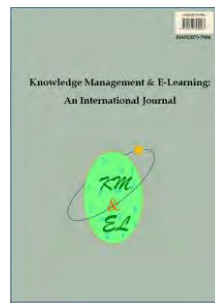

The acceptance of e-learning systems and the learning outcome of students at universities in Vietnam

Quoc Trung Pham

Ho Chi Minh City University of Technology (VNU-HCM), Vietnam

Thanh Phong Tran

Fulbright University in Vietnam, Vietnam



Knowledge Management & E-Learning: An International Journal (KM&EL)
ISSN 2073-7904

Recommended citation:

Pham, Q. T., & Tran, T. P. (2020). The acceptance of e-learning systems and the learning outcome of students at universities in Vietnam. *Knowledge Management & E-Learning*, 12(1), 63–84. <https://doi.org/10.34105/j.kmel.2020.12.004>

The acceptance of e-learning systems and the learning outcome of students at universities in Vietnam

Quoc Trung Pham* 

School of Industrial Management
Ho Chi Minh City University of Technology (VNU-HCM), Vietnam
E-mail: pqtrung@hcmut.edu.vn

Thanh Phong Tran

IT Department
Fulbright University in Vietnam, Vietnam
E-mail: ttp Phong77@gmail.com

*Corresponding author

Abstract: e-Learning systems nowadays become vital for many universities in developing countries. They are useful for increasing educational quality and providing students with high-quality learning resources. However, how to attract students to use e-learning systems and how to improve their learning outcomes through e-learning are still difficult questions. This paper presents a survey study with 357 students from universities in Vietnam. The analysis results showed that e-learning acceptance was influenced by five factors including university support, students' computer competency, infrastructure, content and design of courses, and student collaboration. Besides, the learning outcome was influenced by e-learning acceptance and student collaboration. Finally, some recommendations were suggested to improve e-learning acceptance and learning outcome of students in Vietnam.

Keywords: e-Learning; Information system; Acceptance; Learning outcome; University; Vietnam

Biographical notes: Dr. Quoc Trung Pham is an Associate Professor in the School of Industrial Management, Ho Chi Minh City University of Technology (VNU-HCM). He has been involved in multiple disciplinary research in the areas of technology-enhanced learning, knowledge management, e-commerce, and management information systems. He has published papers in *International Journal of Knowledge Management*, *Journal of Knowledge Management Practice*, *International Journal of Intelligent Computing and Cybernetics*, *Sustainability*, *International Journal of Innovation*, *Journal of Theoretical and Applied Electronic Commerce Research*, among others. He also serves on the editorial/ reviewer board of several international journals/ conferences. More details can be found at <http://trungpham.dx.am/>

MBA. Thanh Phong Tran is a head of IT department of Fulbright University in Vietnam since 2006. His research interests include e-learning, ICT for education, and knowledge management.

1. Introduction

Recently, e-learning systems have been implemented in many schools all over the world at both university and high school levels to support learning and teaching processes. In the US, there are 5.8 million students who registered online courses and the number of registered students is increasing annually during the last decade (EdTech, 2016). Therefore, e-learning becomes a powerful tool for supporting online and distance programs of various schools.

In Vietnam, the IT infrastructure of educational institutions has been established recently and upgraded frequently. By 2010, the project “Edunet” completed successfully to equip all educational institutions (from primary schools to universities) with a high-speed Internet connection (MOET, 2016). So, a lot of universities in Vietnam are ready for deploying e-learning systems and other modern ICT applications for education. Combined with advanced technologies of industrial revolution 4.0, such as cloud computing, internet of thing, and virtual reality, e-learning systems open various opportunities to turn the traditional university into a modern one. In reality, since 2010, most universities in Vietnam have applied e-learning to support teaching and learning activities on various platforms, such as Moodle and Sakai (Pham & Huynh, 2017).

According to a report of Ambient Insight (www.ambientinsight.com), an explosive growth of online higher education enrollments in Asia was forecasted from 2016 to 2021. In 2015, Vietnam’s e-learning market size was estimated at 50 million USD, but its annual growth rate is around 40% from 2013 to 2018. Based on this report, Vietnam is in the top 10 Asia countries of self-paced e-learning during 2013-2018.

e-Learning systems bring many benefits for universities, such as ubiquitous, flexible, information rich, fast updated, easy to monitor the learning progress, convenient, cost-saving, and time-saving. However, ensuring the success of an e-learning system is a difficult task (Pham & Huynh, 2017). Some problems of implementing an e-learning system include the high rate of failure of e-learning projects, the low acceptance and low satisfaction of e-learning users, and ineffectiveness of e-learning systems on learning outcomes. Therefore, there is a need for researching to identify factors affecting the success of the e-learning system, especially on the user acceptance and the learning outcomes. In Vietnam, there are a few pieces of research on this topic, but it is necessary to do more researches for supporting the success of e-learning projects. These researches are helpful to improve the educational quality of higher educational institutions as the goal of the Ministry of Education and Training in recent years.

In general, the main objectives of this research include: (1) identify and measure the impact of some factors on e-learning acceptance and learning outcome of students in several universities in Vietnam; and (2) suggest managerial implications for improving students’ e-learning acceptance and their learning outcome through e-learning system. The structure of the paper is organized as follows: Section 2 introduces main concepts and literature review; Section 3 provides the research model and hypotheses; Section 4 research method; Section 5 summarizes the main research results; and Section 6 presents the discussion and conclusions.

2. Literature review

2.1. E-commerce and e-business

E-commerce is defined as trading, selling and buying products or services on the Internet or computer networks (Rosen, 2000). E-commerce may include online or offline payment processes and delivering paid products in digital form through the internet or in traditional form in the real world (WTO, 1998).

E-business refers to a broader concept of e-commerce, which includes not only the trading process but also all business activities, such as manufacturing, logistics, research and development, customer service, collaboration, and internal operation activities (Turban et al., 2015).

2.2. e-Learning

e-Learning is a specific form of e-business in education, which focuses on learning and teaching processes, such as training, knowledge sharing, and collaboration.

e-Learning is defined as a learning or training process, which is prepared, transferred and managed using various ICT tools locally or globally (Masie, 2016). e-Learning is a learning method using Internet communication through interaction between instructors and students with suitable designed learning materials and contents (Resta & Patru, 2010).

In this research, e-learning is understood as a learning method through the Internet for some formal educational programs, which are managed by a Learning Management System (LMS), to ensure the interaction, collaboration and to satisfy the learning demands of learners at any time, and in any place (Nguyen et al., 2014).

Difference from e-learning in developed countries, in developing countries like Vietnam, e-learning system was applied lately and lack of interaction (Pham & Huynh, 2017). Many teachers and students still thought of e-learning as an online folder for keeping learning materials. Besides, some other barriers to the usage of the e-learning system in Vietnam include lack of infrastructure, lack of support, and low computer competency of learners.

2.3. The success of e-learning systems

Seddon (1997) proposed three aspects to evaluate the success of an Information System, including: (1) System quality (relevance, timeliness, accuracy); (2) Perceptual measures (perceived usefulness, user satisfaction); and (3) Benefits (individual, organizational, social). In the IS success model of DeLone and McLean (2003), besides the above factors, Service quality is also added to evaluate the support of system suppliers.

e-Learning is also an information system, so the success of the e-learning system could be evaluated similarly to any other information system. The success of the e-learning system may include project success, technology acceptance, users' satisfaction, learning outcome, and knowledge transferring. In this research, the success of e-learning referred to the acceptance of e-learning and the learning outcome of students. In which, learning outcomes could be defined as learners' knowledge, skills, perceived value and meaningfulness of a training course and their abilities in applying new knowledge to their works (Nehari & Bender, 1978).

According to Pham and Huynh (2017), the learning outcome/ achievement of students through the e-learning system could be determined by independent variables, such as Computer Self Efficacy, Ease of Use, Perceived Usefulness, Face to Face Interaction, Email Interaction, and Social Presence.

2.4. e-Learning acceptance

To know the impact factors of e-learning acceptance, two foundation theories should be used, including the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT).

Technology Acceptance Model (TAM) is developed by Davis et al. (1989) based on the Theory of Reasoned Action (TRA) of Fishbein and Ajzen (1975). TAM tried to explain human behavior in acceptance of using an information system. In TAM, two main factors are affecting the acceptance of new technology, including perceived usefulness, and perceived ease of use. In which, the usefulness is also affected by the ease of use. Venkatesh and Davis (2000) suggested an extension of the Technology Acceptance Model (TAM2), which explored the determinants to perceived usefulness and perceived ease of use.

Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh et al. (2003) to explain the intention and behavior of using an information system. UTAUT includes performance expectancy, effort expectancy, social influence, facilitating conditions. Some demographic factors, such as gender, age, experience, and willingness to use, have indirect impacts on the intention and using behavior (Venkatesh et al., 2003). An extended version of UTAUT (UTAUT2) is also suggested by Venkatesh et al. (2012). In UTAUT2, three new factors have been added, including convenience, exchange value, and habit.

2.5. Related work

Some related researches on the success of the e-learning system could be summarized in Table 1. Most researches used TAM or UTAUT as a foundational theory for exploring the acceptance of the e-learning system. In this research, the UTAUT model is chosen because it covered the most factors impacting on the e-learning acceptance, including performance expectation, effort expectancy, social influence, and facilitating conditions. In which, facilitating conditions are so important for e-learning in developing countries like Vietnam because of the poor infrastructure of their universities.

However, in this research, these factors not only influence on e-learning acceptance but also influence the learning outcome, the main goal of any e-learning system. Moreover, e-Learning acceptance also has an impact on learning outcomes (DeLone & McLean, 2003). To clarify these impact factors in the context of the e-Learning system, these impact factors should be grouped as follows:

Performance expectancy: In using e-learning, students often expect it could be a possible platform for storing learning materials and for collaborating with other students in doing group-works. According to Laily et al. (2013), e-learning acceptance is influenced by the Collaboration of students and Content of course. Besides, Selim (2007) mentioned Content & design of course as an impact factor of e-learning acceptance. Therefore, Collaboration of students and Content and design of courses could be two influence factors belong to the performance expectancy group.

Table 1
Summary of related researches

Authors	Topic	Impact factors
Pham & Huynh (2018)	Impact factor on learning achievement and knowledge transfer of students through the e-learning system	Computer Self Efficacy, Ease of Use, Perceived Usefulness, Face to Face Interaction, Email Interaction, and Social Presence
Nguyen (2015)	Structural Equation Model for the success of IS projects	Habit, social influence, ease of use, project quality (information, system, and service), project goal, and project features.
Laily et al. (2013)	Critical success factors for e-learning system in IT Telkom Bandung using SEM	Computer competency, Collaboration, Content, Access ability, Infrastructure
Martínez-Caro (2011)	Impact factors on the effectiveness of e-learning: an analysis of manufacturing management courses	Prior experience, Flexibility, Job status, Blended e-learning, Student interaction, Interaction between students and lecturers
Shee & Wang (2008)	Criteria for evaluating web-based e-learning system: an approach from learners' satisfaction and applications	The user interface, Community of learning, Content Individualization
Wang (2008)	Evaluating the success of e-commerce system: a confirmation of DeLone and McLean model	Information quality, System quality, Service quality
Selim (2007)	Critical success factors for the acceptance of e-learning: confirmatory factor model	Teacher attitude toward technology, Teaching style, Computer competency of the learner, Collaboration of learner, Content and design of course, Access ability, Infrastructure, School support
DeLone & McLean (2003)	An updated information system success model	Information quality, System quality, Service quality
Soong et al. (2001)	Critical success factors for online courses	Human factors (effort, skills), Technology capability of students and teachers, Mindset about online learning, Collaboration, Perception about IT infrastructure and support
Nguyen et al. (2014)	Acceptance and Use of e-Learning based on Cloud Computing: The role of Consumer Innovativeness	Performance expectancy, Effort expectancy, Social influence, Facilitating condition, Price Value, Hedonic motivation, and Habit

Effort expectancy: This factor refers to the ease of use or the ability of learners in using the e-learning system. According to Laily et al. (2013), e-learning acceptance and learning outcomes are influenced by the Computer competency of students. So, this factor could be used as an aspect of effort expectancy in an e-learning context.

Social influence: In the context of e-learning, teachers or lecturers have a great impact on students' behavior toward e-learning acceptance, such as: requesting, advising, organizing interactive events, and implementing online tests. According to Selim (2007), Teacher/Lecturer is an important factor influencing e-learning acceptance of learners. Therefore, Lecturer could be representative of the social influence factor.

Facilitate condition: This factor is crucial in the context of encouraging e-learning acceptance in Vietnam. Some conditions make it easy for using the e-learning system in a university could include IT infrastructure, Internet access, and University support. These factors were also mentioned in the research of Selim (2007). Therefore, in this research context, three factors belong to the facilitating condition group should be added, including Infrastructure, Access ability, and University support.

Besides, according to Nguyen et al. (2014), some demographic factors, such as age, gender, program, experience, and major, could have some impacts on the relationship between the independent factors and dependent factors.

3. Research model and hypotheses

3.1. Research model

From the above analysis, the UTAUT model is selected as a foundation theory of this research. However, the impact factors of the UTAUT model should be grouped as follows: performance expectation (the collaboration of students, content and design of course), effort expectancy (computer competency of students), social influence (lecturer), and facilitate condition (infrastructure, access ability, university support). Moreover, these factors influence not only e-learning acceptance but also the learning outcome of the e-learning system (Laily et al., 2013). Besides, e-learning acceptance also impacts on the learning outcome of students (net benefit) as in DeLone and McLean (2003).

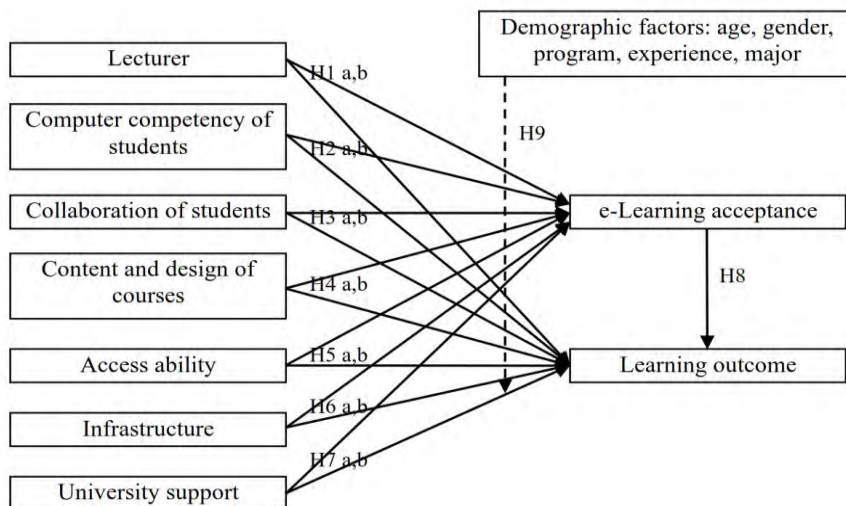


Fig. 1. The proposed research model

In general, there are seven factors affecting e-learning acceptance and learning outcomes of students, and e-learning acceptance also has an impact on learning outcomes

through the e-learning system. Besides, some demographic factors, such as age, gender, program, experience, and major, could have some impacts on the relationship between independent and dependent variables. The proposed research model could be summarized in the Fig. 1.

3.2. Hypothesis statements

Lecturer: e-Learning is a student-centered method, so, the interaction, evaluation, and collaboration between lecturers and students are crucial. Harasim et al. (1995) showed that e-learning helps to increase the interaction between students and lecturers in comparison with traditional methods. Moreover, the fear of students in participating in-class discussion is disappeared in the e-learning environment (Owston, 1997). Selim (2007) showed that the lecturer could play an important role in encouraging the online interaction, and there should be a positive impact of lecturer on the student's acceptance of e-learning system. Therefore, hypothesis H1a and H1b could be stated as follows:

H1a: *Lecturer has a positive impact on e-learning acceptance of students.*

H1b: *Lecturer has a positive impact on the learning outcome of students in e-learning.*

According to Soong et al. (2001), the computer competency of students has a positive impact on the acceptance of an e-learning system. Selim (2007) also showed that computer competency and prior experiences of students have positive impacts on e-learning acceptance. Besides, Laily et al. (2013) confirmed the positive impact of computer competency on the learning outcome of learners through the e-learning system. Therefore, hypothesis H2a and H2b could be stated as follows:

H2a: *Computer competency of students has a positive impact on e-learning acceptance of students.*

H2b: *Computer competency of students has a positive impact on the learning outcome of students in e-learning.*

The collaboration of students refers to active learning activities and interactions between students through the e-learning system. Selim (2007) showed that collaboration between learners could lead to the more acceptance of the e-learning system. Besides, the collaboration also has a positive impact on the learning outcome of students (Laily et al., 2013). Therefore, hypothesis H3a and H3b could be stated as follows:

H3a: *Collaboration of students has a positive impact on the e-learning acceptance of students.*

H3b: *Collaboration of students has a positive impact on the learning outcome of students in e-learning.*

Content and design of courses refers to the perception of learners about the richness, the update of learning content, and the convenience of course design. Previous researches (Laily et al., 2003; Selim, 2007) showed that the content & design of courses have positive impacts on the acceptance of e-learning, and the learning outcome of students. Therefore, hypothesis H4a and H4b could be stated as follows:

H4a: *Content and design of the courses have a positive impact on the e-learning acceptance of students.*

H4b: *Content and design of the courses have a positive impact on the learning outcome of students in e-learning.*

Access ability refers to the easiness in accessing the e-learning system. Selim (2007) showed that the access ability could be seen through the easiness of connecting to the Internet and browsing the e-learning website in the university campus. This ability allows students to use the e-learning system easily and to increase learning outcomes through e-learning. Therefore, hypothesis H5a and H5b could be stated as follows:

H5a: *Access ability has a positive impact on the e-learning acceptance of students.*

H5b: *Access ability has a positive impact on the learning outcome of students in e-learning.*

Selim (2007) showed that the effectiveness of ICT infrastructure in the school, the consistency and the reliability of the local network would lead to the acceptance of an e-learning system. Laily et al. (2003) also confirmed that the infrastructure has a positive impact on the learning outcome of students. Therefore, hypothesis H6a and H6b could be stated as follows:

H6a: *Infrastructure has a positive impact on the e-learning acceptance of students.*

H6b: *Infrastructure has a positive impact on the learning outcome of students in e-learning.*

University support is realized as a critical success factor of the e-learning system (Benigno & Trentin, 2000; Govindasamy, 2001). The support from the university could include library service, supporting department, computer room, and help desk service. Selim (2007) showed that technical support from the school would help to increase the acceptance of the e-learning system, so, it could lead to a better learning outcome. Baleghi-Zadeh et al. (2017) also confirmed the positive impact of technology support on the acceptance of LMS via the perceived ease of use. Therefore, hypothesis H7a and H7b could be stated as follows:

H7a: *University support has a positive impact on the e-learning acceptance of students.*

H7b: *University support has a positive impact on the learning outcome of students in e-learning.*

Besides, previous studies showed that the e-learning acceptance of students could have a positive impact on the learning outcome of students (Laily et al., 2003; Pham & Huynh, 2018). Therefore, hypothesis H8 could be stated as follows:

H8: *e-Learning acceptance has a positive impact on the learning outcome of students in e-learning.*

Moreover, according to Venkatesh et al. (2003), demographic factors including age, gender, and experience may have some impacts on the relationships between independent variables and dependent variables in the UTAUT model. In this research, the impact of some demographic factors, such as age, gender, experience, program, and major, on the e-learning acceptance and learning outcome of students will be examined. Therefore, hypothesis H9 could be stated as follows:

H9: *Demographic factors (age, gender, experience, program and major) have impacts on the relationships between independent factors and the e-learning acceptance, and the learning outcome of students in e-learning.*

4. Method

4.1. Research process

The research process could be summarized as follows:

Step 1: Reviewing the literature, establishing the research model and the draft version of the measurement scale. Then, interviewing 10 users of an e-learning system to check the clarity and to correct the primary mistakes of the draft scales. After this step, the 1st version of the questionnaire could be created for the survey.

Step 2: Primary quantitative research. The 1st version of the questionnaire is used for a survey with the samples of 100 graduate students at Bach Khoa University (VNU-HCM). Then, the collected data will be used for the primary evaluation of the measurement scales using Cronbach's alpha test and exploratory factor analysis. Then, the official measurement scales could be built, and the final version of the questionnaire will be created and used for the main quantitative research step.

Step 3: Main quantitative research. The final version of the questionnaire is used to collect data from various universities in Vietnam, with an expected sample size of 300 students. Then, the data will be used for testing the suitability of the research model using Confirmatory factor analysis and Structural equation model test. The bootstrap test is also used for evaluating the stability of the result, and multiple-group analysis will be used to test the impact of demographic factors.

Step 4: Post-result analysis. Some interviews will be conducted with various stakeholders of the e-learning system, such as e-learning admin, lecturer, student, e-learning experts, etc. These interviews will be used for explaining the results and discussing the recommendations for improving the effectiveness of the e-learning system in Vietnam.

4.2. Data collection and analysis

According to Hoang and Chu (2008), the minimum sample size for data analysis must be greater than 5 times of the number of observed variables. In this research, there are about 46 variables for 9 factors of the measurement scales. Therefore, the minimum sample size must be 225 samples (= 46 x 5). To get enough validated samples for the research, about 500 questionnaires will be sent for collecting data. The data were then analyzed by Cronbach alpha analysis, EFA, CFA, and Structural Equation Modeling (SEM) techniques with the application of SPSS and AMOS.

4.3. Measurement scales

All of the measurement scales for this research are 5 levels of Likert scales (see Appendix I). In which, Lecturer or instructor scales (INS - 6 items) are from Volery and Lord (2000) and Soong et al. (2001); Students' computer competency scales (SCC, 5 items) are from Soong et al. (2001); Students' collaboration (SIC, 5 items) are from Soong et al. (2001); Content and design of courses (CON, 6 items) are from Soong et al. (2001); Access ability (TA, 6 items) are from Volery and Lord (2000); Infrastructure (INF, 4 items) are from Volery and Lord (2000); University support (SUP, 5 items) are from Selim (2007); e-Learning acceptance or usefulness (ELU, 3 items) are from Selim (2007); and Learning outcome (LA, 6 items) are from Nehari and Bender (1978).

5. Results

5.1. Descriptive statistics

Data were collected by a survey using the convenience sampling method. The questionnaires were delivered using Google Docs, E-mail, e-Learning forums, and hard copies to respondents who have used e-learning at several universities in Vietnam. A total of 423 answered questionnaires was received. There are 356 valid samples after removing invalid answers (never use e-learning, the same answer to all questions, lack of information, etc.). The Table 2 below summarizes the percentage of validated samples by several universities in Vietnam.

Table 2
Percentage of validated samples

University	Count	Percentage (%)
Bach Khoa University (VNU-HCM)	93	26.1%
Fulbright University in Vietnam	94	26.4%
HCMC Open University	81	22.8%
HCMC University of Economics	88	24.7%
Total	356	100%

The descriptive statistics of samples by demographic factors could be summarized in the following Table 3.

Table 3
Descriptive statistics of samples by demographic factors

Factors	Values	Frequency	Percentage (%)
<i>Gender</i>	Male	195	54.8%
	Female	160	44.9%
<i>Age</i>	18 – 26 years old	246	69.1%
	27 – 35 years old	80	22.5%
	36 – 45 years old	26	7.3%
	> 45 years old	4	1.1%
<i>Educational level</i>	University	239	67.1%
	Postgraduate level	117	32.9%
<i>Learning program</i>	Regular program	333	93.5%
	Second-degree/distance program	23	6.5%
<i>Major</i>	Technology-Engineering	115	32.3%
	Economics-Management	169	47.5%
	Social sciences-Art-Humanity	72	20.2%
<i>Intake</i>	<=2011	14	4.0%
	2012	22	6.2%
	2013	20	5.6%
	2014	54	15.2%
	2015	133	37.4%
	>=2016	92	25.9%

<i>Experience of using e-learning</i>	<= 1 year	153	43.0%
	1-2 years	183	51.4%
	2-3 years	13	3.7%
	>= 3 years	7	2.0%

The descriptive statistics of samples by the main factors could be summarized in the following Table 4.

Table 4
Descriptive statistics of samples by main factors

Factors	N	Min	Max	Mean	SD
Lecturer/ Instructor (INS)	356	1.00	5.00	3.51	.79
Students' computer competency (SCC)	356	1.40	5.00	3.93	.63
Students' collaboration (SIC)	356	1.80	5.00	3.52	.59
Content and design of courses (CON)	356	1.33	5.00	3.55	.70
Access ability/ availability (TA)	356	1.17	5.00	3.48	.77
Infrastructure (INF)	356	2.00	5.00	3.67	.79
University support (SUP)	356	1.40	5.00	3.74	.71
e-Learning acceptance (ELU)	356	2.00	5.00	4.01	.63
Learning outcome (LA)	356	1.50	5.00	3.77	.59

5.2. Cronbach's alpha analysis

The reliability of measurement scales is evaluated by Cronbach's Alpha analysis (see Table 5). The scale is considered reliable if the Cronbach Alpha coefficient is greater than 0.6, and the item-total correlation must be greater than 0.3 (if not, it should be removed) (Nguyen & Nguyen, 2011). The analysis results showed that the Cronbach Alpha coefficients of all measurement scales were greater than 0.6. However, variable SIC2 had an item-total correlation less than 0.3 (0.110). Therefore, it should be removed. This removal helps to increase the Cronbach alpha coefficient of this factor to 0.757. All other measurement scales satisfied the criteria and could be used for EFA.

Table 5
Cronbach's alpha analysis result

Factors	Alpha	Item-Total correlation	Number of items removed
Lecturer/ Instructor (INS)	0.876	0.402-0.765	0/ 6
Students' computer competency (SCC)	0.757	0.319-0.610	0/ 5
Students' collaboration (SIC)	0.757	0.381-0.687	1/ 5
Content and design of courses (CON)	0.833	0.468-0.726	0/ 6
Access ability/ availability (TA)	0.856	0.563-0.703	0/ 6
Infrastructure (INF)	0.833	0.320-0.809	0/ 4
University support (SUP)	0.829	0.540-0.727	0/ 5
e-Learning acceptance (ELU)	0.843	0.685-0.751	0/ 3
Learning outcome (LA)	0.874	0.566-0.770	0/ 6

5.3. Exploratory factor analysis

Exploratory Factor Analysis (EFA) helps to evaluate the convergent and discriminating value of the measurement scale (see the results in Table 6). KMO and Bartlett test in EFA showed that the hypothesis of a correlation between variables could be rejected (Sig. = 0.000). The KMO coefficient = 0.902 (> 0.5) showed that EFA could be used. The analysis results showed that at Eigenvalue ≥ 1 , with the “Principal Axis Factoring” method, and the “Promax” rotation method with Kaiser Normalization, there could be 10 factors extracted from 45 observed variables, and the extraction variance was 58.82%. After removing 9 variables, which had low loading factor coefficients (< 0.3) or were loaded in several factors, there were 36 remaining variables grouped into 9 factors. The final result had total extraction variance=60.09% ($> 50\%$), KMO = 0.877 (> 0.5), Bartlett test was significant (Sig. < 0.05), and it could be used for confirmatory factor analysis.

Table 6

The exploratory factor analysis result

	Factor								
	1	2	3	4	5	6	7	8	9
INS3	.862								
INS4	.810								
INS1	.778								
INS5	.745								
INS2	.726								
TA3		.881							
TA2		.791							
TA1		.746							
TA4		.520							
TA5		.427							
INF3			.934						
INF2			.868						
INF4			.810						
LA6				.854					
LA5				.714					
LA8				.671					
LA3				.393					
SCC3					.767				
SCC2					.749				
SCC1					.616				
SCC4					.573				
SIC3						.939			
SIC4						.875			
SIC1R						.584			
SIC5						.332			
CON1							.741		
CON3							.728		
CON4							.689		
CON2							.667		
ELU1R								.838	
ELU3								.830	
ELU2								.649	
SUP4									.717
SUP3									.643
SUP2									.610
SUP5									.600
Extraction variance	28.128	10.191	7.368	5.84	4.827	3.971	3.386	3.016	2.794
Eigenvalues	10.126	3.669	2.652	2.102	1.738	1.43	1.219	1.086	1.006
Cronbach Alpha	0.897	0.848	0.929	0.788	0.788	0.757	0.798	0.843	0.806

5.4. Confirmatory factor analysis

To test the fitness of the model with market data, CFA is often used. In which, Chi-square (CMIN); CMIN/df (degree of freedom); Comparative Fit Index (CFI), Tucker & Lewis Index (TLI), RMSEA (Root Mean Square Error Approximation) should be examined. If the values of GFI, TLI, CFI ≥ 0.9 ; CMIN/df ≤ 3 ; and RMSEA ≤ 0.08 , the model is considered to be fit to the market data (Nguyen, 2013).

From the above analysis, there were 9 factors extracted, which were suitable for the research model. The first CFA result showed that the above criteria were not satisfied. Based on the table of Standardized Regression Weights, some variables with low weights were removed to ensure the convergent value of scales. After removing 9 variables (INS4, INS5, TA4, TA5, LA3, SCC4, SIC5, CON2, SUP5), the above criteria were satisfied. The final CFA result could be summarized in the following Fig. 2.

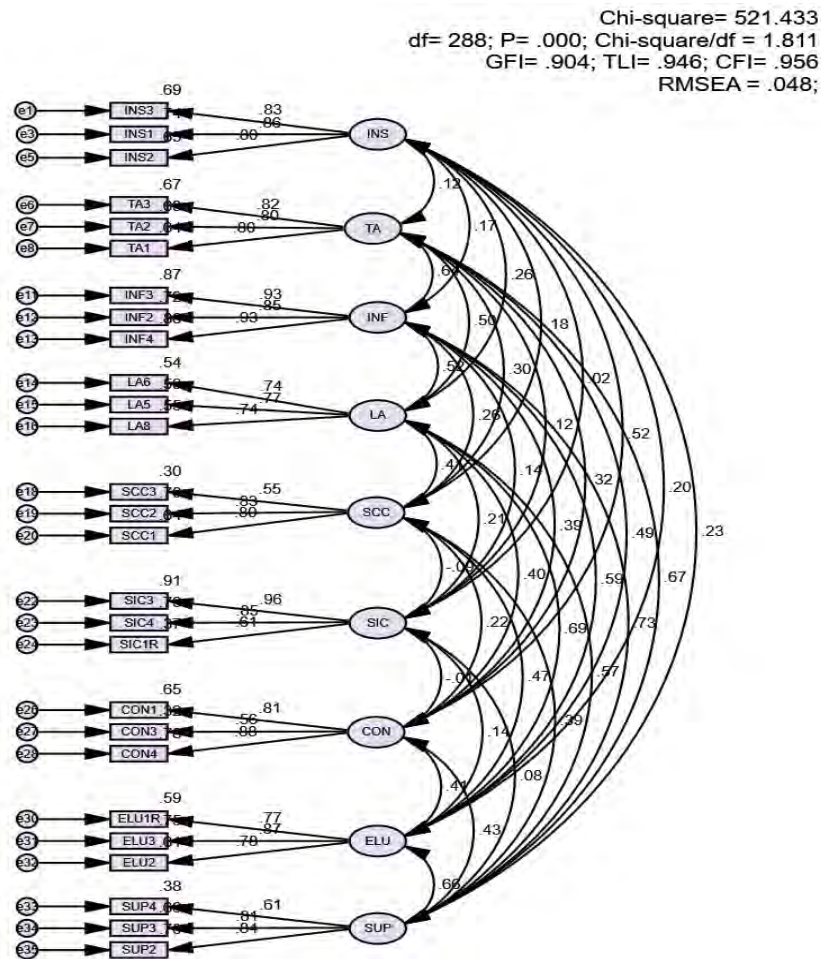


Fig. 2. The final standardized CFA result

The above results showed that Chi-square/df=1.811 (<2), GFI=0.904, TLI=0.946, CFI=0.956 (>0.9), and RMSEA=0.048 (<0.08). Therefore, the model could be fitted to the sample data.

Evaluate the convergent value: In the table of Standardized Regression Weights, the minimum weight was 0.549 (>0.5), and P-value < 0.05, so all constructs were converging.

Evaluate the discriminating value: According to Nguyen and Nguyen (2011), if the correlation coefficients between all variables <1, these variables are discriminating. The analysis results showed that the maximum correlation coefficient was 0.728 (<1). Therefore, all variables were considered to be discriminating.

5.5. Structural equation model analysis

After CFA analysis, the model was concluded to be fit to market data. The SEM analysis results showed that CMIN/df=1.811 (< 2), confirmed the model fitness. Besides, other criteria of SEM analysis were satisfied: GFI=0.904; TLI=0.946; CFI=0.956 (>0.9); and RMSEA=0.048 (<0.08), the results could be significant and summarized as follows (see Fig. 3).

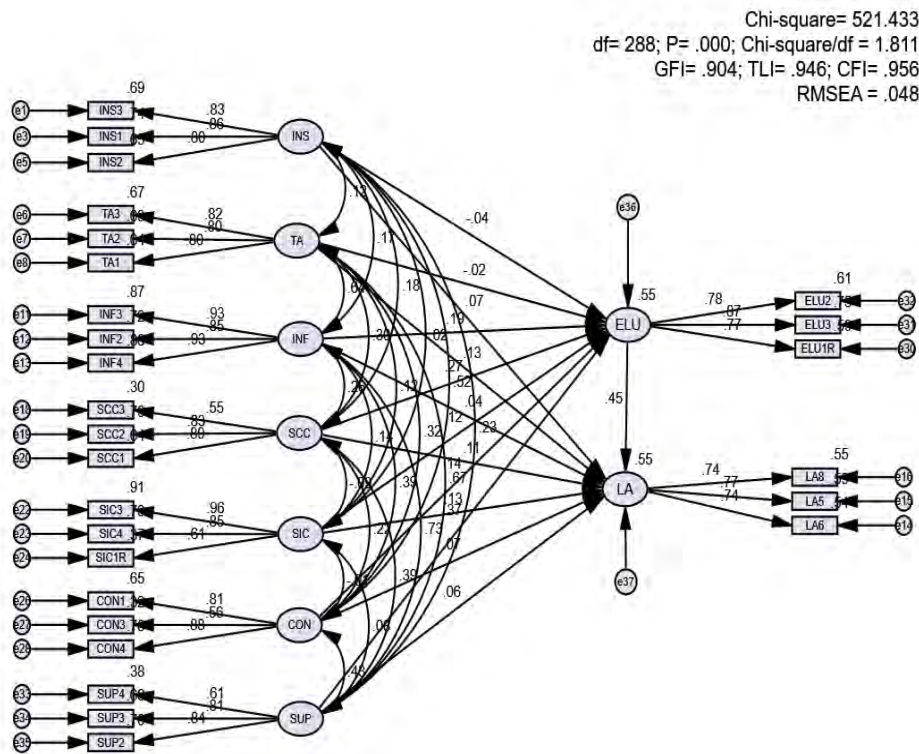


Fig. 3. The final standardized SEM result

From the results, five factors: University support (0.367), Computer competency of students (0.274), Infrastructure (0.195), Content & design of courses (0.145), and Collaboration of students (0.118) had significant impacts on e-learning acceptance of

students and they could explain for 54.8% of the variance in e-learning acceptance of students. However, the learning outcome of students through the e-learning system was determined by two factors: e-Learning acceptance (0.446), and Collaboration of students (0.129). These two factors explained for 54.5% of the variance of the learning outcome of students. The Table 7 below summarizes the testing results.

Table 7
Hypothesis testing results

Code	Hypothesis statement	Standardized weight	P-value	Result
H1a	Lecturer => e-Learning acceptance	-0.039	0.503	Rejected
H1b	Lecturer => Learning outcome	0.070	0.262	Rejected
H2a	Computer competency of students => e-Learning acceptance	0.274	***	Accepted
H2b	Computer competency of students => Learning outcome	0.107	0.098	Rejected
H3a	Collaboration of students => e-Learning acceptance	0.118	0.012	Accepted
H3b	Collaboration of students => Learning outcome	0.129	0.012	Accepted
H4a	Content & design of courses => e-Learning acceptance	0.145	0.026	Accepted
H4b	Content & design of courses => Learning outcome	0.072	0.306	Rejected
H5a	Access ability => e-Learning acceptance	-0.017	0.817	Rejected
H5b	Access ability => Learning outcome	0.129	0.107	Rejected
H6a	Infrastructure => e-Learning acceptance	0.195	0.013	Accepted
H6b	Infrastructure => Learning outcome	0.044	0.602	Rejected
H7a	University support => e-Learning acceptance	0.367	***	Accepted
H7b	University support => Learning outcome	0.061	0.572	Rejected
H8	e-Learning acceptance => Learning outcome	0.446	***	Accepted

5.6. ANOVA result (Testing H9)

ANOVA test is carried out to test H9, i.e., to analyze if there is any difference in the relationship between independent variables and e-learning acceptance or learning outcome of students by the demographic variables, such as gender, age, program, experience, and major. The analysis results showed that the relationship between independent and dependent variables was not changed by gender, age, learning programs, and major.

However, the impact of the experience of using the e-learning system for e-learning acceptance could be realized. The relationship changed as follows:

- For the group of students with less experience (<=1 year), there were three remaining significant impact factors, including Computer competency of students, Content & design of courses, and University support (no significant impact from the Infrastructure and Collaboration of students).

- For the group of students with more experience (>1 year), there were four remaining significant impact factors, including Computer competency of students, Content and design of courses, Infrastructure, and Collaboration of students (no significant impact from University support). Certainly, university support is only necessary for junior students.

6. Discussion and conclusions

6.1. Discussion

The above analysis result showed that the e-learning acceptance of students in Vietnam was affected by University support (0.367), Computer competency of students (0.274), Infrastructure (0.195), Content & design of courses (0.145), and Collaboration of students (0.118). While the learning outcome was affected by the e-Learning acceptance (0.446), and Collaboration of students (0.129). These results are similar to previous researches by Laily et al. (2013) and Selim (2007). But the order of impact is a little bit different. For example, in Laily et al. (2013), the top three impact factors in e-learning acceptance are students' collaboration, students' content, and infrastructure. But, in this research, the collaboration of students has the lowest impact. The reason may be in the characteristic of Vietnamese students, who are not active in collaboration and lack of self-study skills. This result is also suitable with the previous research result of Pham and Huynh (2018), in which, Computer competency, Social presence, and Collaboration play important roles in improving the effectiveness of the e-learning system.

Based on this result, Lecturers and Access ability had no impact on e-learning acceptance and learning outcomes of students. This could be explained by the low participation of the lecturer in the e-learning system in Vietnamese universities. Although there are some policies to encourage more participation and using of lecturers through the e-learning system, the effectiveness of these policies is low (Pham & Huynh, 2018). So, currently, the lecturer plays a less important role in the acceptance of the e-learning system and the learning outcome of students. Moreover, Internet connection and network access are popular and not differences between campuses and programs, so that, access ability has less impact on e-learning acceptance and learning outcomes of students at the university.

According to the above results, the strongest factor impacting on the learning outcome of students through e-learning system is the e-learning acceptance. This means the more time of using the e-learning system, the better the learning outcomes of students. So, we should encourage the students to use the e-learning system during their learning program to increase the educational results. The strongest impact factor in e-learning acceptance of students is university support. This result indicated that the success of the e-learning system in Vietnam depends mostly on the supporting services from the school. Therefore, the board of management of universities should pay more attention to providing support services, especially technical support for students and lecturers in using e-learning system, and in helping them to interact and to get benefits from e-learning usages, such as information seeking, group forming, online testing, and online manuals, etc.

The computer competency of students is the 2nd strongest impact factor on e-learning acceptance of students in Vietnam. If the students have good computer skills, they will feel more confident in using the e-learning system to support their learning tasks.

So, they will use the e-learning system more. In Vietnam, many junior students are from provincial high schools, where they are not familiar with computers. Therefore, training students on computer skills could help to encourage the acceptance of an e-learning system.

Moreover, the collaboration of students has a fairly strong impact on both e-learning acceptance and learning outcomes. In practice, if the students collaborate with their friends more on the e-learning system, they will spend more time using e-learning. As a result, their learning outcome will be improved during the learning process. Therefore, encouraging the interaction and collaboration between students through the e-learning system, such as group work assignments, ideas preparation, and online projects could help to increase the use of the e-learning system and to improve the learning outcomes of students.

Other factors impacting e-learning acceptance of students in Vietnam include Infrastructure, Content and design of course. It is easy to understand these relationships because of the following reasons: Infrastructure enables the successful implementation of the e-learning system; and Content and design of course (slides, media, information, and schedule) determines the attractiveness and usefulness of the online course. Therefore, improving Infrastructure, and Content and design of courses could help to increase the acceptance of the e-learning system in practice.

6.2. Implications

From the above results, some managerial implications for increasing the acceptance of the e-learning system and for improving the learning outcome of students through e-learning system could be suggested as follows:

- The university should equip students with computer skills and knowledge for using the e-learning system to support their study. Especially, the university should require students to study computer-related subjects in the 1st or 2nd year. Besides, an orientation meeting for junior students should be organized to provide students with information to use the online library and other computer facilities to support their study on the campus.
- The university should invest more in their ICT infrastructure, equip students with a secure and high-speed Internet connection, so that, the infrastructure could help to improve the information quality and communication services inside of the university. The IT admin must also ensure the availability and the quality of Wi-Fi/ wireless connection in all learning regions inside the campus. According to Shuja et al. (2019), mobile platform and m-learning could help to increase students' academic performance.
- The content and design of online courses should be revised and updated to be suitable for an online environment. For example, more learning materials should be provided, long lectures should be broken into small chunks, more active learning methods should be applied, online tests and virtual workshops should also be used. The admin of the e-learning system should pay attention to improving the layout of the system and embedding advanced features to make it more convenient and useful for both lecturers and students.
- Encourage students to collaborate through the e-learning system by providing more online services for them. Developing an information portal for connecting

e-learning systems with other information systems of the university. Moreover, training the lecturers to apply new teaching methods focusing on collaboration and active learning to improve educational quality, such as online tests, group projects through e-learning and online collaboration in solving a real problem, etc. Scoring methods could also help to increase the use of the e-learning system and to allow students to learn actively from anywhere and at any time. Taking advantage of collaborative technologies, such as social network sites, Teams (Microsoft), and Hangout (Google), IT managers can integrate these technologies into the current e-learning system to increase the social interaction and the collaboration between students.

- The university should pay attention to university support for junior students because it is crucial for making it easy for new students to be familiar with the e-learning system and to realize the benefit of e-learning on self-study. The university supports could include integrate e-learning systems with the university portal, organizing seminars on sharing experiences of using e-learning, and encouraging the library to share digital learning resources through the e-learning system.

6.3. Conclusions & limitations

In summary, based on previous researches (Laily et al., 2003; Selim, 2007), this paper proposed a research model for evaluating the impact of some factors on e-learning acceptance and learning outcomes of students at several universities in Vietnam. Some main factors were examined, including lecturer, student computer competency, student collaboration, content & design of courses, access ability, infrastructure, and university support.

Based on 356 valid samples collected from students at several universities in Ho Chi Minh City (Vietnam), the measurement scales were verified and the research model was tested. After the Cronbach alpha test, EFA, CFA, and SEM analysis, five factors were confirmed to have a positive impact on e-learning acceptance, including: University support (0.367), Computer competency of students (0.274), Infrastructure (0.195), Content and design of courses (0.145), and Collaboration of students (0.118). Besides, the learning outcome of students through the e-learning system was determined by two factors: e-Learning acceptance (0.446), and Collaboration of students (0.129).

According to ANOVA analysis, there was no difference in the relationship between independent variables and e-learning acceptance or learning outcome of students by the demographic variables, such as gender, age, program, experience, and major. However, the e-learning acceptance of more experienced students was not affected by university support (which had a strong impact on less experience group).

Based on this result, the managers of the e-learning system of Vietnamese universities should have a proper plan for improving the quality of the e-learning system, attracting more users, and creating an effective environment for teaching and learning inside of their institutions. Yuan et al. (2016) also emphasized the necessary for a learning environment that enabling students in problem solving through e-learning.

There are still several limitations of this research, including (1) The small and limited sample size, (2) The lack of evaluating the impact of mediating factors and other variables related to online learning processes.

Therefore, some implications for future researches could include: (1) increase the sample size or extend the scope to various educational institutions/ programs; and (2) identify and measure the impact of some new factors, such as knowledge process and evaluating and teaching method on e-learning acceptance and learning outcomes of university students.

ORCID

Quoc Trung Pham  <https://orcid.org/0000-0003-4197-3725>

References

- Baleghi-Zadeh, S., Ayub, A. F. M., Mahmud, R., & Daud, S. M. (2017). The influence of system interactivity and technical support on learning management system utilization. *Knowledge Management & E-Learning*, 9(1), 50–68.
- Benigno, V., & Trentin, G. (2000). The evaluation of online courses. *Journal of Computer Assisted Learning*, 16(3), 259–270.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982–1003.
- DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, 19(4), 9–30.
- EdTech. (2016). *Report of e-learning system applications in US universities*. EdTech.
- Govindasamy, T. (2001). Successful implementation of e-learning: Pedagogical considerations. *The Internet and Higher Education*, 4(3/4), 287–299.
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
- Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1995). *Learning networks: A field guide to teaching and learning online*. Cambridge, MA: The MIT Press.
- Hoang, T., & Chu, N. M. N. (2008). *Phân tích dữ liệu nghiên cứu với SPSS (tập 1 & 2)*. HCMC: NXB. Hồng Đức.
- Laily, N., Kurniawati, A., & Puspita, I. A. (2013). Critical success factor for e-learning implementation in institute technology Telkom Bandung using structural equation modeling. In *Proceedings of the International Conference on Information and Communication Technology*. Indonesia.
- Martínez-Caro, E. (2011). Factors affecting effectiveness in e-learning: An analysis in production management courses. *Computer Applications in Engineering Education*, 19(3), 572–581.
- Masie, E. (2016). *E-learning definition of Masie Elliot Learning Center*. Retrieved from <https://www.elearninglearning.com/masie/>
- MOET. (2016, August 31). *Report & strategy of VN Education and Training Ministry*. Ministry of Education and Training, Vietnam.
- Nehari, M., & Bender, H. (1978). Meaningfulness of a learning experience: A measure for educational outcomes in higher education. *Higher Education*, 7(1), 1–11.
- Nguyen, D. T. (2013). *Phương pháp nghiên cứu khoa học trong kinh doanh*. HCMC: NXB. Tài Chính.
- Nguyen, D. T. (2015). Mô hình cấu trúc cho sự thành công của dự án hệ thống thông tin. *Tạp chí Phát triển Khoa học và Công nghệ*, 18(2), 109–120.
- Nguyen, D. T., & Nguyen, T. M. T. (2011). *Nghiên cứu khoa học Marketing: Ứng dụng*

- mô hình cấu trúc tuyến tính SEM. HCMC: NXB. Lao Động.
- Nguyen, T. D., Nguyen, T. M., Pham, Q. T., & Misra, S. (2014). Acceptance and use of e-learning based on cloud computing: The role of consumer innovativeness. *Lecture Notes in Computer Science*, 8583, 159–174.
- Owston, R. D. (1997). Research news and comment: The world wide web: A Technology to enhance teaching and learning. *Educational Researcher*, 26(2), 27–33.
- Pham, Q. T., & Huynh, M. C. (2017). Impact factor on learning achievement and knowledge transfer of students through e-learning system at Bach Khoa University, Vietnam. In *Proceedings of the International Conference on Computing Networking and Informatics (ICCN)*. IEEE.
- Pham, Q. T., & Huynh, M. C. (2018). Learning achievement and knowledge transfer: The impact factor of e-learning system at Bach Khoa University, Vietnam. *International Journal of Innovation*, 6(3), 194–206.
- Resta, P., & Patru, M. (2010). *Teacher development in an e-learning age: A policy and planning guide*. Paris: UNESCO.
- Rosen, A. (2000). *The e-commerce question and answer book*. New York, NY: American Management Association.
- Seddon, P. B. (1997). A respecification and extension of the DeLone and McLean model of IS success. *Information Systems Research*, 8(3), 240–253.
- Selim, H. M. (2007). Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education*, 49(2), 396–413.
- Shee, D. Y., & Wang, Y.-S. (2008). Multi-criteria evaluation of the web-based e-learning system: A methodology based on learner satisfaction and its applications. *Computers & Education*, 50(3), 894–905.
- Shuja, A., Qureshi, I. A., Schaeffer, D. M., & Zareen, M. (2019). Effect of m-learning on students' academic performance mediated by facilitation discourse and flexibility. *Knowledge Management & E-Learning*, 11(2), 158–200.
- Soong, B. M. H., Chan, H. C., Chua, B. C., & Loh, K. F. (2001). Critical success factors for online course resources. *Computers & Education*, 36(2), 101–120.
- Turban, E., King, D., Lee, J. K., Liang, T.-P., & Turban, D. C. (2015). *Electronic commerce: A managerial and social networks perspective*. Switzerland: Springer International Publishing.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186–204.
- Venkatesh, V., Moms, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478.
- Venkatesh, V., Thong, J. Y. L., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36(1), 157–178.
- Volery, T., & Lord, D. (2000). Critical success factors in online education. *The International Journal of Educational Management*, 14(5), 216–223.
- Wang, Y.-S. (2008). Assessing e-commerce system's success: A re-specification and validation of the DeLone and McLean model of IS success. *Information Systems Journal*, 18(5), 529–557.
- WTO. (1998). *E-commerce definition*. Retrieved from https://www.wto.org/english/thewto_e/minist_e/mc11_e/briefing_notes_e/bfecom_e.htm
- Yuan, B., Wang, M., Kushniruk, A. W., & Peng, J. (2016). Design of a computer-based learning environment to support diagnostic problem solving towards expertise development. *Knowledge Management & E-Learning*, 8(4), 540–549.

Appendix I

The measurement scales

ID	Statement	Agreement				
Lecturer or Instructor (INS)						
1	The instructor is enthusiastic about teaching the class on e-learning	1	2	3	4	5
2	The instructor’s style of presentation holds my interest	1	2	3	4	5
3	The instructor is active in the interaction/ discussion via e-learning	1	2	3	4	5
4	We were invited to ask questions/receive answers on e-learning	1	2	3	4	5
5	We were encouraged to participate in class discussion on e-learning	1	2	3	4	5
6	The instructor encourages and motivates us to use e-learning	1	2	3	4	5
Students’ computer competency (SCC)						
1	I enjoy using personal computers	1	2	3	4	5
2	I use the personal computers for work and play	1	2	3	4	5
3	I was comfortable with using the PC and software applications before I took up the e-learning	1	2	3	4	5
4	My previous experience in using the PC and software applications helped me in the e-learning	1	2	3	4	5
5	I am not intimidated by using the e-learning-based courses	1	2	3	4	5
Students’ collaboration (SIC)						
1	I do not read/participate in the discussion group on e-learning	1	2	3	4	5
2	I only read messages in the discussion group on e-learning	1	2	3	4	5
3	I do read, as well as participate in the discussion group on e-learning	1	2	3	4	5
4	The instructor initiated most of the discussion on e-learning	1	2	3	4	5
5	The students initiated most of the discussion on e-learning	1	2	3	4	5
Content and design of courses (CON)						
1	The learning material on e-learning is sufficient and relevant to the subject	1	2	3	4	5
2	The functions of e-learning system are easy to use	1	2	3	4	5
3	It is easy to navigate on e-learning system	1	2	3	4	5
4	The functions of e-learning are always available	1	2	3	4	5
5	The course materials are uploaded to e-learning on time	1	2	3	4	5
6	The user interfaces of e-learning system are well designed.	1	2	3	4	5
Access ability (TA)						
1	Easy on-campus access to the internet	1	2	3	4	5
2	Did not experience problems while browsing	1	2	3	4	5
3	Browsing speed was satisfactory	1	2	3	4	5
4	I could interact with classmates through the web	1	2	3	4	5
5	I could easily contact the instructor through e-learning system	1	2	3	4	5
6	Overall, the e-learning website was easy to use	1	2	3	4	5
Infrastructure (INF)						
1	I can use any PC at the university using the same account	1	2	3	4	5
2	I can use the computer labs for practicing	1	2	3	4	5
3	The university internet connection is stable and secured	1	2	3	4	5
4	Overall, the information technology infrastructure is efficient	1	2	3	4	5
University support (SUP)						
1	I can access the central library website and search for materials	1	2	3	4	5
2	I can get technical support from technicians	1	2	3	4	5
3	I think that the university support for e-learning system is good	1	2	3	4	5
4	There are enough computers to use and practice	1	2	3	4	5

5	I can print my assignments and materials easily	1	2	3	4	5
E-learning acceptance or usefulness (ELU)						
1	E-learning is a failure and a bad idea	1	2	3	4	5
2	E-learning is an effective method of learning	1	2	3	4	5
3	I like the idea of using e-learning	1	2	3	4	5
Learning outcome (LA)						
1	I believe that, this online course was a very valuable learning experience for me.	1	2	3	4	5
2	I believe that this online course was a constructive and definitely helpful learning experience.	1	2	3	4	5
3	Taking the online course made little difference for me.	1	2	3	4	5
4	In some ways I feel good about myself due to this online course.	1	2	3	4	5
5	Some of my values have been clarified due to this learning experience.	1	2	3	4	5
6	This online course was useful in helping me develop new ways to achieve work tasks.	1	2	3	4	5
