examines students' perceived benefits, such as accessibility, flexibility, and accommodation of learning needs, that prior literature identifies as enabling conditions for equitable learning environments. As a result, equity is addressed indirectly through these perceived benefits rather than through explicit indicators of fairness or disadvantage.

Learning equity refers to a condition in which every student has access to learning opportunities, resources, support, and experiences that enable them to achieve their optimal academic potential. This perspective aligns with Becher et al. (2025), who emphasize that "equitable access" extends beyond devices or internet connectivity to include students' broader socio-physical contexts. These contextual factors, in turn, shape students' schemata. Another research by Miller et al. (2023) also argues that when lecturers or faculty members fail to consider students' prior experiences (which form the basis of their schemata), equitable learning cannot be fully achieved in online environments. This further highlights the central role of acknowledging learners' diverse backgrounds and experiences in designing equitable instruction.

However, while sociocultural and structural equity frameworks emphasize broader institutional, economic, and policy-level factors, the present study focuses on system-level and cognitive mechanisms through which learners experience online learning environments. This approach complements, rather than replaces, macro-level equity perspectives by examining how institutional systems translate into learner-perceived benefits.

The significance of schemata has also been acknowledged in prior literature. Each student possesses unique cognitive frameworks (schemata), which influence how they interpret and retain information, resulting in varied learning outcomes (Fuchs et al., 2021). Beyond their role as learners, students also operate within online learning environments, bringing the same underlying schemata to their interactions with system features and functions. Schemata are cognitive structures that shape how users process information and interact with systems (Chalmers, 2003; Wei et al., 2023). When users engage with a system, their existing schemata can be activated, allowing them to recognize familiar patterns and anticipate functions more efficiently. New information is then integrated either through assimilation, when it aligns with existing schemata, or through accommodation, when adjustments are required to make sense of unfamiliar features or interactions. This dynamic process not only influences users' cognitive engagement but may also shape how learners experience fairness-related aspects of system interaction.

According to major cognitive learning theories, schemata play a foundational role in learning and information processing. Piaget explains that schemata develop through assimilation and accommodation, allowing learners to integrate new information into existing structures or modify those structures based on new experiences (Bormanaki & Khoshhal, 2017). Vygotsky adds that learning systems and interfaces function as scaffolding, activating and strengthening schemata through guided interactions that gradually fade as learners progress within their Zone of Proximal Development (Margolis, 2020). Cognitive Load Theory further emphasizes that well-developed schemata reduce cognitive load by enabling more efficient automated processing of information (Sweller, 2020). Empirical evidence from Wirzberger et al. (2018) supports this view, showing that as schema acquisition increases, cognitive load decreases logarithmically.

Together, these theories clarify why schemata critically influence how learners process information, interact with online systems, and experience learning benefits.

Consequently, the success of an online learning system and the students' success in using it largely depend on their schemata (Liu & Cheng, 2025; Noreña et al., 2025) and are related to the system and learning process (Magsamen-Conrad & Dillon, 2020; Truong, 2016). Despite this, studies evaluating online learning systems using the DeLone and McLean model have rarely incorporated schemata as a contributing factor. For instance, many studies have largely overlooked the role of schemata (Sweller, 1988; Lutfi, 2023). Given the rapid advancement of online learning and its technological infrastructure, understanding how schemata influence system use and perceived benefits is increasingly important (Al-Maroof et al., 2022). These gaps highlight the need not only to evaluate system effectiveness through technical indicators, but also to examine how learners' cognitive structures shape their engagement with online learning systems.

At the same time, despite extensive use of the DeLone and McLean IS Success Model in online learning research, prior studies have primarily focused on technical and service-related determinants of system success, with limited attention to learner-level cognitive mechanisms that may condition how system qualities translate into perceived benefits. Moreover, while learning equity is frequently invoked in discussions of online education, empirical IS research rarely examines how system success interacts with learners' prior knowledge structures to support conditions associated with equitable learning. This study addresses this gap by integrating schemata into the IS Success Model to examine how cognitive frameworks shape the relationships between system qualities, user perceptions, and perceived system-related benefits that may support equitable online learning conditions.

This focus is particularly relevant in self-paced learning environments, where schemata serve as a critical cognitive component (Anderson et al., 1978; Jung et al., 2022). Schemata allow learners to make sense of new information by linking it to their existing knowledge base (Neumann & Kopcha, 2018). This cognitive process enables students to construct meaning by aligning new content with their prior experiences (Halkias, 2015). Online learning technologies can further enrich students' schemata through opportunities for interaction and reflection (Zheng & Warschauer, 2015). Therefore, this study seeks to examine and clarify the influence and position of schemata within the DeLone and McLean framework in order to better understand how successful information systems generate benefits that may support equitable online learning conditions.

Research Questions

1. Is the Information System Success Model a good fit for examining students' schemata in relation to system-related benefits that may support equitable online learning conditions?
2. What role do students' schemata play within the Information System Success Model in shaping equity-enabling system benefits?
3. How do students' schemata influence system-related benefits associated with online learning equity within the framework of the Information System Success Model?

Together, these questions examine model suitability (RQ1), the structural positioning of schemata (RQ2), and the mechanisms through which schemata shape perceived system-related benefits associated with equity (RQ3).

Literature Review

Information Systems Success Model

The Information Systems (IS) Success Model comprises six interrelated components: system quality, information quality, service quality, use/intention to use, user satisfaction, and net benefits (DeLone & McLean, 2003). According to the model's proponents, system quality refers to how effectively a technology system functions. In the context of online learning, this includes technical aspects of e-learning platforms such as speed, reliability, and the system's capacity to meet user needs (Dhawan, 2020; Sarrab et al., 2016). Recent research suggests that high system quality, which is characterized by platform reliability and a user-friendly interface, can positively affect both user satisfaction and intention to use the system (Tsai et al., 2014; Xiao et al., 2024).

Information quality is another key component, encompassing attributes such as accuracy, completeness, relevance, timeliness, and consistency. Users who receive information that is accurate, relevant, timely, and easy to understand are more likely to be satisfied and engage regularly with the system (Molinillo et al., 2021). In the online learning context, this refers to the quality of materials, exams, and feedback provided by the platform. High information quality, when aligned with user schemata, enhances satisfaction and intention to use the system. This ultimately leads to deeper engagement and improved learning outcomes.

Service quality refers to the extent to which support services delivered through the platform meet user expectations, whether from students, lecturers, instructors, or administrators (Ramírez-Hurtado et al., 2021). In online learning, this includes timely, responsive technical support and effective interactions within the system (Rughoobur-Seetah & Hosanoo, 2021). High service quality has been shown to increase student engagement, particularly when users feel supported in resolving technical or instructional issues (Baloran et al., 2021; Salas-Pilco et al., 2022). Students who are satisfied with their overall experience, whether in terms of support, system responsiveness, or content quality, tend to be more engaged and active participants in learning activities.

These three core dimensions, which are system quality, information quality, and service quality, jointly influence both intention to use and user satisfaction. According to DeLone and McLean (2003), intention to use is a strong predictor of actual system usage and, by extension, a key factor in determining system success (Alotaibi & Alshahrani, 2022; Lutfi, 2023). Meanwhile, user satisfaction reflects the degree to which users are content with their experience using the system. Research shows that user satisfaction mediates the relationship between system quality and perceived usefulness (Abdullah et al., 2025; Alkhawaja et al., 2022). Satisfied users are more likely to continue using the platform, increase their engagement, and derive greater educational benefits (Elmunsyah et al., 2023; Sabeh et al., 2021).

Ultimately, these factors contribute to the system's net benefits, which are the tangible outcomes users gain from using the system, such as improved understanding, mastery of content, and academic achievement (Sabeh et al., 2021; Wang et al., 2025). Net benefits are significantly shaped by user satisfaction (Çelik & Ayaz, 2022). A successful learning system enhances these benefits, leading to better collaboration, skill development, and overall learning outcomes (Ng et al., 2022). However, recent studies argue that schemata also play a critical role in enabling users to fully benefit from information systems (Wang & Yin, 2023), which suggests that cognitive frameworks must be considered alongside traditional success factors.

Online Learning Equity

Online learning equity refers to a systematic effort to reduce disparities in digital education by ensuring equal access, participation, learning experience, and outcomes for all students (Tate & Warschauer, 2022). One of the primary technologies used in online learning is the Learning Management System (LMS), which has been identified as a vital support system for both online and blended learning environments (Rahmi et al., 2022; Turnbull et al., 2021). Although LMSs hold great potential for promoting equity, various factors hinder their effective use and limit their ability to support all learners equally.

Students from rural or underserved communities often face barriers such as limited access to technology and internet connectivity (Gu, 2022; Nichuhovska et al., 2023). These access issues are compounded by individual differences in schemata, i.e., students' prior knowledge structures, that significantly influence how they process and apply new information (Gurlitt et al., 2012). As a result, these gaps can lead to unequal participation and outcomes in online learning, thereby exacerbating existing educational inequities (Çelik & Ayaz, 2022; Flynn, 2021).

While online learning is praised for its flexibility and accessibility, achieving equity requires more than just access. It requires thoughtful system design that considers diverse learner backgrounds and prior experiences (Goodman et al., 2018). In this context, information systems used in online learning will only function optimally if they accommodate learners' schemata throughout the instructional process. Therefore, this study explores the integration of schemata into the DeLone and McLean (2003) framework, aiming to examine system-related factors that may support online learning equity by understanding how cognitive structures influence engagement and system benefits.

It is important to clarify the scope of equity within the present study. Although online learning equity serves as a central theoretical lens, this study does not operationalize equity as a standalone construct in the empirical model. Instead, the analysis focuses on perceived system-related benefits, such as accessibility, flexibility, participation, and accommodation of learning styles, which prior research has identified as enabling conditions for equitable learning environments (Tate & Warschauer, 2022). Thus, equity is examined conceptually through the extent to which online learning systems provide conditions that may support fair learning opportunities, rather than through direct measurement of equity outcomes.

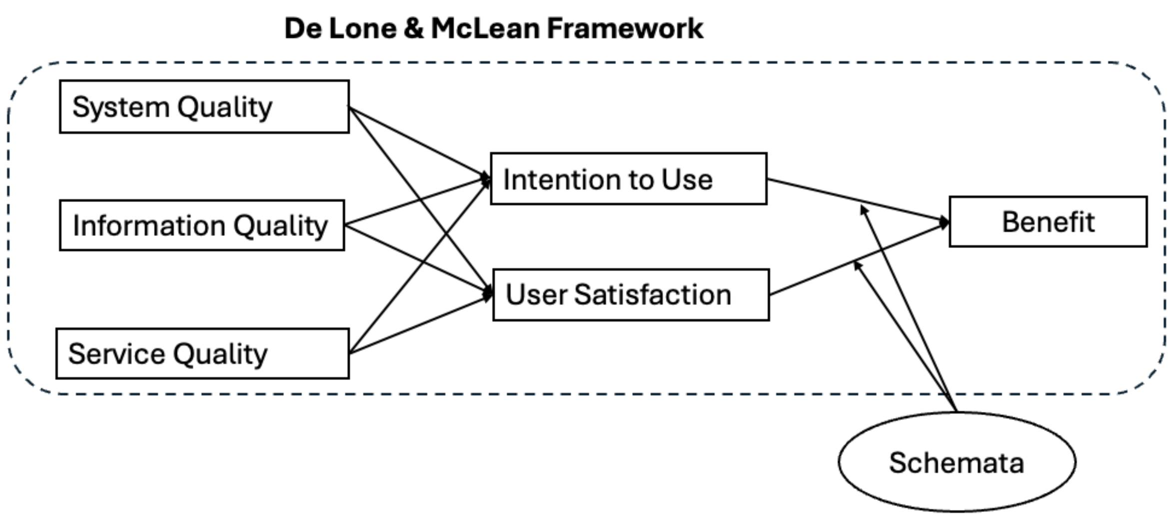
Schemata Theory

In the context of online learning, schemata refer to knowledge structures or cognitive frameworks developed through previous learning experiences. These structures enable individuals to interpret and organize new information (Jung et al., 2022) presented through digital platforms. The presence of schemata is essential in online learning settings (He, 2020), as students are required not only to grasp academic content but also to navigate digital interfaces, understand system processes, and manage their learning strategies independently (Jung et al., 2022; Koh, 2017). Schemata can further influence the relationship between satisfaction, intention to use, and the perceived benefits of online learning systems. Students who possess more developed cognitive frameworks related to online learning are often more capable of managing the learning process effectively. This remains true even when the quality of the systems and services available to them is consistent across users. Despite this, research over the past decade has not yet examined the position of schemata within the Information Systems Success Model (Sabeh et al., 2021). This study addresses that gap by identifying and explaining the position and function of schemata within the DeLone and McLean framework as they relate to perceived system benefits.

The findings of this study reinforce the growing evidence that differences in cognitive schemata have a meaningful impact on student behavior and learning outcomes (Gurlitt et al., 2012), particularly in digital environments (Vuopala et al., 2016). As a result, schemata should be recognized as a moderating variable within the DeLone and McLean model. Its inclusion can enhance the understanding of what contributes to the effectiveness of online learning systems.

Figure 1

The Theoretical Framework



Methods

Research Design

This study employed a quantitative research design using a survey method to describe and analyze the relationships among variables. The study also aimed to test a proposed relationship model grounded in the Information Systems Success Model (DeLone & McLean, 2003) by examining the role of a moderating variable in shaping the benefits derived from using information systems that are associated with equitable learning conditions.

Participants

The participants in this study were university students with experience using online learning systems for at least one year. These students were drawn from two state universities in Indonesia, which share comparable institutional structures and online learning infrastructures. Both institutions offer teacher education programs that prepare prospective teachers and employ similar instructional designs that integrate online learning and Learning Management Systems (LMS) as core components of course delivery. As a result, students at both universities have comparable exposure to LMS-based learning environments and digital instructional practices.

The instrument was administered to students via a Google Form. The link was distributed at the end of the semester, after the lecture session had concluded. A total of 280 students were invited to participate, and 252 responses were collected. Out of the total respondents, 79% were female, and 21% were male. In terms of experience, 58.2% had at least one year of online learning experience, 25.1% had two years, and 16.7% had three years. While this sampling approach ensures contextual consistency across institutions, the findings should be interpreted as situated within public teacher education universities using LMS-based instructional designs, rather than as representative of all higher education contexts.

Measurement

The instrument used in this study was based on the dimensions of the IS Success Model as proposed by DeLone and McLean (2003), which includes the following constructs: System Quality, Information Quality, Service Quality, Intention to Use, User Satisfaction, and Net Benefits. In addition to these, this study introduces schemata as a moderating variable influencing the relationship between user experience and perceived benefits.

The schemata construct was operationalized to reflect learners' prior knowledge and cognitive readiness in online learning contexts. While the measurement items were drawn from validated instruments used in prior IS and educational research (see Table 1), their conceptualization is theoretically aligned with established work on schema theory, prior knowledge activation, and cognitive engagement in digital learning environments (Bruning et al., 2004; Kalyuga et al., 2003; Azevedo, 2005).

A questionnaire was developed to measure each construct in the proposed model. The items were adapted from validated instruments used in previous studies and were categorized under their respective dimensions. The full list of variables, items, and references is provided below.

Table 1

Measurement Items by Variable and Reference

No.	Variable	Item	References
1.	System Quality	This system is easy to use. This system provides accurate information. This system is reliable and performs consistently. The interface of the system is user-friendly. The system response time is satisfactory.	DeLone & McLean (2003)
2.	Information Quality	The information provided by the system is relevant to my needs. Information is presented clearly and is easy to understand. This information is up-to-date and timely. This information is well-organized. This information meets my needs for decision-making.	DeLone & McLean (2003)
3.	Service Quality	Support services related to this system are easily accessible. Help and support from service staff meet my needs. Responses to my questions are provided quickly. Overall service quality meets my expectations. Service staff have extensive knowledge of this system.	DeLone & McLean (2003)
4.	Intention to Use	I frequently use this system for my tasks. I depend on this system to complete my work. This system is my preferred tool for information retrieval. I am confident that I use this system effectively.	DeLone & McLean (2003)
5.	User Satisfaction	I am satisfied with my overall experience using this system. I would recommend this system to others. I feel comfortable using this system regularly.	DeLone & McLean (2003)
6.	Schemata	My access to learning resources has increased with the use of the online learning platform.	Roh & Won (2023)

		I have prior knowledge that encourages me to actively engage with the online learning platform.	You (2022)
		Prior knowledge is supported by the online environment for equity.	Phillips et al. (2012)
		My information retention is enhanced by the availability of diverse learning resources.	Gorman & Rentsch (2017)
		Previous learning experiences help me complete tasks on the online learning platform.	DeFeo & Caparas (2014)
7.	Benefits	I benefit from the increased accessibility of the online learning system.	DeLone & McLean. (2003); Buttimer et al. (2022)
		I experience flexible learning opportunities with the system.	DeLone & McLean (2003); Reedy (2019)
		My learning style is accommodated by the variety of learning modalities available.	DeLone & McLean (2003)
		I actively participate in learning with this system.	DeLone & McLean (2003); Martin et al. (2020)
		Online learning is designed based on DeLone & McLean's principles.	DeLone & McLean (2003); Abdelkareem, (2021)

It is important to note that although learning equity informs the theoretical framing of this study, it is not measured directly as a separate construct. The 'Benefits' variable captures students' perceptions of system-related outcomes, such as increased accessibility, flexibility, participation, and accommodation of learning preferences, that are widely associated in the literature with equitable learning conditions. Therefore, equity is addressed indirectly through learners' perceived benefits rather than through explicit indicators of fairness or barrier reduction.

In addition, several sources of potential bias of this research should be also acknowledged. Self-reflection bias may have occurred because participation was voluntary, which may affect the representativeness of the sample. Institutional bias is also possible, as data were collected from only two public universities, which may limit the representativeness of the sample. To address these concerns, the questionnaire link was distributed to all students at each institution to maximize participation, and anonymity was maintained to encourage honest responses. Respondent characteristics such as academic major and year of study were also compared with available university population data to assess sample representativeness.

The instrument was validated through multiple steps to ensure accuracy and reliability. Consistent with PLS-SEM procedures, construct validity was primarily assessed through convergent and discriminant validity, while expert review, involving three specialists, was used to establish content validity. Construct validity was evaluated through indicator loadings, composite reliability, and AVE values. To measure internal consistency, reliability analysis was conducted using Cronbach's Alpha, with values of 0.70 or higher considered acceptable and indicative of reliable constructs (see Table 3 for full results of the reliability test).

Data Analysis

After the basic assumptions were verified and the research data were declared valid, the next step was to conduct a Structural Equation Modeling (SEM) analysis using SmartPLS statistical software. After the structural and measurement models were evaluated, the hypothesis was tested by examining the path coefficient and significance value (p-value). A hypothesis is considered supported when the p-value is less than or equal to 0.05 and the path coefficient is in the expected direction. If the path coefficient indicates the expected direction (positive or negative), the relationship between the variables is considered valid. Consistent with common practice in PLS-SEM research, hypotheses were evaluated using a significance level of $\alpha = 0.05$.

Results

Model Assumption Test

Convergent validity.

Convergent validity tests the ability of each indicator to explain the latent variable. According to (Hair Jr et al., 2017) and (Chin, 1998), a loading factor value greater than 0.50 is considered to indicate an acceptable level of convergent validity. Similarly, Ghozali (2016) states that an indicator is considered valid if its outer loading value exceeds 0.50. As shown in Table 2, all indicators across the seven constructs meet this requirement, with most values above 0.75, demonstrating strong relationships between the indicators and their corresponding constructs. Construct reliability was also confirmed through Composite Reliability (CR) values above 0.70 (Nunnally & Bernstein 3rd, 1994) and AVE value exceeding 0.50 (Chin, 1998), which indicates that the constructs exhibit both adequate reliability and convergent validity.

Table 2

Outer Loading Value of Each Variable

	Information Quality	Intention to Use	Schemata	Service Quality	System Quality	User Satisfaction	Benefit
KS2					0.757		
KS3					0.822		
KS4					0.777		
KS5					0.814		

KS6					0.717		
QI1	0.854						
QI2	0.812						
QI3	0.859						
QI4	0.812						
QI5	0.813						
QS1				0.833			
QS2				0.755			
QS3				0.840			
QS4				0.823			
QS5				0.811			
bene1							0.853
bene2							0.886
bene3							0.813
bene4							0.716
bene5							0.874
satis1						0.860	
satis2						0.926	
satis3						0.895	
satis4						0.883	
scm1			0.876				
scm2			0.864				
scm3			0.843				
scm4			0.845				
scm5			0.813				
use1		0.841					
use2		0.862					
use3		0.799					

Table 3 below shows that all constructs meet the recommended criteria for internal consistency, with Cronbach's alpha and composite reliability (CR) values exceeding 0.70. Furthermore, all AVE values are above 0.50, confirming that each construct explains more than half of the variance of its indicators. These results collectively indicate that the measurement model demonstrates strong reliability and convergent validity, and that the constructs are measured with high internal consistency.

Table 3

Composite Reliability Variable Value

Construct Model	Cronbach's alpha	Composite reliability (rho_a)	**Composite reliability (rho_c) CR**	AVE
Information Quality	0.887	0.888	**0.917**	0.690
Intention to Use	0.781	0.781	**0.873**	0.696

Schemata	0.896	0.899	**0.923**	0.707
Service Quality	0.871	0.875	**0.907**	0.661
System Quality	0.837	0.843	**0.885**	0.606
User Satisfaction	0.913	0.914	**0.939**	0.794
Benefit	0.886	0.897	**0.917**	0.690

Discriminant validity test.

Discriminant validity is conducted to ensure that each concept in each latent model is distinct from the other variables (Ghozali, 2016). It is assessed using two approaches: the Fornell–Larcker criterion and cross-loadings (Ringle et al., 2012; Salloum et al., 2019). According to the Fornell–Larcker criterion, discriminant validity is confirmed when the square root of a construct's AVE is greater than its correlations with other constructs (Fornell & Larcker, 1981a, 1981b; Mahande et al., 2024; Mehmetoglu & Venturini, 2021). Cross-loading analysis further requires that each indicator loads higher on its own construct than on others (Sekaran & Bougie, 2016; Hair Jr. et al., 2017). As presented in Table 4, all constructs meet the Fornell–Larcker criterion, with each construct's AVE root exceeding its correlations with other latent variables. This confirms that the constructs are empirically distinct and that the model meets the requirements for discriminant validity (Kock, 2023).

Table 4

Fornell Larcker (Correlation Between Factors and Root AVE)

Construct	Information Quality	Intention to Use	Schemata	Service Quality	System Quality	User Satisfaction	Benefit
Information Quality	0.830						
Intention to Use	0.629	0.834					
Schemata	0.685	0.664	0.841				
Service Quality	0.805	0.626	0.636	0.813			
System Quality	0.791	0.575	0.614	0.692	0.778		
User Satisfaction	0.681	0.757	0.699	0.673	0.699	0.891	
Benefit	0.665	0.790	0.749	0.688	0.650	0.795	0.831

Collinearity test.

The collinearity test, also known as the multicollinearity test, is used to determine whether there is inequality in variance and residuals within an observation in a regression model. If the VIF value is no more than 5, it is concluded that there is no collinearity between the statements. As shown in Table 5, all VIF values fall below the recommended upper limit of 5.00, indicating that multicollinearity is not present among the indicators or interaction terms. This means that the predictors do not exhibit problematic levels of shared variance, and each variable contributes uniquely to explaining the dependent variables in the model.

Table 5

Variance Inflation Factor Variable Value

	VIF
KS2	1.706
KS3	1.916
KS4	1.728
KS5	1.875
KS6	1.480
QI1	2.434
QI2	2.011
QI3	2.582
QI4	2.077
QI5	1.929
QS1	2.159
QS2	1.765
QS3	2.138
QS4	2.431
QS5	2.380
bene1	2.870
bene2	3.334
bene3	2.046
bene4	1.743
bene5	2.699
satis1	2.471
satis2	3.853
satis3	3.175
satis4	2.842
scem 1	1.934
scem 2	3.014
scem 3	3.303
scem 4	2.503
scem 5	2.465
use1	1.706
use2	1.867
use3	1.464
Schemata x Intention to Use	1.000
Schemata x User Satisfaction	1.000

<u>Reliability test.</u>

Next, the instrument's validity and reliability are tested. Based on Composite Reliability values all exceeding 0.7, it is concluded that the instrument used is valid and reliable (see Table 3 for full results of the reliability test).

Structural Model Test and Model Fit

To determine the structural relationship between latent variables, hypothesis testing is conducted by analyzing the path coefficients between those variables. This involves comparing the p-value with an alpha level of 0.05 or evaluating the t-statistic, which must exceed 1.96 to be considered significant. Both the p-value and t-statistic are obtained from the SmartPLS output using the bootstrapping method. Hypothesis testing is done by comparing the t-statistics obtained from the bootstrapping results with the critical t-value of 1.96, as recommended by Hair Jr. et al. (2017). If the t-statistic value for each hypothesis exceeds this threshold, the hypothesis is considered accepted or supported. The details of the structural model test results can be seen in Table 6.

As shown in Table 6 and Figure 2, system quality and service quality have significant positive effects on both intention to use and user satisfaction, while information quality significantly affects intention to use but not user satisfaction. Intention to use and user satisfaction both significantly predict perceived benefits. In addition, schemata have a significant direct effect on benefits and significantly moderate the relationships between intention to use and benefits, as well as between user satisfaction and benefits.

Table 6

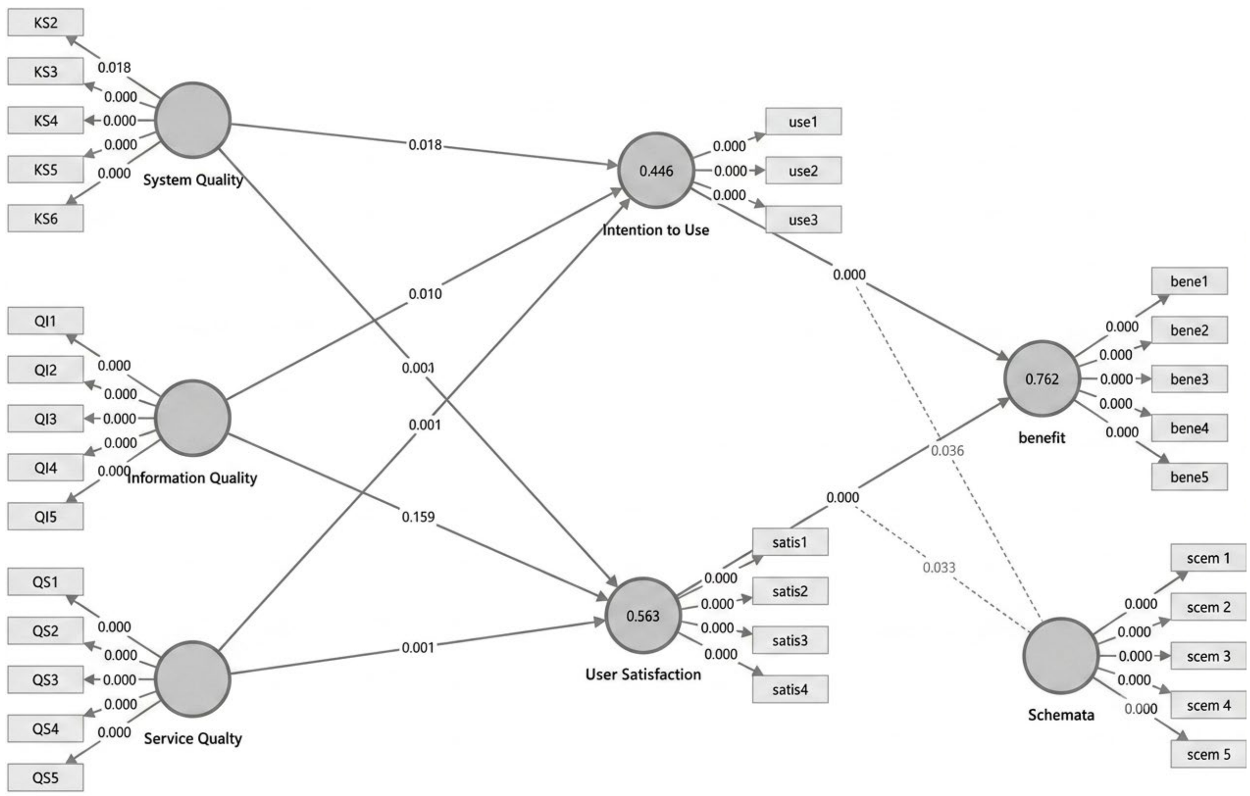
Results of the Path Model Analysis

Path Model	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Information Quality -> Intention to Use	0.248	0.241	0.096	2.572	0.010
Information Quality -> User Satisfaction	0.140	0.135	0.100	1.408	0.159
Intention to Use -> benefit	0.403	0.405	0.067	6.008	0.000
Service Quality -> Intention to Use	0.315	0.318	0.092	3.436	0.001
Service Quality -> User Satisfaction	0.293	0.300	0.085	3.459	0.001
Schemata M -> benefit	0.280	0.280	0.058	4.831	0.000
System Quality -> Intention to Use	0.161	0.169	0.068	2.376	0.018
System Quality -> User Satisfaction	0.385	0.386	0.078	4.921	0.000
User Satisfaction -> benefit	0.285	0.284	0.070	4.054	0.000
Schemata M x User Satisfaction -> benefit	-0.134	-0.130	0.063	2.130	0.033

Schemata M x Intention to Use -> Benefit	0.122	0.118	0.058	2.098	0.036

Figure 2

SEM Analysis



Following hypothesis testing, overall model fit was assessed to evaluate how well the proposed structural model represents the observed data. The standardized root mean square residual (SRMR) value was 0.078. Consistent with recommendations for PLS-SEM (Hair et al., 2021), an SRMR value below 0.08 indicates acceptable model fit, suggesting that the proposed model adequately represents the data.

Discussion

Before interpreting these findings, it is important to clarify the role of learning equity in this study. While equity is a guiding theoretical concern, it is not measured directly in the structural model. Instead, the findings are interpreted in terms of perceived system-related benefits that the literature associates with more equitable learning conditions, such as improved access, flexibility, participation, and learner accommodation. The discussion therefore focuses on how schemata influence learners' ability to translate system use and satisfaction into these equity-enabling benefits.

This study explores the role of schemata within the Information Systems (IS) Success Model, particularly in supporting equity-related learning conditions in online learning. The findings indicate that schemata function effectively as a moderator variable within the model. Taken together, the findings suggest that experiential and support-related system qualities play a more decisive role in shaping perceived benefits than information quality alone. This pattern indicates that how learners experience and interact with the system may matter more than content attributes in translating system use into meaningful benefits. This result aligns with Urbach and Ahlemann (2010), who found that user experience has a stronger influence on user satisfaction than the quality of information itself. Together, these initial findings highlight the importance of examining not only technical system attributes but also the cognitive factors that shape how learners interpret and respond to online learning environments.

Moreover, the study reveals that both intention to use and user satisfaction positively and significantly affect net benefits associated with conditions that may support equitable online learning. In particular, the relationship between user satisfaction and net benefits underscores user satisfaction as a critical link connecting system quality with the actual benefits perceived by users (Sachan et al., 2018). This reinforces the importance of ensuring high user satisfaction to maximize the impact of system improvements.

The findings indicate that schemata have a significant direct effect on perceived benefits and function as a moderating factor in the relationships between user satisfaction, intention to use, and benefits. This moderation suggests that learners' cognitive frameworks condition how effectively positive system perceptions are translated into meaningful outcomes. Students with more developed schemata are better able to interpret their satisfaction with the system and their intention to use it, resulting in higher perceived benefits, whereas learners with weaker schemata may struggle to convert similar system experiences into comparable gains.

These patterns are consistent with established cognitive learning theories. From a constructivist perspective, Piaget conceptualized schemata as evolving cognitive structures through which learners assimilate and accommodate new information (Piaget, 1970). Building on this view, Vygotsky's theory of the Zone of Proximal Development (ZPD) emphasizes that learning occurs most effectively when learners receive scaffolding that supports the gradual internalization of knowledge and strengthens schema development until independent performance is achieved (Vygotsky, 1978).

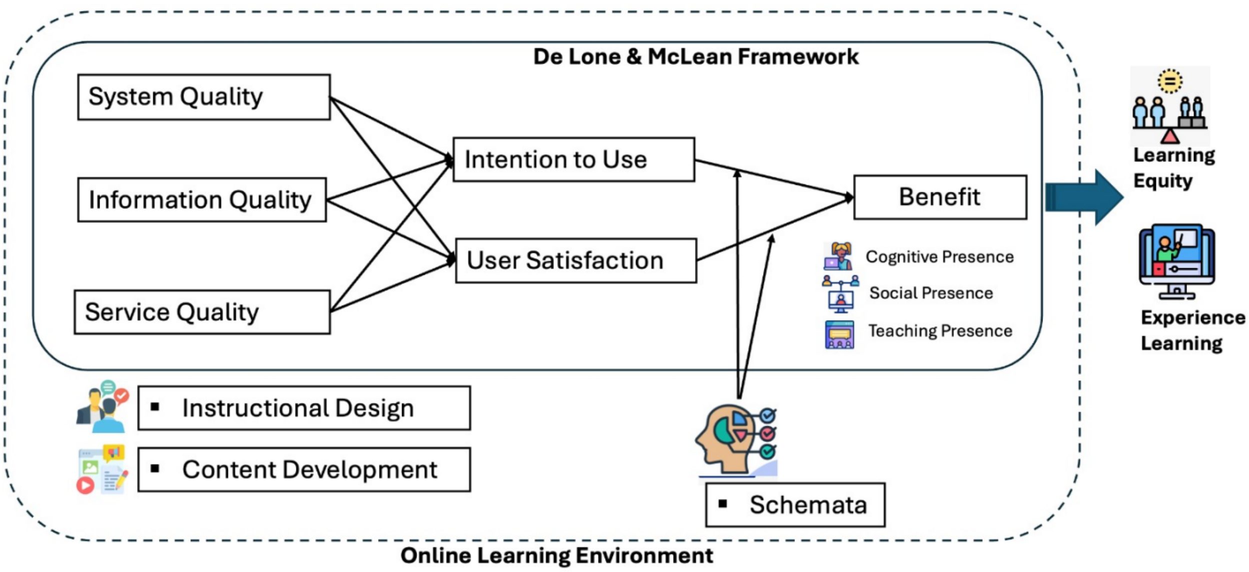
Complementing these perspectives, Cognitive Load Theory explains how well-developed schemata reduce extraneous cognitive load by enabling more efficient processing of complex information (Sweller, 1988; Sweller et al., 2023). Contemporary research further demonstrates that instructional designs that activate prior knowledge and provide structured scaffolding facilitate schema construction and improve learners' capacity to process information independently in digital environments (Sweller, Ayres, & Kalyuga, 2023). Together, these theories clarify how schemata, scaffolding, and cognitive load operate as distinct yet interrelated mechanisms shaping learners' engagement and outcomes in online learning systems.

The conceptual model highlights schemata as a key cognitive mechanism through which system quality dimensions and user perceptions are translated into perceived benefits. Rather than operating independently, system quality, user satisfaction, and intention to use interact with learners' existing cognitive frameworks, shaping how effectively system features are interpreted and used.

This model emphasizes that schemata function not only as cognitive filters but also as facilitators of meaning-making in online learning environments. When system design and instructional features align with learners' prior knowledge, students are better positioned to engage with content, navigate the system efficiently, and derive meaningful benefits. In this way, schemata help explain why similar system conditions may result in different learning experiences across learners and how system-level factors can support conditions associated with learning equity.

Figure 3

Conceptual Representation of the Interaction Between Schemata, System Quality Dimensions, User Perceptions, Perceived Benefits, and Equity-Related Learning Conditions Within the Online Learning Environment



Building on this framework, schemata also play a crucial role in shaping learners' cognitive engagement and their ability to derive meaningful benefits from online learning systems. By guiding how learners interpret and process online content, schemata influence how effectively learners make sense of instructional materials and sustain meaningful engagement (Shi et al., 2025; Bong et al., 2023). Given this role, online learning platforms and pedagogical approaches should be intentionally designed with schema theory in mind. Understanding how learners' prior knowledge shapes cognitive processing allows lecturers and instructional designers to create learning experiences that are more effective, relevant, and responsive to learner needs (D'Souza et al., 2023). For instance, enhancing system quality in ways that align with users' prior knowledge can increase satisfaction and, in turn, amplify the benefits students derive from the system.

Leveraging schema theory also enables designers to create content, tasks, and activities that connect with learners' existing cognitive structures, thereby strengthening both cognitive and social presence through interaction and shared meaning-making (D'Souza et al., 2023). Such schema-aware design may contribute to conditions conducive to more equitable learning experiences, as students with varied backgrounds are better able to access, interpret, and benefit from online learning. Thus, supporting equity in online learning requires attention not only to system quality but also to learner-related factors, such as self-efficacy, motivation, and interface usability, that interact with cognitive structures like schemata to shape engagement and comprehension (Shi et al., 2025; Lin et al., 2022).

In this context, the significant moderating effect of schemata on the relationship between intention to use and perceived benefits provides further practical insight. Consistent with findings by Alraimi, Zo, and Ciganek (2015) in MOOC environments, learners with stronger schemata are better able to translate their intention to use online systems into meaningful benefits. As a result, learners with weaker schemata may require additional support features, i.e., such as scaffolding, guided navigation, or introductory resources, to bridge this gap and fully benefit from system use.

While theoretical insights deepen the interpretations of the findings, certain methodological limitations should be acknowledged. The sample was drawn from two public universities in Indonesia, and this institutional context may have shaped students' experiences with online learning systems. Factors such as governance structure, resource allocation, digital infrastructure, and student demographics in public universities may influence how system quality, support services, and learning benefits are perceived. As a result, the findings should be interpreted as contextually situated rather than universally generalizable, particularly when considering private institutions or international higher education settings. Future research could broaden the sample by incorporating students from additional institutions, including those in other countries. Moreover, this study focused exclusively on online learning modes. Subsequent studies could extend the scope to compare different course formats such as MOOCs, blended learning, and traditional in-person classes, and incorporate a wider range of academic disciplines across both the sciences and social sciences to enhance the robustness of the findings.

The implications of this study highlight opportunities for leveraging adaptive learning design to improve learning equity and effectiveness. Adaptive learning systems can use the insight gained here to dynamically adjust content difficulty based on students' schemata and cognitive load. Artificial Intelligence (AI), with its capacity for personalized learning pathways, can enhance schema formation and system usability by predicting student needs and tailoring instruction accordingly. Lecturers also play a critical role by providing appropriate scaffolding to support the adaptation process without overloading cognitive resources. In online learning contexts, learning analytics dashboards within Learning Management Systems (LMS) can visualize student progress, track schema development, and detect moments requiring intervention, enabling lecturers to offer timely and data-driven support. The integration of these technologies enhances learning efficiency by aligning instructional pathways with individual cognitive states and performance patterns to promote more meaningful and sustainable learning outcomes. These implications reinforce the broader argument that addressing cognitive diversity, through adaptive systems and structured support, is essential for advancing equity in online learning environments.

Conclusions and Recommendations

The Information System Success Model (DeLone & McLean, 2003) provides a comprehensive framework for understanding how system quality, information quality, and service quality influence both user satisfaction and perceived benefits in online learning environments. This study extends that framework by demonstrating that schemata function as a significant moderating factor, particularly in the relationships between user satisfaction and perceived benefit, as well as intention to use and perceived benefit. The findings show that learners with limited prior knowledge or weaker schemata may not derive meaningful benefits solely from intending to use the system; instead, they require scaffolding, personalized support, or introductory materials to bridge cognitive gaps. As such, users with stronger schemata are more likely to translate their system satisfaction and intention to use into actual learning benefits, especially when the platform assumes a certain level of prior understanding. These findings highlight that learners' cognitive structures play a pivotal role in mediating how system attributes translate into educational value, and further reinforce the importance of schema-aware design principles emphasized in the discussion.

Given this moderating role, online learning systems need to be designed with features that accommodate variations in schemata. Adaptive functionalities and user-friendly interfaces can help bridge cognitive differences among users and support conditions conducive to more equitable learning outcomes. Furthermore, schemata are essential in explaining individual differences in how users perceive and experience the benefits of online learning. Therefore, integrating psychological and cognitive factors such as schemata into the IS Success Model provides a more nuanced and holistic understanding of how learners engage with technology in higher education contexts. Based on the study's findings, it is recommended that future system designs address not only the technical aspects, such as system, information, and service quality, but also consider user-related factors such as self-efficacy, learning motivation, interface usability, interface design, user interface, and prior experience. Taking these elements into account will enhance the effectiveness of online learning systems and support broader learning equity goals. In the end, embedding cognitive considerations into online learning design represents a critical step toward supporting conditions that increase the likelihood that learners, regardless of prior knowledge, can achieve meaningful and equitable learning experiences.

Declarations

Conflicts of Interest Statement

The authors have no competing interests to declare that are relevant to the content of this article.

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