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E-learning Outcomes during the COVID-19 Pandemic

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Abstract. During the COVID-19 pandemic, it was necessary to implement online courses so that teaching and learning would not be interrupted. While online courses cannot replace traditional forms of learning, this form of teaching and learning has been and is the most effective solution. How to effectively teach and learn online is still a question of interest to many. The study aimed to determine the relationship between factors that promote learner satisfaction and e-learning outcomes among online learners of nine private universities in Ho Chi Minh City, Vietnam, from the learner's perspective. Because the model has an intermediate variable, the PLS SEM method is used. The study used the technology-mediated learning (TML) approach. Independent variables in this study include student motivation, student self-regulation, teacher-student dialogue, student-student dialogue, activities, course structure, technology quality, and LMS tools and features. The dependent variable in this study is e-learning outcomes. Research shows that student-to-student dialogue, course structure, and technology quality have a positive and significant impact on learner satisfaction. The results also show that learner satisfaction correlates with learner outcomes. From the research results, we have proposed some solutions, such as teaching platform, accuracy in course design, selection of software and teaching aids. This research offers a new understanding of the relationship between learner satisfaction and the learning effectiveness of online education at private universities, and contributes online education solutions suitable for new conditions in Vietnam.

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1. Introduction

The COVID-19 pandemic has forced educational institutions to shift from traditional face-to-face classes to online classes (Yahya et al., 2021). Despite the general population's acceptance and implementation of this setup, the students face a variety of challenges (Del Rosario & dela Cruz, 2022). Online education has benefits, but it also has disadvantages (Xie et al., 2020). Students who took online classes encountered a number of challenges in delivering information (Jaca, 2022). In Vietnam, the COVID-19 outbreak also began to spread to other provinces. As of April 8, 2020, all 63 provinces and cities across the country allowed students to stay at home. On April 1, 2020, Vietnam began implementing social distancing across the country to prevent the spread of the disease. The pandemic brought various challenges to Vietnam's education and training system (Nguyen, 2022).

Education and training changes gradually to adapt to a new trend as society's development changes. In the context of Technology 4.0, education systems have transformed from traditional structures to modern teaching methods. Teaching and learning are not limited to face-to-face courses; today's educational technology also enables learners to learn remotely and on mobile devices (Yahya et al., 2021). In addition, educational technology enables teachers and learners to interact at any time. Many educational institutions, such as universities, colleges, and training centers, have used online teaching methods and created virtual classroom environments to organize courses (Vanessa, 2020). Online learning allows learners to take classes in their free time, even if they have other jobs (Xie et al., 2020). Consequently, under the new trend, both teachers and learners have the opportunity to gain further teaching experience.

Modern teaching methods are beneficial to learners and provide many conveniences for teachers' teaching subjects, and the teaching environment may be more pleasant (Xie et al., 2020). Additionally, advancements in educational technology have pushed the boundaries of the classroom, ensuring learning is always available (Yahya et al., 2021).

The COVID-19 pandemic forced universities to switch to emergency online learning (Yahya et al., 2021). The complex and rapid evolution of the pandemic made it difficult for policymakers to devise appropriate solutions for the pandemic situation, especially for the education sector (Crawford et al., 2020). Organizing learning in new conditions is not easy for some countries, especially low- and middle-income countries where even physical facilities are still challenging.

E-learning is affected by many other factors, so the quality of e-learning is also a matter of concern (Saba, 2012). Similarly, satisfaction in this form of learning is also affected by many other factors, such as learner motivation, course structure, teacher qualifications and supporting factors (Baber, 2020).

To connect with students and ensure the continuity of teaching, universities shifted from face-to-face training to online learning. While online training has many benefits, its implementation also has certain limitations, especially at a time when many universities are just beginning to adopt this form of teaching.

A summary of previous studies shows that this is a topic of high urgency and research on this topic has recently begun to receive the attention of researchers. However, because online teaching in Vietnam only began after the pandemic, there had been no research on this topic. As a result, research is required to find solutions.

The goal of this study was to identify factors that influence learner satisfaction and the outcomes of e-learning from the learner's perspective; propose appropriate solutions to help increase learner satisfaction, and increase learning efficiency in new educational conditions. The findings can help university managers, government politicians, teachers, and students to improve the quality of online learning and enhance learner satisfaction and e-learning outcomes.

2. Literature Review

2.1 Technology-Mediated Learning (TML)

Technology-mediated learning (TML) is a learning environment supported by a complex information technology system, in which teachers, learners, and learning resources can interact online. The term "information technology" refers to the convergence of computing, communication, and data management technologies (Islam Sarker et al., 2019). TML is an essential trend in education as it enables the advantageous inclusion of traditional and IT-based learning activities. Consequently, TML's significance will grow as it empowers the creation of innovative, personalized, and resource-efficient ways of education. Learners can learn from a physical workplace or a self-contained, cloud-based learning location.

Despite its numerous advantages, such as growing business feasibility and increased student achievement, TML raises several fundamental problems due to its variability. For example, due to the complexity of TML, studies cannot fully capture the impact of synchronous and asynchronous learning elements on TML outcomes (Zhong et al., 2022).

2.2 E-learning and E-Learning Satisfaction

E-learning is the use of information technology to disseminate information and knowledge for education and training. This form of teaching and learning has become a model of modern education. E-learning involves using the internet to access information and update knowledge at any place and time (Aparicio et al., 2014). Al-Fraihat et al. (2020) also define an e-learning system as an information system that can integrate a variety of instructional materials (via audio, video, and text media) via email, live chat sessions, online discussions, forums, tests, and assignments. It is an internet learning ecosystem that connects various stakeholders to technology and processes.

E-learning allows learners to have greater access to internet-connected devices, such as mobile phones, computers, tablet devices, and laptops (Alraimi et al., 2015). In general, an e-learning system is a collection of information systems, human activities (students, trainers, and managers), as well as non-human organizations (learning management systems), that enable holistic learning communication (Andrade et al., 2019).

Cyert and March (1963) pioneered user satisfaction to assess the success of information systems. It was proposed in that review that if data systems meet users' needs, their satisfaction will grow naturally. Satisfaction can be defined as feeling the result of comparing perceptions and experiences of perceived service with people's expected happiness or disappointment. According to Moore (2012), characteristics, including the use of learning strategies, learning challenges, peer interaction, capacity to apply data, and achievement of learning outcomes, all effect learners' satisfaction levels with e-learning (Moore, 2012).
There are various instruments for measuring student satisfaction in an online context. Survey questionnaires, such as the course experience questionnaire, the national student survey, and students' evaluations of educational quality, are widely used to assess learner satisfaction.

E-learning is a system composed of three elements, including learners, teachers, and a learner management system (LMS). This system will connect everyone to optimize learning outcomes and increase student satisfaction (Eom et al., 2006).
There are two sorts of processes that result in learning satisfaction. The course structure and design specify the process that the instructor creates and manages. In an e-learning system, student satisfaction is an important question in understanding the success factors of any online learning. Student satisfaction is an important factor that creates the final learning outcomes and student achievements (Babushkina et al., 2017).

According to Eom et al. (2006), eight elements influence e-learning satisfaction: student motivation, student self-regulation, instructor-student interaction, student-student interaction, instructor activities, and course structure. Additionally, in the research of Kintu and Zhu (2016), technology quality and LMS tools and features were also found to impact on e-learning satisfaction.

2.3 Learner Motivation

Learner motivation is regarded as a complex and difficult issue in education (Dewi et al., 2021). The five main factors that affect student motivation are students, teachers, content, method/process, and environment (Meşe & Çiğdem, 2021). The role of students in education is critical and should go beyond the traditional view of students as clients or recipients of knowledge. Students prefer teachers they like for their motivational benefits over ones they dislike.

Instructors are responsible for guiding the knowledge based on designed content, and supervising the learners and the learning environment. Instructors need to be empowered to take the initiative in assessment to achieve the desired goals.

Besides, the content must be accurate, timely, relevant and valuable to a student's life.

The educational method should provide an environment conducive to optimal motivation, engagement, and learning, and assist students in developing tools that will allow them to be self-regulated (Howard et al., 2021). A suitable atmosphere must be present and easily accessible; the environment can be both physical and mental, emotional, and spiritual. Students with high motivation will be more successful in online environment than students with low motivation (Hsu, 2019). The reason for dropouts from online courses is dissatisfaction with the learning environment.

2.4 Course Structure

In an e-learning environment, the most important consideration is course structure. Course content should be carefully developed and taught in moderation (Gopal et al., 2021). Course design is how courses are structured so that they can be delivered through various communication media. It expresses the program's educational objectives, instructional practices, and evaluation methods' rigidity or flexibility (Foster-Hartnett et al., 2022). This is how an education campaign can accommodate or respond to the unique needs of each learner.

In low transaction distance courses, learners are guided through the course structure and conversations with instructors. In more remote programs, learners must decide on their learning strategies (Yahya et al., 2021), so course structure is fundamental in e-learning. The course structure includes course development, organization, design, curriculum, pedagogy and methodology, schedule, and master planning before, during, and after course instruction (Sadikin & Hakim, 2019). Eom et al. (2006) found that course structure has a strong impact on student satisfaction.

2.5 Learner Self-Regulation

Self-regulated learning strategies are "actions and processes aimed at acquiring information or skills that involve the learner's perception of agency, purpose, and tools" (Zimmerman, 1990). Self-regulated studying is a loop of "self-oriented feedback". In teaching, self-regulated learning has a framework that does not take into account students' internal states, but instead relies heavily on learners' self-control styles (e.g. self-mentoring, self-evaluation, self-support, self-correction, and self-instruction) (Batool et al., 2019). Ejubović & Puška (2019) found that student self-regulation significantly influences satisfaction.

2.6 Instructor-Learner Dialogue

Lecturers and students are the human resources for initiating and maintaining interpersonal dialogue; they act within structured resources. Dialogue can be used to improve student comprehension, strengthen learners' analytic skills, or as an evaluation tool. In online classes, dialogue can take several forms. For any type of dialogue to be successful, it must be carefully integrated into the curriculum, including using e-mail, bulletin boards, 'real-time' chat, asynchronous chat, group discussion, and debate (Shoepe et al., 2020).

According to Simmons and Simmons (2020), if student interaction is not involved in the learning process, students will not participate voluntarily. The findings of the empirical study have revealed a variety of impact trends. According to Gopal et al. (2021), teacher-student interaction is an important predictor of student satisfaction. The results of Eom at el. (2006) demonstrate a statistically significant positive relationship between instructor-student interaction and users' satisfaction.

2.7 Learner-Learner Dialogue

In the current study, dialogue refers to "communication, collaboration, and interaction between learners and their instructors, as well as learners among themselves, to improve learners' understanding and engagement with course content" (Abuhassna et al., 2020). Abuhassna et al. (2020) discovered that learners' cooperation with their classmates influences their reaction to that cooperation. Only important interactions are considered. Meaningful connections directly impact on learners' knowledge acquisition, stimulate their curiosity, and assist them in engaging in constructive learning activities that have an immediate impact on their learning results.

Eom et al. (2006) and Kintu et al. (2017) discovered that student-student interaction predicts satisfaction with the delivery medium, which has a positive impact.

2.8 Instructor Activities

In a traditional classroom, instructors are the primary actors in education and are primarily responsible for students' learning experiences. However, changes in the educational environment require a different approach from instructors, such as a scaffolding role or a coaching role. E-learning instructors have combined two distinct pedagogies: students and the classroom climate. When students have problems in an online course, prompt guidance from the professor inspires them to continue their studies. Previous studies found that instructors' quick responses substantially impacted learners' satisfaction (Lee et al., 2018). An instructor's attitude in the teaching process has an impact on student satisfaction. According to Gopal et al. (2021), teachers' views toward e-learning considerably impact e-learner satisfaction.

2.9 Technology Quality

E-learning involves learning and conversation through the use of other technologies such as video conferencing (Bari et al., 2018). Therefore, the quality of technology and the internet is crucial for e-learning. The quality and reliability of information technology systems have an impact on the learning performance of learners. Web data loading speed is closely related to the host server. The higher the server quality, the faster the online interface loads. If students have no sign-in or sign-out issues, continuing to interact with the teacher will increase their satisfaction. According to several studies, the strength of digital technology has a serious influence on e-learning satisfaction (Lam et al., 2021).

2.10 LMS Tools and Features

Today, a large number of universities around the world are equipped with LMS to aid in the provision of a rich online learning environment, as well as to use its

tools and functionalities to improve pedagogy and learning quality (Al-Sharhan et al., 2020). LMS tools and features are one of the most important elements of an e-learning system. LMS tools and features quality is related to whether LMS tools and features are error-free and easy to use.

The quality of LMS tools and features affects learner satisfaction, especially those aspects that affect how learners use the system. These characteristics include ease of use, learnability, and friendliness. Therefore, learners will be more likely to use a system if it is simple to use, and this increased use will have a positive impact on their satisfaction.

Kintu and Zhu (2016) analyzed LMS tools and features for usability, navigation, published course content, and perceived usefulness. The results showed that learners made heavy use of the tools and resources, and found them valuable, leading to learners' satisfaction.

2.11 E-learning Satisfaction and E-Learning Outcomes

E-learning outcomes are goals that must be met during the learning process (Kustono et al., 2021). This is an important factor when studying e-learning, measuring whether students attain competencies in their e-learning (Weinert, 2001). Evaluating e-learning outcomes is critical because dissatisfied students become less likely to be enrolled in prospective e-learning classes. E-learning outcomes occur when participants acquire new knowledge through e-learning programs.

E-learning satisfaction is a significant predictor of student outcomes. It frequently represents the cognitive component of course outcomes and is thus critical to evaluate in an e-learning environment. In their research, Eom et al. (2006) found that user satisfaction is an important predictor of student outcomes.

3. Hypotheses of the Study

H1. Student motivation has a positive influence on e-learning satisfaction.
H2. The course structure has a positive influence on e-learning satisfaction.
H3. Student self-regulation has a positive influence on e-learning satisfaction.
H4. Instructor-student dialogue has a positive influence on e-learning satisfaction.
H5. Student-student dialogue has a positive correlation with e-learning satisfaction.
H6. Instructor activities have a positive correlation with e-learning satisfaction.
H7. Technology quality has a positive correlation with e-learning satisfaction.
H8. LMS tools and features have a positive correlation with e-learning satisfaction.
H9: E-learning satisfaction is significantly associated with e-learning outcomes.

Figure 1 shows the article's hypothetical model showing the interrelationships between the variables of interest.

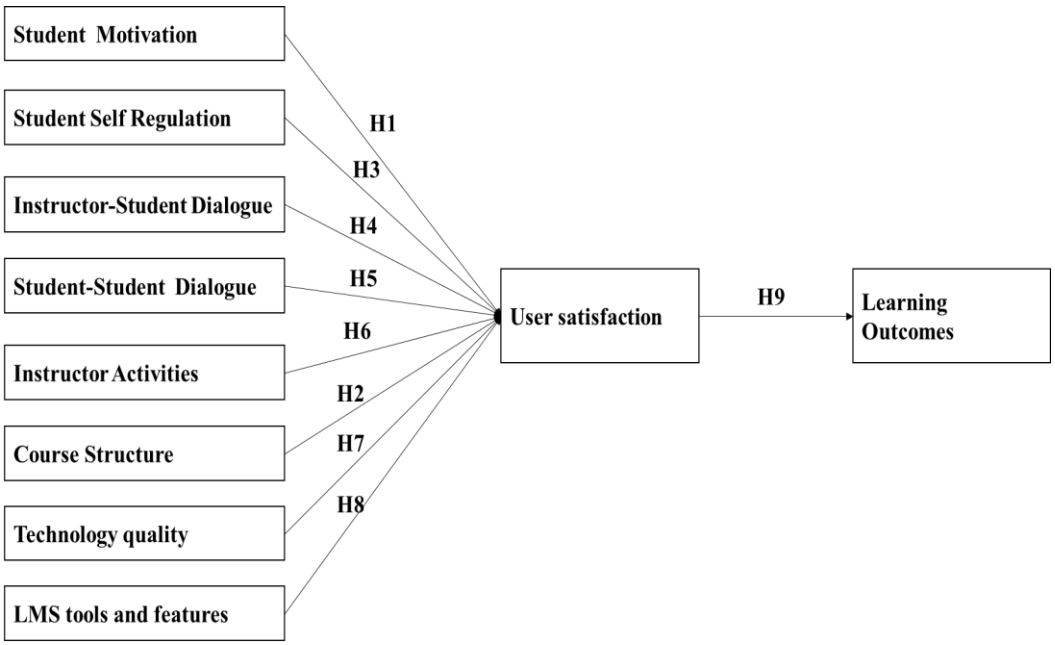


Figure 1. Hypothesized model

4. Methodology

4.1 Research Design

To answer the research question, we used partial least squares structural equation modelling (PLS-SEM) to analyze the data. The study employed quantitative research methods, including tests the model's fit, CFA analysis and SEM model analysis. PLS-SEM is a powerful instrument used to analyze linear structural models under abnormal conditions (Latan, 2018).

4.2 Research Setting and Participants

The respondents for this study were students of nine private universities in Ho Chi Minh City, including Hutech University, UEF, Hoa Sen University, Hong Bang University, Van Lang University, Huflit, Van Hien University, FPT University, Sai Gon University. The interviewees were economics students in their first to fourth years who are studying online. The questionnaire was available in Vietnamese, translated by the authors.

A group of 15 people each took part in face-to-face discussions for the pre-test. The subjects selected for the pre-test were students of two universities, UEF and FPT University. These were students who had online learning experiences during the pandemic.

The goal of pre-testing is to identify and eliminate potential problems with wording, topic, sequence, and question difficulty. The results of the pre-test questionnaire provide important feedback and helped to improve the construct validity of the questionnaire (Cook et al., 2002).

4.3 Research Instrument and Data Collection

In the research, we use the online data collection tool Google Forms. A total of 250 questionnaires were distributed via Google Sheets. A total of 223 valid answers were received, corresponding to a response rate of 89%. This is regarded as a high response rate, which reduced the possibility of response bias.

In PLS-SEM, the sample size must be at least 10 times the number of structural routes in the structural model that are directed at a specific latent construct (Hair et al., 2019). Because there are nine possible paths, the sample group should be greater than 90. As a result, the sample size of 223 answers in this study met the PLS-SEM minimum size criteria.

4.3.1 Measure of Constructs

We assessed all items using a five-point Likert scale ranging from "1" ("strongly disagree") to "5" ("strongly agree"). All 10 construct measures of the 44 variables were adjusted. Existing scales were used in the questionnaire to determine the content validity, which was modified from previous studies (Trochim et al., 2016). The scale for student motivation, instructor activities, student-student dialogue, instructor-student dialogue, course structure, student self-regulation, and learning outcomes was adapted from Eom and Ashill (2016).

The scale for technology quality was adapted from Kintu and Zhu (2016). The scale for LMS tools and features was adapted from Kintu and Zhu (2016). All constructs and measures are shown in Table 1.

Table 1. Questionnaire items and their derivation sources

Student motivation (STUM) [Source: Eom & Ashill, 2016]	
STUM 1	I prefer challenging teaching material in online courses like this so I can learn new things.
STUM 2	In this online course, when allowed the opportunity to choose class assignments, I choose those that will help me with my studies, even if a good grade isn't guaranteed.
STUM 3	I do everything in my power to ensure that my assignments are completely perfect.
STUM 4	Even when I dislike a class, I work hard to get a good grade.
STUM 5	I want to do well in this online class so that I can demonstrate my abilities to my family, parents, and others.
STUM 6	I want to be one of the most well-known students in my class.
Instructor Activities (INSA) [Source: Eom & Ashill, 2016]	
INSA1	The instructor actively facilitated this online class.
INSA2	This online class's instructor provided timely and useful feedback on assignments, exams, and projects.
INSA3	The instructor in this online class encouraged students to exert intellectual effort beyond what was required in face-to-face classes.
INSA4	In this class, the instructor was concerned about my learning.
INSA5	In this class, the instructor pays attention to all the interests of the learners.
Learner-Learner Dialogue (STUD) [Source: Eom & Ashill, 2016]	
STUD1	In this online class, I had a lot of good and constructive interactions with other students.
STUD2	Online classrooms are built to foster student interaction.
STUD3	In this class, my classmates taught me more than any other class at this university.
STUD4	Positive interaction between students in the class has helped me improve my academic results.
Instructor- Learner Dialogue (INSD) [Source: Eom & Ashill, 2016]	
INSD1	In this online class, I frequently interacted with the instructor in a positive and constructive manner.
INSD2	In this online class, the instructor and students had a lot of positive and constructive interactions.
INSD3	Interaction between learners and teachers has helped me achieve better learning results.
INSD4	Interactions between students and the instructor that was positive and constructive were an important part of the learning process.
Course Structure (COUS) [Source: Eom & Ashill, 2016]	
COUS1	This online class's course objectives and procedures were communicated.
COUS2	The modules are simple and straightforward.

COUS3	This online class's course materials were interesting and piqued my interest in learning.
COUS4	This online class's course materials provided me with a diverse set of challenges.
COUS5	Learning outcomes have been linked to assignments, projects, and exams.
Learner Self-Regulation (STUR) [Source: Eom & Ashill, 2016]	
STUR1	I set goals and develop learning strategies to achieve the expected results.
STUR2	I still try to finish my homework even though the study materials are boring.
STUR3	I keep track of my grades in each course, and if one appears to be slipping, I prioritize that class in my studies.
STUR4	When I'm studying for a test, I try to combine information from class notes and the book.
Learning outcomes (LOUT) [Source: Eom & Ashill, 2016]	
LOUT1	The quality of online and in-person classes is the same during the pandemic.
LOUT2	During the pandemic, this online class taught me just as much as the offline classes.
LOUT3	During the pandemic, online classes taught me more than in-person classes.
LOUT4	During the pandemic, the quality of the learning experience in online classes is superior to that of offline classes.
User satisfaction (SAST) [Source: Eom & Ashill, 2016]	
SAST1	Other students would benefit from having this instructor as a teacher.
SAST2	I will recommend this course to other students.
SAST3	I will continue to follow this school's online courses in the near future.
SAST4	I am satisfied with this school's online course during the pandemic.
Technology quality (TECQ) [Source: Kintu & Zhu, 2016]	
TECQ1	I believe that the information technologies used in e-learning are simple to use.
TECQ2	I believe that the information technologies used in e-learning serve a variety of purposes.
TECQ3	I believe that the information technologies used in e-learning are adaptable.
TECQ4	I believe that the information technologies used in e-learning are simple to obtain.
LMS tools and features (LMSF) [Source: Kintu & Zhu, 2016]	
LMSF1	LMS tools and features are easy to use.
LMSF2	LMS tools and features spawn interaction between the learners and instructor.
LMSF3	I can access resources via LMS tools and features.
LMSF4	LMS tools and features give learners feedback on tasks.

In qualitative research, we assess the model's fit, reliability, and validity by test composite reliability (CR) and average variance extracted (AVE). Composite reliability is the lower constraint for internal consistency reliability, for all latent variables or constructs must be greater than 0.70 (Sahoo, 2019). The average variance extracted (AVE) metrics could be used to evaluate the convergent validity of the constructs, and an acceptable AVE is 0.50 or greater, suggesting that the construct explains at least 50% of its items' variance (Hair et al., 2019).

The outer loadings are used to assess individual item dependability. This ratio indicates the loadings of the reflective manifest variables in relation to their associated latent variables. A loading greater than 0.7 indicates that the item is reliable.

After confirming the measurement model, the research then estimates the structural model, which specifies the relationships between latent variables. The square root of the AVE indicator is used to assess discriminant validity; the construct must be greater than the approximate correlation between that conceptual framework and the other concepts (Sahoo, 2019).

4.4 Data Analysis

The partial least squares structural equation modelling (PLS-SEM) method was used to analyze these studies. The multivariate data analysis technique has gained popularity among academics in recent years (Sahoo, 2019). PLS-SEM can be used for smaller samples, but the nature of the population will dictate when small sample sizes are appropriate (Latan, 2018).

The study required confirming the measurement model's reliability and validity before performing a non-iterative implementation of ordinary least squares regression to provide latent and manifest variable outer weights, loadings, and structural model linkages. Finally, the bootstrap resampling method was used to determine the statistical significance of structural paths.

5. Results

No data items were missing from the 223 questionnaires sent by email and received filled out by the respondents. The first step was to assess the measurement model, which included assessing the model's fit, reliability, and validity. The second step considered the results of outer loadings. The next step assessed discriminant validity.

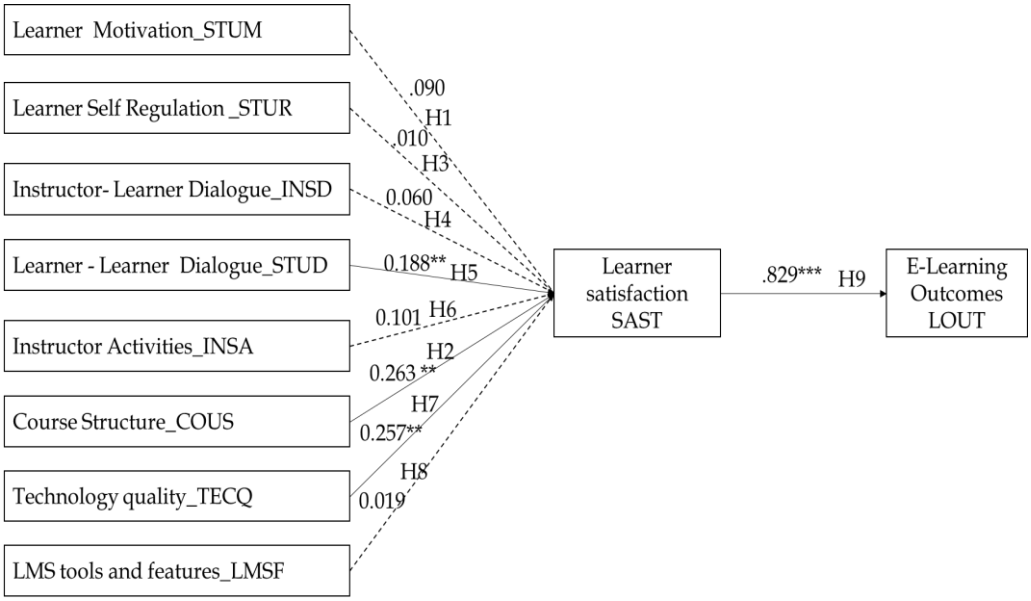
Table 2. The results from the measurement model estimation (weight, loading, CR value, and AVE)

Latent variable	Manifest variable	Outer weight	Outer Loading	CR value	AVE
Course Structure	COUS1	0.204	0.747	0.898	0.638
	COUS2	0.235	0.779		
	COUS3	0.301	0.851		
	COUS4	0.275	0.843		
	COUS5	0.230	0.767		
Instructor Activities	INSA1	0.247	0.759	0.871	0.576
	INSA2	0.287	0.779		
	INSA3	0.282	0.795		
	INSA4	0.286	0.736		
	INSA5	0.214	0.723		
Instructor-Learner Dialogue	INSD1	0.413	0.828	0.878	0.707
	INSD2	0.349	0.820		
	INSD3	0.426	0.873		
LMS Tools and Features	LMSF1	0.281	0.853	0.913	0.724
	LMSF2	0.309	0.830		
	LMSF3	0.283	0.879		
	LMSF4	0.303	0.841		
E-Learning Outcomes	LOUT1	0.292	0.871	0.914	0.727
	LOUT2	0.307	0.851		
	LOUT3	0.291	0.865		
	LOUT4	0.284	0.823		
Learner's Satisfaction	SAST1	0.274	0.774	0.884	0.656
	SAST2	0.298	0.799		
	SAST3	0.317	0.809		
	SAST4	0.343	0.854		
Learner-Learner Dialogue	STUD2	0.392	0.818	0.863	0.678
	STUD3	0.409	0.824		
	STUD4	0.413	0.829		
Learner Motivation	STUM1	0.683	0.846	0.783	0.644

	STUM5	0.557	0.757		
Learner Self-Regulation	STUR1	0.348	0.745	0.856	0.598
	STUR2	0.362	0.792		
	STUR3	0.272	0.748		
	STUR4	0.311	0.806		
Technology Quality	TECQ1	0.304	0.825	0.894	0.678
	TECQ2	0.313	0.854		
	TECQ3	0.288	0.801		
	TECQ4	0.310	0.811		

According to the statistical findings shown in Table 2, the CR values in the models used in this study ranged from 0.863 to 0.914, exceeding the criterion (0.7). The results also include the estimated results of the measurement model, such as outer loadings. All outer loadings in this study, ranging between 0.723 to 0.879, were greater than 0.7. The AVE values in this study ranged from 0.576 to 0.727, which exceeds the threshold value (0.5) proposed by Fornell and Larcker (1981).

Following the validation of the measurement model, we estimated the relationship between latent variables. Figure 2 shows the path coefficients and R-squared of the endogenous latent variables.



*** ρ < 0.001; ** ρ < 0.05

Figure 2. Empirical study results

The empirical results show that learner's satisfaction associates significantly with e-learning outcomes from the learner's perspective. Where learner's satisfaction (SAST) associates significantly with instructor–student dialogue COUS (β = 0.263, p = 0.006), learner–learner dialogue STUD (β =0.188, p=0.007), course structure TECQ (β = 0.257, p = 0.001), but does not significantly associate with learner self-regulation STUR (β = 0.010, p=0.885), learner motivation STUM (β =0.090,

p=0.085), INSA instructor activities (β =0.101, p=0.191), LMSF (β =0.019, p=0.775), instructor- learner dialogue INSD (β =0.06, p=0.407); (2) learner's satisfaction SAST significantly associates with e-learning outcomes LOUT (β = 0.829, p=0.000). The findings supported hypotheses H2, H5, H7, and H9, but not hypotheses H1, H3, H4, H6, and H8. This shows that learner motivation, learner self-regulation, instructor-learner dialogue, instructor activities, LMS tools and feature have not affected the satisfaction of learners at private universities in Vietnam.

The findings also show that the square root of AVE on each conceptual framework (i.e., the diagonal elements in Table 3) is higher than the correlation between the construct and other constructs (i.e., those related off-diagonal elements in Table 3.)

Table 3. Inter-construct correlations and the square root of AVE measure

	COUS	INSA	INSD	LMSF	LOUT	SAS	STUD	STUM	STUR	TECQ
COUS	0.799									
INSA	0.595	0.759								
INSD	0.618	0.578	0.841							
LMSF	0.569	0.504	0.462	0.851						
LOUT	0.628	0.499	0.537	0.497	0.853					
SAS	0.715	0.579	0.592	0.527	0.829	0.810				
STUD	0.619	0.513	0.653	0.406	0.639	0.633	0.823			
STUM	0.341	0.316	0.360	0.413	0.401	0.420	0.401	0.803		
STUR	0.578	0.509	0.419	0.501	0.424	0.488	0.377	0.389	0.773	
TECQ	0.748	0.577	0.557	0.628	0.610	0.702	0.561	0.389	0.526	0.823

6. Discussion

In terms of the positive influence of STUD on SAST, the results show that encouraging student-to-student dialogue may improve learner satisfaction (Kintu et al., 2017b). One of the biggest barriers to online learning is students' lack of intimacy and interaction. Therefore, solutions are needed to improve student-to-student dialogue in the classroom and increase the efficiency of interactions. This may be because students are motivated to learn when they are in a group. They no longer feel isolated and benefit from the feedback of others.

Our study is one of the few that enhances the growing literature by validating a model investigating the determinants of learner satisfaction and their impact on learner outcomes. This research also confirms that COUS is significantly associated with SAST. This information indicates that learners' satisfaction increases.

Course structure plays a central role in a successful e-learning ecosystem. If learners are not able to ask for help and feedback throughout the entire learning process, the desired results will not be achieved. More simply, learners cannot join the -learning ecosystem, because they have no motivation and support.

The findings are consistent with the research of Eom et al. (2006), that the course structure is more than just words on a page. There are links, images, and formatting. It is not just about designing a page. It is about designing a complete learning journey. Instructional designers need to recognize the importance of

content and visual design to provide learners with a better learning experience and make e-learning a great success (Eom et al., 2006).

Consistent with findings in the literature, this study demonstrates that SAST receives a positive and significant influence from TECQ. When the quality of technology increases, learner satisfaction will increase. Similar results have previously been found by Sun et al. (2008) and Kintu et al. (2017a).
Online learners face difficulties when using live online learning and other platforms requiring an internet connection. They face technical challenges not because they are unfamiliar with computer technology and applications. A fast and reliable technology connection can change the speed at which they can join classes and avoid missing live classes. So, if technology quality increases, the satisfaction of learners will increase.

In terms of learner's outcome, it is shown that SAST positively relates to LOUT. Learners' outcomes are driven by satisfaction, as has been proven in the literature of previous research (Eom et al., 2006). Satisfaction can bring happiness to the individual in the learning process, and thereby generate excitement and create conditions to stimulate, arouse and achieve high learning efficiency.

In the process of designing online classrooms, educational institutions need to consider overall factors such as policy frameworks, facilities and technology infrastructure, human resources, teaching methods, assessment, and content, and digital resources for teaching. In which, there should be solutions to promote learner-learner interaction, classroom structure design and technology quality.

6. Conclusion

This study emphasizes key concepts related to the determinants of e-learning satisfaction and e-learning outcomes. According to the findings, student-to-student dialogue is positively related to satisfaction. Instructors need to add a social element to help online learners connect and feel connected to the entire group, creating a sense of authentic presence through interactions and discussions through web chat and direct messaging. Teaching platforms must be used to create online discussion groups.

The higher the level of satisfaction, the more complete the course structure. So, creating online course content requires extreme precision. Online courses need be both necessary and appropriate for learners. A key requirement for every lecture is a clear and coherent layout. With such a reasonable layout, online courses will be able to guide learners very effectively, and thereby improve the teaching quality of any online course.

Technological quality is also seen as an important factor in student satisfaction. Therefore, appropriate online learning software and teaching aids must be selected. Attention should be given to internet systems to best support connections between teachers and students.

Based on the above ideas, the authors propose the solution for the online classroom design process as follows:

Step 1. Create a plan. This is the first stage of the process of organizing an interactive course. It is necessary to identify the objectives of the course, the learning activities and methods that will best support student learning, the tasks students must complete, and the opportunities for students to demonstrate their academic achievement.

Step 2. Teach Design. When designing courses, instructors should pay attention to the determination of learning outcomes, the determination of learning content and resources, the choice of teaching methods, the choice of technology, the form of assessment and assessment methods.

Step 3. Organize implementation. The role of instructors in organizing the curriculum includes organizing online and in-person learning activities, managing learners, supporting and sustaining learner learning, motivating and engaging learners, reviewing and evaluating learning outcomes.

Step 4. After-school assessment. The assessment of online teaching and learning is based on three main areas: pedagogy – the learning activities that underlie teaching; resources – the content and information provided to learners; and questions.

Step 5. Improvements. During the improvement phase, the design process, the course organization starts again to incorporate any changes made to improve the course into the next course.

7. Limitations

The research also has several limitations. First, it has not yet compared the two periods before and during the pandemic. Second, the authors only conducted research on college students at private schools, and not on a group of public universities that invest in facilities according to national standards. Future research could expand the comparison of the relationship before, during, and after the pandemic. It is also possible to conduct a broad survey of all types of universities.

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