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Article

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ACCOUNTING, CORPORATE GOVERNANCE & BUSINESS ETHICS | RESEARCH ARTICLE - REPLICATION STUDY

A holistic success model for sustainable e-learning based on the stakeholder approach: Case of Vietnamese students during the COVID-19 pandemic

Mai Ngoc Tran^{1*}

Abstract: The ongoing COVID-19 pandemic has disrupted traditional ways of learning and teaching, leading to a significant shift toward e-learning. This shift has resulted in the emergence of new challenges and opportunities for stakeholders involved in the education sector. To ensure the continuity of education and overcome the challenges faced by e-learning, a holistic success model that considers all stakeholders' needs and perspectives is required. Therefore, this paper proposes a holistic success model for sustainable e-learning based on the stakeholder approach during the COVID-19 pandemic. The model aims to provide a comprehensive framework for ensuring the success of e-learning initiatives by addressing the concerns of all stakeholders, including students, teachers, institutions, and service providers. Drawing upon the Information System Success Model and as the foundation for hypothesis formulation, the research employs structural equation modelling to analyze the collected data from 321 Vietnamese undergraduate students. The findings reveal that instructor quality, course content quality, education system quality, technical system quality, and self-regulated learning all have significant positive influences on learner satisfaction. The results demonstrate that increased satisfaction substantially contributes to improved learning outcomes. The proposed model is expected to contribute to developing sustainable e-learning practices that can withstand the challenges posed by the pandemic and ensure the continuity of education.

ABOUT THE AUTHOR

Mai Ngoc Tran is a Lecturer and Researcher at the International Business Faculty of the Banking Academy Vietnam. A noted scholar, Ms. Tran boasts impressive academic credentials, having earned her Bachelor's degree in Business Administration from University of Nebraska at Omaha, USA her Master's degree in Banking and Finance at Queen Mary University of London, UK and her PhD in International Economics at Foreign Trade University Vietnam. Her research expertise lies in the fields of International Trade, FDI, Sustainability, Entrepreneurship, Digitalization, Technology, E-business and CSR. To date she has published numerous academic articles in international peer review journals such as *Management Science Letters*, *International Journal of Electronic Business*, *International Journal of Energy Economics and Policy*, *International Journal of Electronic Commerce Studies* and multiple articles in local scholarly journals and various conference proceedings.

Subjects: Communication Technology; Electronic Devices & Materials; ICT; Open & Distance Education and eLearning;

Keywords: sustainability; e-learning; COVID-19; stakeholder; success model; Vietnam

1. Introduction

The stakeholder approach is useful for developing a holistic success model for sustainable e-learning (HSMSE). This approach involves identifying and engaging all stakeholders, including e-learning providers, students, lecturers, and institutions (Ahmad et al., 2018). Each stakeholder has a unique perspective and set of needs that must be addressed to ensure the success of e-learning initiatives.

In the context of COVID-19 and social distancing, to ensure continuous learning, many countries have allowed training institutions to deploy training programs on online platforms (Dawadi et al., 2020; Pokhrel & Chhetri, 2021). Due to this initiative, many businesses that provide online learning services benefited from the rapidly growing number of users. However, after the COVID-19 situation was controlled, the economy returned to a new normal when students returned to study directly in the lecture hall, and the number of people using online learning platforms decreased, causing significant losses. Therefore, businesses need to identify the factors that have an impact on user satisfaction, thereby constantly improving their services to attract and retain customers.

Furthermore, given the scenario, many students have been forced to switch to online learning platforms in order to continue their studies (Chakraborty et al., 2021). In the initial stages of implementation, students objected to using this method as it was thought that online learning did not address and meet the needs for learning and acquisition as did face-to-face interaction with lecturers and classmates in a formal learning environment (Wong, 2020). However, after acclimatization and usage, many students have come to adapt and appreciate the benefits of online learning and are content to maintain this form of learning. These students would need to be educated about the factors affecting learning satisfaction and outcomes to improve their learning ability when undergoing online learning programs.

When approaching the online teaching form, lecturers still face many challenges with respect to converting traditional content and teaching methods to online teaching content. Therefore, lecturers also need to know the factors that play an important role in affecting student satisfaction as well as learning outcomes. Online teaching and learning also positively impact lecturers and students in several ways such as providing a flexible and personalized learning experience, reducing the cost of education, and enabling learning on demand (Cidral et al., 2018). Many educational institutions deploy a model that combines both online and in-person learning to provide the best results for learners and teachers (Christian et al., 2021). Thus, training institutions need to understand the factors affecting student satisfaction to design effective and enjoyable programs for all students involved.

Numerous studies have explored the success factors of e-learning, yet only a few have attempted to develop a holistic model assessing the success of e-learning systems from a stakeholder perspective (Al-Adwan et al., 2021). Such a model would evaluate all relevant factors—human, technological, and organizational—to provide a comprehensive definition of “success” in e-learning. A holistic understanding of these factors is vital for creating truly successful e-learning experiences.

Against this backdrop, this paper attempts to underscore the importance of a holistic approach to sustainable e-learning. It proposes a success model that contemplates the perspectives and needs of all stakeholders involved, including students, teachers, administrators, and service

providers. The Informational System Success Model (ISSM) has been adapted, with alterations reflecting the e-learning context.

The research question was addressed through a survey of Vietnamese university students during quarantine. By using a stakeholder approach, the model hopes to deliver valuable insights for informed decision-making, policy development, and the design of effective e-learning programs that meet the needs of all stakeholders. The proposed model could guide the establishment of sustainable practices that endure current and future challenges while upholding educational standards.

The importance of this work lies in its contribution to the existing body of literature regarding sustainable e-learning. The novelty of this paper is in the comprehensive stakeholder approach to e-learning success, a perspective that has been neglected in many past studies. It highlights the importance of a holistic, stakeholder-focused approach to e-learning success, which is particularly relevant in the post-pandemic educational landscape. Furthermore, the proposed model aims to inform policy-making and e-learning program design in a way that meets the needs of all stakeholders, thus ensuring sustainability in the face of evolving educational challenges.

2. Theoretical framework, hypothesis and research model

2.1. Theoretical framework

DeLone and McLean (1992, 2003) proposed the ISSM to measure the success of an IS, including six factors: information quality, quality system, service quality, usage, satisfaction, and net benefit. The model shows that quality factors (systems, information, and services) directly affect users' satisfaction and behavior while using information technology, while satisfaction and usage behavior affect net profit. Although the ISSM has been used in various areas of information systems (IS) research, it has limitations when analyzing e-learning systems' success (Al-Adwan et al., 2021). Many studies have shown that the factors influencing the net benefits are not sufficiently acknowledged in the model (Martins et al., 2019; Salam & Farooq, 2020), and the ISSM lacks theoretical support regarding the relationship between the behaviors and determinants of e-learning adoption (Islam, 2013). Net benefits were originally expressed in the model as the combination of individual and organizational impacts. However, some scholars argue that the model does not adequately address organizational impacts or benefits beyond those directly experienced by individual users, together with net benefits, are entirely user-dependent and case-specific (Sabeh et al., 2021).

According to Al-Fraihat et al. (2020), additional elements of the e-learning system can be added to increase the explanatory power of the ISSM. Extending the model to include context-specific factors such as learner engagement and motivation is particularly beneficial in online learning environments (Al-Adwan et al., 2021). Technical feasibility is the extent to which an e-learning solution can be implemented with the available resources (Lassoued et al., 2020). Institutional capacity is the ability of an organization to provide the necessary support for an e-learning solution (Dahms & Zakaria, 2015). Demand is the extent to which learners are willing and able to adopt and use an e-learning solution. When all three components are present, sustainable e-learning is possible.

2.2. Information quality

The success of any e-learning system is largely reliant on the quality of its information. It is generally recognized that information quality comprises accuracy, usefulness, reliability, thoroughness, access, relevance, completeness and up-to-date content (Al Mulhem & Wang, 2020; Seta et al., 2018). Moreover, a key determinant of information quality lies in course content quality (CCQ). Therefore, ensuring proper evaluation of CCQ and striving for ever-improving information quality is paramount, as this directly impacts successful e-learning systems and associated outcomes.

2.3. System quality

System quality is an accordant component of e-learning quality and can be divided into two dimensions—educational system quality (ESQ) and technical system quality (TSQ). ESQ focuses on aspects such as communication, diverse learning styles, and interactivity, while TSQ considers elements such as usability, availability, and reliability (Mohammadi, 2015). Perceived ease of use (PEOU) has been suggested as a key indicator for TSQ, as it reflects how effortless the user finds their experience with a given system (Davis, 1989). Generally speaking, having high ESQ and TSQ demonstrate that an e-learning system is well-constructed and can be relied upon to provide effective learning experiences. Overall, assessing the levels of PEOU can be very useful in understanding how successful e-learning systems are created and maintained.

2.4. Service quality

Cheng (2014) posited that service quality in the e-learning environment is reliant on two primary elements—instructor quality (IQ) and support service quality (SSQ). The former encompasses educator qualifications and ability, while the latter is determined by the kind of help accessible such as advice or technical assistance. Instructors play a major role in the success of an e-learning environment, as they help bridge the gap between providing course content, giving students an opportunity to engage with the material, and teaching them applicable skills. Furthermore, software and technology issues can be challenging for online learners if technical assistance is not readily available. Support service technicians provide important troubleshooting services to help prevent and rectify problems that may impede learning progress, thus being integral in providing a satisfactory e-learning experience.

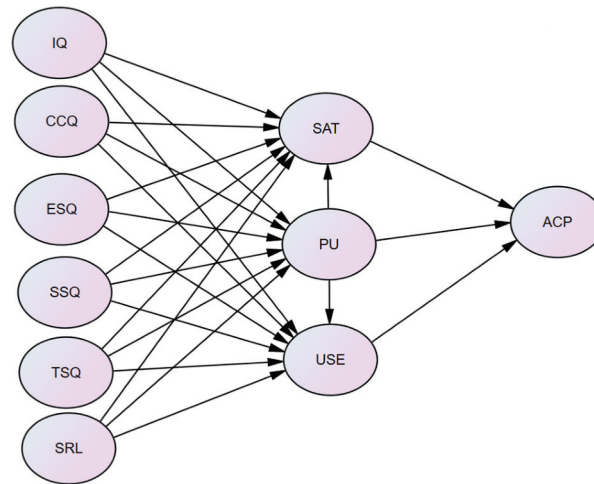
The model is based on the premise that sustainable e-learning practices should be designed with the active involvement of all stakeholders. It recognizes that each stakeholder has a unique role to play in the success of e-learning programs, and that their perspectives and needs must be taken into account when designing these programs. For example, learners have specific expectations and needs regarding e-learning such as access to high-quality materials, interactive learning experiences, and support from educators. At the same time, educators require training and support to deliver effective e-learning experiences, while administrators need to ensure that the necessary infrastructure is in place to support e-learning programs.

The holistic success model for sustainable e-learning based on the stakeholder approach aims to provide a comprehensive framework that addresses the needs of all stakeholders involved in the e-learning process. It identifies and analyzes the various factors that contribute to the success of e-learning, including the quality of content, the delivery methods used, the level of learner engagement, and the extent to which the program aligns with the needs of all stakeholders (Table 1). By adopting this framework, they can better understand the needs and expectations of all stakeholders involved in the e-learning process and design programs that are sustainable, effective, and in accordance with the needs of all stakeholders.

Table 1. Proposed research factors

ISSM factors	HSMSE factors	Stakeholders
Information Quality	Course content quality	Lecturer
System Quality	Educational System Quality Technical System Quality	Institution Service Provider
Service Quality	Instructor quality Support Service Quality	Lecturer Service Provider
Use	E-learning Use	Student
Satisfaction	Satisfaction	Student
Net Benefits	Academic Performance	Student
	Perceived Usefulness	Student
	Self-learning ability	Student

Figure 1. Proposed research model.



This study proposes a contextualization model of e-learning success factors based on the ISSM, in which information quality is represented by course content quality (CCQ); system quality is represented by education system quality (ESQ) and technical system quality (TSQ); and service quality is represented by instructor quality (IQ) and support service quality (SSQ). Besides, the model also adds an extra research variable named self-regulated learning (SRL), Al-Adwan et al. (2021) suggested (Figure 1). The research model of the impact of these six factors on learner satisfaction (SAT), Perceived usefulness (PU) and usage behavior (USE) and the impact of SAT, PU USE on the net benefit. Specifically, the net benefit in e-learning will focus on the benefit of learners, which is the learning outcome factor and is represented by the academic performance (ACP).

2.5. Hypothesis development and research model

2.5.1. Course Content Quality (CCQ)

Providing quality course content is essential to maximize students' learning experience. Appropriateness, timeliness, and meeting the purpose of students are all important characteristics that should be incorporated into course design in order to promote effective learning and consequent student satisfaction (Chiu et al., 2005; Sun et al., 2008). As Mtebe & Raisamo (2014) explain, high-quality online course content can allow learners to successfully apply the course's knowledge to different contexts. This can be observed when course creators make efforts to configure high-quality materials that include interactive elements, varied discussion topics, and well-written content to optimize the learning experience (Cheng, 2014). Similarly, Yakubu and Dasuki (2018) assert that the quality of course content is an important motivator for learners to use an online learning system by improving learner satisfaction. Therefore, we have the following:

H1a: CCQ positively influences SAT with the e-learning system

H1b: CCQ positively influences PU of the e-learning system

H1c: CCQ positively influences the USE of the e-learning system

2.5.2. Education System Quality (ESQ)

Education system quality refers to the features that an educational institution should have, in order to be able to provide a quality learning experience for online learners, such as

communication tools, assessment materials, and the means by which students can learn interactively and collaboratively (Almaiah et al., 2020). The availability of these features in the system will ensure that each learner's needs are met, thereby maximizing their learning potential. Moreover, these features can enhance cooperation and information exchange between learners and lecturers (Goh et al., 2017) through active learning functions such as discussion forums, translation services, and document sharing, thereby building a more structured learning environment (Al Mulhem & Wang, 2020; Cidral et al., 2018; Seta et al., 2018) and enhancing the user's satisfaction, perceived usefulness, and actual use. Thus, we have the following hypothesis:

H2a: ESQ positively influences SAT with the e-learning system

H2b: ESQ positively influences PU of the e-learning system

H2c: ESQ positively influences the USE of the e-learning system

2.5.3. Technical System Quality (TSQ)

Effective evaluation of the technical system quality of an online education platform requires measuring a range of technical characteristics such as security, controllability, direction, availability, and reliability (Mohammadi, 2015; Seta et al., 2018; Yakubu & Dasuki, 2018). The quality of the engineering system is also reflected in the modern graphical interface with user-friendly design, which not only helps improve learner satisfaction but also gives them a more engaging experience (Bauk et al., 2014). Al-Fraihat (2018) points out that the quality of an engineering system is reflected in its educational effectiveness and user usability. The better the quality of the technical system, the more it attracts learners and increases their satisfaction and perceived usefulness, so that the users will more actively use the online platform for learning purposes and achieve high learning outcomes. Therefore, we have the following hypotheses:

H3a: TSQ positively influences SAT with the e-learning system

H3b: TSQ positively influences PU of the e-learning system

H3c: TSQ positively influences the USE of the e-learning system

2.5.4. Instructor Quality (IQ)

According to Cheng (2014), the quality of lecturers is expressed through teaching style, which has a clear influence on learner success, participation, attitude, and enthusiasm towards the e-learning system. Pham et al. (2019) pointed out that learners' perception of the quality and timely feedback of instructors are key factors in the success of online—offline combined courses. The enthusiasm and teaching methods of the lecturers throughout the training process are always appreciated in traditional and online classes (Tu et al., 2020). Besides, Rajabalee and Santally (2021) found that teacher support is important in shaping learner satisfaction. In particular, learners in an online learning environment may feel frustrated and express negative emotions when they receive inadequate instructor support, even when they perform well. Proper academic guidance can generate increased interest in high achievement and desire for self-improvement among learners (S. J. Lee et al., 2018). Learners will be more willing to accept such systems when instructors actively provide timely feedback and quality learning material via e-learning systems. Thus, instructors are responsible for devising learning objectives and providing activities or assignments to help students attain these goals. Therefore, it is evident that instructors should have sufficient technical knowledge and understanding of pedagogy to effectively incorporate ICT into the educational process (Almerich et al., 2016; Turugare & Rudhumbu, 2020). Having these skills

gives instructors the power to impart active academic guidance in an effective manner, which helps promote learners' perception of value when interacting with e-learning systems and increases the usefulness of such systems, the satisfaction from them, and eventually their actual use by the learners. Therefore, we have the following hypotheses:

H4a: IQ positively influences SAT with the e-learning system

H4b: IQ positively influences PU of the e-learning system

H4c: IQ positively influences the USE of the e-learning system

2.5.5. Support Service Quality (SSQ)

The quality and availability of support services have been shown to have an impact on the success of online learning systems (Cheng, 2014) and are correlated directly to learner satisfaction and acceptance (J.-W. Lee, 2010; Pham et al., 2019). Cheok and Wong (2015) point out that when there is no adequate technical support or failure to resolve user problems satisfactorily, frustration can arise in learners and create a situation whereby the utility of an online learning system is devalued due to the technical problems encountered by users (Turugare & Rudhumbu, 2020). The ability of technical support to assist with adopting e-learning systems is an essential factor of success to ensure that the instructors and learners are not burdened by difficulties that might be beyond their capability to solve (Turugare & Rudhumbu, 2020). Technical support provides an effective means to maintain the utility of the diverse functions of an e-learning system, thus improving performance alongside increased user interaction, which leads to greater satisfaction. Studies have suggested that users will be more likely to accept the usefulness of a system if continual accessible service is provided by organizations. This reinforces the importance of dedicated technical support in order to optimize user engagement and positive sentiment within an e-learning system. Understanding learners' needs when providing support services is essential to improve the service quality; this helps promote the smooth use of existing systems and closes the gap between users and technology while improving student satisfaction when using online learning platforms. Organizations that offer services by IT technicians and other support units related to an e-learning system have an advantage in terms of their learners' perceptions; Al-Fraihat et al. (2020) indicate that the perception of a system's usefulness is impacted if technical support is available. Perceived usefulness plays a crucial role in affecting learners' perceived satisfaction and ease of use with the system, which can further motivate usage. Therefore, we have the following hypotheses:

H4a: SSQ positively influences SAT with the e-learning system

H5b: SSQ positively influences PU of the e-learning system

H5c: SSQ positively influences the USE of the e-learning system

2.5.6. Self-Regulated Learning (SRL)

Self-learning is the process of self-perception and behavioral adjustment to facilitate knowledge acquisition and skill development (Zimmerman, 2015). Self-learning is demonstrated through goal-setting, planning, strategy-making, and self-monitoring activities. It is also an individual's ability to participate actively in cognitive, motivational, and behavioral aspects of his or her learning (Y. C. Kuo et al., 2014; Y.-C. Kuo et al., 2013). In particular, for online learning platforms where the presence of an instructor or classmate is limited, the ability to self-study becomes the foundation for learner success (Al-Adwan et al., 2022; Tú et al., 2020). The factor that has the greatest influence on the satisfaction of e-learners is the learners themselves. Online learning is done between a person and a computer connected to other people (teachers, classmates) through a virtual environment, and so the influence of teachers and friends on students' learning is

significantly reduced, and therefore self-study plays a decisive role in students' ability to absorb learning and study. Therefore, people with lower self-study ability will have considerable difficulty in such an independent learning environment. They become dissatisfied with e-learning systems in general and refuse to use them and recognize their usefulness. Therefore, we have the following hypotheses:

H6a: SRL positively influences SAT with the e-learning system

H6b: SRL positively influences PU of the e-learning system

H6c: SRL positively influences the USE of the e-learning system

2.5.7. *Perceived Usefulness (PU)*

Perceived usefulness (PU) has been of paramount significance in technology acceptance research related to the theory of acceptance and use of technology (TAM), as it reflects the instrumental value of IS such as e-learning systems (Al-Adwan et al., 2021). The concept of PU refers to the degree to which an individual believes that a certain system can improve their job performance (David, 1989). Modern e-learning systems offer students useful features such as downloading learning material and interacting with peers and instructors, which is expected to enhance learning by a large margin. By perceiving that the system delivers beneficial outcomes for students' learning, a sense of satisfaction is induced, which subsequently causes an increase in overall usage (Al-Fraihat et al., 2020). Therefore, we have the following hypotheses:

H7a: PU positively influences SAT with the e-learning system

H7b: PU positively influences the USE of the e-learning system

H7c: PU positively influences students' ACP

2.5.8. *Satisfaction (SAT)*

Long-standing satisfaction has been shown to have a positive impact on student learning outcomes (Williams & Smith, 2018); however, the advent of digital education platforms provides one more real-life example of the relationship between these variables. In particular, Chen et al. (2016) showed that students who enroll in online courses report higher levels of satisfaction and also have improved academic performance. Besides, when learners have more control over their learning process, they tend to feel more satisfied with their learning and have better results. Thus, the following hypothesis is proposed:

H8: SAT positively influences students' ACP

2.5.9. *USE of e-learning system (USE)*

Salam and Farooq (2020) identified USE as an indicator of how much a user takes advantage of the features offered in a particular system to satisfy their needs. The use of an e-learning system is measured in terms of duration, nature, and frequency of use, as well as through user assessment of effectiveness and usefulness (Alzahrani et al., 2019; Farooq et al., 2017). Several studies established that the use of e-learning systems in an academic setting leads to enhanced learner academic performance and revealed that such systems could improve student learning in terms of providing effective interaction, fast information transfer, and increased collaboration opportunities (Islam, 2013; Maqableh et al., 2021; Martins et al., 2019; Mohammadi, 2015). The active utilization of these systems further indicates that students view them as beneficial to their learning

endeavors, providing the knowledge and resources necessary for improved academic outcomes. Thus, the following hypothesis is proposed:

H9: *The use of e-learning positively influences students' ACP.*

3. Methodology

The research was carried out during the social distancing period, relying entirely on an indirect survey instrument generated via Google Forms. The convenient sampling technique was adopted due to the practical limitations imposed by the pandemic, as it was the most feasible way to reach out to respondents. It is acknowledged that this method might introduce some bias in the responses. However, given the circumstances, the method was deemed suitable. The sample size of 321 students is considered appropriate as it represents a decent cross-section of the university population and allows for statistically significant results.

In examining the demographics of the 321 respondents, 260, equating to approximately 81% of the total, were women. Men made up a smaller proportion, with 58 respondents, or about 18.1%. The percentages do not total exactly 100%, and this discrepancy is due to a small portion (approximately 0.9%) of respondents who opted not to disclose their gender.

When categorizing responses by year of study, 3.7% were freshmen, 24.9% were sophomores, with the majority being third-year students at 66%, and seniors made up 5.3% of responses. The percentages again do not add up to 100%, and this discrepancy is attributed to a small number of respondents (approximately 0.1%) who did not specify their year of study.

Regarding the online learning platforms, 97.2% of the students were users of Zoom, 15.9% used Google Meet, and 5.6% operated Microsoft Teams. It's important to note that students could use multiple platforms, which is why the percentages exceed 100%. No students reported using other platforms.

In terms of the motivation behind the choice of online learning software, about 87.9% of students indicated that they chose the software predominantly required by the school. Roughly 24% selected a software that best catered to their needs, while 39.1% opted for a platform due to its ease of use. A small percentage, approximately 1.6% of students, cited other reasons for their choice. As these percentages do not total 100%, it's clear students could have more than one influencing factor in their decision.

The present study was conducted in two phases. In the first phase, preliminary qualitative research was undertaken to develop a set of survey questions based mainly on studies of similar topics, with adjusted wording appropriate for the new context. To measure respondents' attitudes and perceptions toward the topic, a Likert scale spanning 5 points from 1 (strongly disagree) to 5 (strongly agree) was employed. Furthermore, a pilot test with a restricted sample size (10 respondents) was run to assess the comprehension and efficacy of the provided survey questions before its official application. The results from this process allowed for revisions to be made to ensure maximal clarity in the researcher's communication.

In the second phase, the survey data was processed on SPSS and Amos 22 software to assess measurement constructs following the guidelines on the use of structural equation modeling suggested by Anderson and Gerbing (1988). First, a scale reliability test with Cronbach's alpha coefficient was performed to eliminate inappropriate variables. With this selection step complete, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to evaluate the convergent validity of the remaining variables. Finally, structural equation modeling (SEM) was adopted to examine the hypotheses of causal relationships present among constructs.

4. Results

4.1. Reliability and validity of measurement items

The study utilizes Cronbach's alpha, EFA, and CFA to determine the reliability, convergence validity, and discriminant value of the research model. After running Cronbach's alpha on each variable, SAT4 and USE3 were found to have correlation coefficients of 0.162 and 0.175, respectively, which fell short of the criterion for inclusion in the scale (correlation coefficient of at least 0.3). Consequently, it was excluded from the model. Upon rerunning Cronbach's alpha with this eliminated variable, all constructs demonstrated satisfactory reliability with Cronbach's alpha index higher than 0.7 and composite reliability (CR) value above 0.7, thus validating the reliability of these scales (Hair et al., 2010).

The convergent validity of the measurement was examined using EFA and the principal axis factoring extraction method with Promax. The analysis of item PU3 rendered a convergence coefficient value of 0.493, undershooting the threshold of 0.5 and thus resulting in removal from the data set. The EFA was run the second time and yielded a KMO value of 0.931, thereby exceeding the threshold criterion for performing factor analysis of 0.5 and indicating that there were statistically significant correlations among the observed variables (Sig. = 0.000 < 0.005). Variance extraction totaled 67.388%, indicating that these factors explained most of the variation in dependent variables. Ten factors were extracted and converged and the variable names were retained as they were not disruptive. Moreover, all items had standardized loading estimates above 0.6 and loaded on separate factors while all average variance extracted (AVE) exceeded 0.5, thereby meeting the required convergent condition (Hair et al., 2010; Henseler et al., 2009).

Discriminant validity was achieved, as evidenced by the maximum shared squared variance (MaxR(H)) and average shared squared variance (ASV) being lower than AVE. Additionally, the root mean square of AVE for each construct was higher than the inter-construct correlations, confirming the discriminant validity between the study variables (Chin, 1998; Fornell & Larcker, 1981). The evidence that was gathered gave strong support to the absence of collinearity issues within the dataset (Table 3).

4.2. Hypotheses testing

The results of the CFA and SEM, as determined by Arbuckle (2006), and Baumgartner and Homburg (1996), demonstrate an acceptable fit to the guidelines, with adequate measurement model reliability established for the hypothesis testing that was conducted (Tables 2 and 4).

Hypothesis test results show that there are five factors affecting SAT, PU, and USE including IQ, CCQ, ESQ, TSQ, SRL due to Sig value less than 0.05; therefore, hypotheses H1, H2, H3, H5, and H6 are accepted with a 95% confidence level. Similarly, H7 is accepted, showing that PU has impacts on SAT, USE, and ACP. Both SAT and USE have significant impacts on ACP (H8,9 accepted). Rejected H4 indicates that SSQ has no significant impact on SAT, PU, and USE.

5. Discussion and managerial implications

First, the course content quality is one of the most impactful factors in determining the success of e-learning. It is argued that since learners often interact with technology more than they do with their faculty, institutes and learning materials need to be tailored to cater to diverse requirements and be engaging (Pham et al., 2019). The quality of course content affects learner success through different factors that include the theoretical and practical elements, regular updates, and relevancy of materials to the curriculum (Hang & Tuan, 2013). When the content is designed adequately, it maximizes the enjoyment derived from learning, thereby promoting satisfaction, perceived usefulness, and actual use. Educational institutions and lecturers must strive to make clear and understandable content available while also making it accessible, incorporating multiple sources and utilizing a variety of exercises.

Table 2. Results of the reliability and validity of measurement items

	Items	Factor loading	CR	AVE	CA	Sources
Self-regulated learning (SRL)	SRL3	.913	0.909	0.713	0.908	Al-Adwan et al. (2021)
	SRL4	.875				
	SRL2	.763				
	SRL1	.754				
Support Service Quality (SSQ)	SSQ2	.851	0.876	0.640	0.873	Cidral et al. (2018)
	SSQ3	.765				
	SSQ1	.738				
	SSQ4	.571				
Academic performance (ACP)	ACP4	.912	0.860	0.609	0.854	Islam (2013)
	ACP2	.807				
	ACP1	.733				
	ACP3	.653				
Instructor Quality (IQ)	IQ4	.818	0.857	0.600	0.856	Al-Fraihat et al. (2020)
	IQ2	.767				
	IQ1	.764				
	IQ3	.743				
Educational System Quality (ESQ)	ESQ3	.857	0.864	0.614	0.860	Seta et al. (2018)
	ESQ4	.817				
	ESQ2	.751				
	ESQ1	.517				
Technical System Quality (TSQ)	TSQ1	.913	0.886	0.722	0.885	Seta et al. (2018)
	TSQ3	.835				
	TSQ2	.751				
Course Content Quality (CCQ)	CCQ3	.823	0.878	0.643	0.877	Al Mulhem and Wang (2020)
	CCQ1	.796				
	CCQ2	.764				
	CCQ4	.613				
Satisfaction (SAT)	SAT1	.859	0.853	0.659	0.852	Yakubu and Dasuki (2018)
	SAT2	.849				
	SAT3	.715				
Perceived Usefulness (PU)	PU4	.968	0.851	0.656	0.838	Mohammadi (2015)
	PU1	.696				
	PU2	.621				
The use of information system (USE)	USE1	.748	0.844	0.644	0.836	Shahzad et al. (2021)
	USE2	.729				
	USE4	.677				

Notes: Model fit indicators of CFA: chi-square = 1051.946; df = 549; $p = 0.000$; chi-square/df = 1.916 (< 3); TLI = 0.923 (> 0.8); CFI = 0.933 (> 0.8); RMSEA = 0.053 (< 0.08) (Arbuckle, 2006; Byrne, 2001).

Second, the quality of lecturers plays a pivotal role in e-learning success. While the content of lectures is pre-designed, it is important to recognize that teaching methods such as problem suggestions, instructions, and feedback for the final assessment yield significant influence on knowledge acquisition regardless of the platform they teach. Although the relationship between the members of the system is a virtual relationship, the teacher—student relationship allows the teacher to retain a certain role

Table 3. Discriminant value

	MSV	MaxR(H)	SRL	SSQ	ACP	IQ	ESQ	CCQ	TSQ	SAT	USE	PU
SRL	0.340	0.911	0.845									
SSQ	0.459	0.881	0.495***	0.800								
ACP	0.278	0.876	0.451***	0.408***	0.780							
IQ	0.380	0.862	0.416***	0.441***	0.408***	0.775						
ESQ	0.380	0.871	0.355***	0.543***	0.444***	0.508***	0.783					
CCQ	0.485	0.881	0.583***	0.678***	0.494***	0.610***	0.605***	0.802				
TSQ	0.381	0.892	0.356***	0.533***	0.444***	0.555***	0.578***	0.572***	0.850			
SAT	0.456	0.854	0.521***	0.510***	0.480***	0.601***	0.580***	0.660***	0.573***	0.812		
USE	0.487	0.861	0.540***	0.589***	0.527***	0.617***	0.616***	0.697***	0.617***	0.676***	0.803	
PU	0.487	0.857	0.545***	0.492***	0.504***	0.613***	0.595***	0.655***	0.562***	0.653***	0.698***	0.810

Table 4. Results of hypothesis testing

Hypotheses	Construct path	Model 1 (original)	Model 2 (SAT)	Model 3 (PU)	Model 4 (USE)
H4b	IQ → PU	.228***		.222***	
H1b	CCQ → PU	.225**		.234**	
H2b	ESQ → PU	.234***		.223***	
H5b	SSQ → PU	-.051		-.048	
H3b	TSQ → PU	.146**		.151**	
H6b	SRL → PU	.223***		.228***	
H4a	IQ → SAT	.155**	.192***		
H1a	CCQ → SAT	.194**	.231***		
H2a	ESQ → SAT	.138**	.181***		
H4a	SSQ → SAT	-.005	-.012		
H3a	TSQ → SAT	.133**	.161**		
H6a	SRL → SAT	.124**	.172***		
H4c	IQ → USE	.129**			.175***
H1c	CCQ → USE	.177**			.224***
H2c	ESQ → USE	.134**			.188***
H5c	SSQ → USE	.079			.067
H3c	TSQ → USE	.155**			.188***
H7a	PU → SAT	.178**			
H7b	PU → USE	.222***			
H6c	SRL → USE	.109**			.166***
H8	SAT → ACP	.187**	.603***		
H9	USE → ACP	.310***			.623***
H7c	PU → ACP	.207**		.590***	
CMIN/df		1.916	1.923	2.013	1.967
CFI		.932	.942	.937	.940
GFI		.843	.867	.861	.865
AGFI		.812	.839	.832	.836
RMR		.029	.037	.035	.033
RMSEA		.053	.054	.056	.055
PCLOSE		.121	.151	.039	.082

inherent in the traditional classroom, thus still having an important influence on learners' learning experiences.

Designing effective online topics/lessons that adequately cover materials and organizing them to guide students in their studies is essential for effective online teaching. Assigning appropriate learning and testing tasks, evaluating student learning results, and monitoring content exploitation by the students ensure optimal learning conditions. Answering questions, providing feedback and support, as well as being available to provide timely answers and advice are important responsibilities of instructors in this context. As such, managing the flow of the learning process and rapidly checking student assessments on the system is paramount. Students often have questions that need to be answered and therefore they seek support from lecturers. So, a timely approach should be taken toward answering inquiries to best meet the needs of such learners.

Third, the quality of the education system is the third-most influential factor in e-learning success. This result coincides with the findings of previous research papers such as Mohammadi (2015) and Roca et al. (2006). The quality of an education system's interactive interface is paramount in determining student satisfaction. The speed and clarity with which functions are executed and tools are navigated are essential to maintain engagement during those intellectually demanding hours. Further, the design of the interface must be aesthetically pleasing and able to make technical information intelligible at a glance; to a certain extent, its ability to do so might even reflect on its user's aptitude for learning. In this way, it can act as both aesthetically pleasant support and challenge, helping each individual along their theoretical pathway.

Fourth, self-learning is an essential component of successful online learning. Traditional education methods often involve an instructor controlling the learning process; however, due to the decentralized nature of the online teaching model, those activities become more of an individual responsibility for each student. Therefore, learners are needed to build their capacity for self-regulated learning, developing the skills required to work independently such as resourcefulness and creativity, engaging in the self-directed exploration of new knowledge, and supplementing existing skills or knowledge for further improvement. Self-study is fast becoming an ever-important skill for students; it allows them to practice their problem-solving, troubleshooting, and critical thinking skills. It also encourages students to explore different approaches to the same problem, fostering creativity, and allowing students to discover the most efficient and effective solutions. In addition, learning how to properly use free time can help students acquire greater affinity with their studies, while synthesizing and analyzing relevant materials allows them to gather further knowledge beyond what they already know. Ultimately, self-study abilities can help improve student outcomes by letting them study more in-depth, retain information better, and grow as learners.

Fifth, technical system quality has been demonstrated to be an important factor in determining e-learning success. To achieve an optimal learning experience, it is imperative to provide reliable and secure technical systems for students, with the primary prerequisite of a stable network connection, suitable equipment, and high security. These heightened demands underscore the importance of government support in developing and providing Internet infrastructure solutions. This could include elevating existing domestic data backup capacities to handle higher than typical demand levels, increasing domestic data consumption, or constructing a domestic data center to reduce the impact on online learning when undersea fiber optic cables experience difficulties.

Finally, the quality of support services has no impact on online learning success. This can be explained by several factors. Recent advances in technology such as Zoom, Google Meet, and Microsoft Teams have made online learning more accessible and user-friendly than ever before. Furthermore, most users are likely to be younger people with an adequate level of digital literacy, and thus they can independently explore and resolve technical issues with minimal external support. Furthermore, those who experience difficulties can take help from their lecturers or classmates or the Google tool, making it feasible for them to get the necessary assistance without relying on application-specific support services.

This finding implies that e-learning providers can effectively reduce operational costs by cutting down on unnecessary support services. Furthermore, businesses should create forums for users to facilitate communication by sharing information, asking and answering questions, and exchanging knowledge. This approach offers a great opportunity for companies to lower operating costs and build loyal customer relationships.

6. Conclusion, limitations, and suggestions for future research

This study proposed a holistic success model for sustainable e-learning from the stakeholder approach, focusing on Vietnamese students during the COVID-19 pandemic. The proposed model considers essential factors across four stakeholder perspectives: students, instructors, institutions, and technology. By considering these multi-dimensional factors, the model provides

an integrated set of strategies to achieve long-term success and sustainability for e-learning. The study aimed to identify the factors that influence students' academic performance in online learning mode. The empirical results indicated that instructor quality, course content quality, educational system quality, technical system quality, and self-regulated learning have significant impacts on the learners' satisfaction, perceived usefulness, and actual use, which influence learners' academic performance.

Despite the achieved results, the study also had certain limitations. The sampling method of response collection through online questionnaires may limit the generalizability of the study. To further explore this topic, future research should include larger and more diverse samples from multiple countries to broaden the scope of the results, adopt probability sampling, compare results among different demographic groups, and consider other factors to increase the credibility of the results and discover new relationships. Additionally, in-depth interviews, stratified or snowball sampling techniques, and rigorous quantitative methods should be used to gain a deeper understanding of the holistic success model for sustainable e-learning from a stakeholder perspective.

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