The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/1066-2243.htm

How can we achieve better e-Learning success in the new normal?

Sodam Kim
Shenzhen MSU-BIT University, Shenzhen, China
Jumin Lee
Kyung Hee Cyber University, Seoul, Republic of Korea
Sang-Hyeak Yoon
KOREATECH, Cheonan-si, Republic of Korea, and
Hee-Woong Kim
Graduate School of Information, Yonsei University, Seoul, Republic of Korea

Received 18 May 2021
Revised 1 October 2021
15 December 2021
2 February 2022
Accepted 6 February 2022

Abstract

Purpose – This study aims to propose and validate a model for e-Learning success based on students' experiences in the "new normal." To achieve this goal, this study focused on answering three research questions: (1) What are the students' experiential factors that impact e-Learning? (2) How do these experiential factors affect e-Learning success? (3) In what ways does a multimethod provide a comprehensive perspective and an in-depth understanding of students' e-Learning experiences in the new normal?

Design/methodology/approach – This study applied a mixed-methods sequential approach using exploratory, confirmatory and complementary studies. First, this study undertook a text-mining exploratory analysis of the review data to extract e-Learning topics. Then, based on the Information Systems (IS) success model, this study identified an integrated framework drawn from the results of the text-mining analysis. Second, this study proposed an e-Learning, experience-based success model and corresponding hypotheses and conducted a confirmatory study with surveys to validate the model. Third, this study conducted in-depth interviews to better identify the phenomenon of interest.

Findings – The five factors extracted from the first stage are system quality, lecture content, teaching quality, online interaction and achievement. This study subsequently confirmed the significant relationships between the e-Learning success factors in the second stage based on the IS success model. Finally, a complementary study identified the importance of interactivity for e-Learning success in the new normal.

Originality/value – To the best of the authors' knowledge, this paper is the first to develop an e-Learning success model using a comprehensive mixed-methods approach.

Keywords e-learning, Student experience, Mixed-methods approach, IS success Model, New normal

Paper type Research paper

Introduction

Advances in information and communication technologies have brought many changes, not the least of which is the ability to share knowledge anytime, anywhere (Martínez-Torres *et al.*, 2008). Moreover, the educational environment has dramatically changed in response to the COVID-19 pandemic, resulting in a new emphasis on e-Learning (Li and Lalani, 2020). Because of the pandemic, various social and economic activities were moved into contactless environments that constitute a "new normal" for their conduct. This new normal refers to these changes in our behavior during or after the pandemic (Elnaj, 2021). The pandemic forced the global shutdown of many, if not most, offline educational activities in the academic field. It has led to pervasive e-Learning as a type of contactless digital technology (Adedoyin and Soykan, 2020; Almaiah *et al.*, 2020). e-Learning refers to the use of technology to create educational

Funding: This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2018S1A3A2075114).

Internet Research
© Emerald Publishing Limited
1066-2243
DOI 10.1108/INTR-05-2021-0310

experiences (Horton, 2001). Even in business, training employees with technology-based educational tools is essential in improving their performance (Bates and Bates, 2005). However, e-Learning is a departure from more traditional approaches to education, such as the "cramming" method of teaching (Allen and Seaman, 2008; Cheng, 2012). A combination of social network services, real-time interactive systems and online forums might attract and motivate learners to participate in e-Learning (Farhan *et al.*, 2019).

Universities have used e-Learning quite effectively to conduct higher educational courses (Laurillard, 2004). There are two types of e-Learning in higher education; massive online open courses (MOOCs) and online universities. A popular trend in e-Learning, MOOCs provide high-quality educational systems worldwide to all who want to take them. The rise of MOOCs stems primarily from a desire to accommodate the needs of busy professionals and individuals who wish to add to their skills, degrees or knowledge in specific areas. Online universities, the second type of e-Learning, support distance and open learning programs to earn their degrees online. For example, the Massachusetts Institute of Technology in the United States offered virtually all of its courses online in 2007. The Open University in the UK has widened access to the highest standards of scholarship in higher education (Wu *et al.*, 2006).

However, despite the growing use of e-Learning, little research exists on the concepts or elements of e-Learning success. Many previous studies have indicated that e-Learning has a lower substitution effect on traditional learning systems and a lower degree of users' satisfaction than expected (Packham *et al.*, 2004). In addition, it is not cost-effective (Islam, 2016; Mohammadyari and Singh, 2015). Without the active participation of learners, e-Learning systems cannot produce successful outcomes in terms of increased learning performance. Many learners enroll in e-Learning courses, but few of them pass (Contini *et al.*, 2018; Sun *et al.*, 2008). According to MOOCs data, the completion rate of e-Learning courses was only 3.13% in 2017–2018 (Lederman, 2019). Low completion rates cause negative e-Learning experiences for both instructors and students. Thus, e-Learning success in this study means high completion rates in courses taught exclusively online. Moreover, research lacks the various aspects of the success, or lack of it, of e-Learning. Most studies treat success as a single element of either the system (Packham *et al.*, 2004; Wang *et al.*, 2007), the lecturer (Bacca *et al.*, 2014; Oliver and Herrington, 2003) or the student (Chen and Liu, 2013).

An information system consists of four components: task, people, roles and technology (O'Hara *et al.*, 1999). *People* perform *tasks* with *roles* using *technologies*. *Roles* (or structure) refer to "the communications, authority and workflow systems within the organization" (O'Hara *et al.*, 1999, p. 64). Similarly, in an e-Learning context, students' experiences are compounds formed by the relationships between e-Learning's four components: *Teachers* perform *lectures* to *students* using e-Learning *systems*. Tasks in e-Learning refer to lectures, and technology relates to the e-Learning system itself. Teachers and students represent people and roles together in the e-Learning context. We adopted the Information Systems (IS) success model (DeLone and McLean, 2003) as an overarching theory because this study takes a holistic view not only of the e-Learning system but also of its various aspects (e.g. learning system, student and lecture) related to the realization of e-Learning. The IS success model explains the major dimensions of these aspects and the relationships between them that account for IS success. Because e-Learning occurs based on the interactions between students and lecturers through a learning system, several critical dimensions may work together to the success of e-Learning. It is, therefore, appropriate to use the IS success model in holistically examining e-Learning success. Previous research also applied the IS success model to explore e-Learning success (e.g. Shahzad *et al.*, 2021; Al-Fraihat *et al.*, 2020; Subaeki *et al.*, 2020; Freeze *et al.*, 2019), but not with a holistic view, as we do in this study.

We proposed in our study to validate the e-Learning success model based on factors of students' experiences with e-Learning in the new normal. To achieve our goal, we focused on answering three research questions:

RQ1. What are the students' experiential factors that impact e-Learning?

RQ2. How do these experiential factors affect e-Learning success?

RQ3. In what ways does a multimethod provide a comprehensive perspective and an in-depth understanding of students' e-Learning experiences in the new normal?

We applied a mixed-methods approach to these questions by combining qualitative and quantitative study methodologies. First, we conducted topic modeling through a text-mining analysis of students' actual reviews of MOOCs. By collecting these views of practical learners, this study can compensate for the lack of previous empirical research. Significant issues and the hidden structure of e-Learning services can be discerned from an analysis of the experiential factors embedded in students' reviews. Second, we interpreted the extracted experiential factors of e-Learning's use of the IS success model using the exploratory study results and developed an e-Learning success model. Third, we conducted a survey of e-learners to validate the proposed research model. Lastly, through a complementary study, we gained additional insight into our results by analyzing in-depth interviews of 34 participants. Consequently, this study provides a comprehensive e-Learning success model. Using our results, providers of e-Learning services can devise practical guidelines for developing e-Learning systems that achieve their educational goals within the context of contactless technology.

Conceptual background

e-Learning in new normal

e-Learning consists of two components: learning and technology. Learning is acquiring knowledge or modifying existing knowledge, and technology facilitates the learning process (Aparicio *et al.*, 2016). The concept of e-Learning first emerged in the 1960s under the term "Computer-Assisted Instruction" (Anderson, 2008). Since its initial conceptualization, this idea has been evolving. In higher education, what universities will be like in the next millennium is a simple but critical question (Lee, 2001). It is still being answered with the emergence of various modalities of e-Learning, the two major types being MOOCs and online universities. Both support learners who cannot reach universities or specialized courses because of geographic, economic or political constraints (Aparicio *et al.*, 2016).

Although earlier studies of e-Learning focused on course content and activities (Brox *et al.*, 2004), recent studies have addressed more diverse issues. Some studies have tried to identify the adoption of e-Learning systems (Chen and Liu, 2013; Lee *et al.*, 2005). Some other studies sought to evaluate learners' perceived satisfaction with e-Learning (Aggelidis and Chatzoglou, 2012; Sun *et al.*, 2008). For example, Sun *et al.* (2008) empirically identified seven critical factors that affect learners' perceived satisfaction – computer anxiety, instructors' attitudes toward e-Learning, e-Learning course flexibility, e-Learning course quality, perceived usefulness, perceived ease of use and diversity in assessments. Meanwhile, numerous post-pandemic studies are underway to prepare for a new normal era. Discussions in the research related to the new normal perspective have focused on the role of technology and on efforts to understand the popularization of contactless education services. As the use of e-Learning increases after the pandemic, some researchers are focusing on how e-Learning systems can technically support instructors and learners (Bozkurt and Sharma, 2020; Elhaty *et al.*, 2020; Müller *et al.*, 2021; Pham and Ho, 2020; Rashid and Yadav, 2020). Other researchers are primarily concerned with discussing e-Learning usage and its importance in each country after the pandemic (Alhumaid *et al.*, 2020; Naddeo *et al.*, 2021; Phuthong, 2021; Tria, 2020).

Despite the differences in e-Learning research as the usage of e-Learning increases, the factors for its success remain unclear. Previous studies have indicated that users' participation, adoption and satisfaction with e-Learning are important, and their antecedents as critical success factors have been revealed. Nevertheless, there is doubt: What are the essential factors for success?

Successful outcomes can be assessed according to grades and independent learning performance at the individual level. From a holistic perspective, the relationships between the factors extracted from students' experiences are essential to its success in exploring the mechanism.

e-Learning success

e-Learning is a web-based system that makes information or knowledge available to users or learners without temporal or geographic limitations. e-Learning success refers to the degree to which a student evaluating the e-Learning system believes that taking an e-Learning course is worthwhile (Kim *et al.*, 2003). Evaluating an e-Learning system requires attentiveness to its e-Learning components and their relationships from a broader perspective. e-Learning operates on four elements: students, teachers, lectures and systems. A student takes a course (i.e. participates, completes assignments and asks questions) via an e-Learning system. A teacher offers material through lectures and answers students' questions via the e-Learning system. Although e-Learning has advantages over traditional face-to-face education (Piccoli *et al.*, 2001), major concerns include time, labor-intensiveness and the material resources required to operate e-Learning environments. The costly low-completion rate of implementing e-Learning courses discussed by Arbaugh and Duray (2002) deserves management and system designers' attention.

Many researchers from the education and IS fields have identified important variables contributing to e-Learning success. The technology acceptance model (Ajzen and Fishbein, 1977; Davis, 1989) and the expectation and confirmation model (Bhattacherjee, 2001; Wu *et al.*, 2006) have partially contributed to the current understanding of e-Learning success. These models focus on technology. A summary of the literature relevant to all factors vital to e-Learning activities and affecting e-Learning satisfaction is presented in Table 1. Many studies (e.g. Shahzad *et al.*, 2021; Subaeki *et al.*, 2020) have addressed adopting an e-Learning system with a single method such as an experiment or a questionnaire. For example, Mohammadi's study (2015) integrated the technology acceptance model into the IS success model to identify constructs influencing the use of e-Learning. However, these efforts focused on the use of e-Learning, not on its success from the perspective of the students' experiences, and only considered factors for the system and the student. There is also a lack of research that encompasses the learning system, lecture, teacher and students in terms of success. Accordingly, these knowledge gaps illustrate the need to develop a comprehensive framework for assessing e-Learning success.

IS success model from a student experience perspective

The IS success model provides a comprehensive understanding of the factors that determine IS success (DeLone and McLean, 2003). The six critical success dimensions commonly used to evaluate service or platforms based on IS are system quality, information quality, service quality, use, users' satisfaction and net benefit (DeLone and McLean, 2003). This model has been used as a background theory in the e-Learning context. It is sufficiently applicable if we look at the e-Learning system as a type of information system because the model evaluates the success of an information system based on users' experiences in using it. Applying this to an e-Learning context, the student is the key factor that determines its success or failure.

Meanwhile, creating a secure customer experience is a principal management objective in various areas. The concept of customer experience (CX) refers to a customer's holistic perception of a brand. In the business field, CX is formed through the interaction between a customer and an organization during a customer's purchase journey (Lemon and Verhoef, 2016). Customers' experiences also encompass their interactions with a specific brand or service. In other words, every service exchange leads to CX, regardless of its nature and form (Schmitt *et al.*, 2015). CX management aims to ensure that customers' experiences match their expectations at every point of contact (Thompson and Kolsky, 2004). Accordingly, providers of educational services must pay attention to students' experiences and expectations

Table 1. Previous research on e-Learning success

Context	Research	Theory	Method	Teacher factors	Student factors	System factors	Lecture factors
Education	Ayu (2020)		Survey	Lecturers' perceptions of e-Learning	Learners' attitudes toward e-Learning		
	Mohammadyari and Singh (2015)	UTAUT[1]	Survey		Digital literacy, individual-level social influence, organizational support, performance expectancy, effort expectancy		
	Bacca *et al.* (2014)		Content analysis		Learning motivation, student engagement	Virtual information; Just-in-time information	Learning content
	Yang *et al.* (2014)				Cultural orientation	Technology integration	
	Belleflamme and Jacqmin (2016)	Theory of multisided platforms	Business model analysis	Feedback	Interactions	MOOC[2] platform	
	Ludvigsen and Mørch (2010)			Communication	Interactivity		Online collaboration
	Oliver and Herrington (2003)		Content analysis	Learning tasks, learning resources			Learning support
Information systems (IS)	Shahzad *et al.* (2021)	IS success Model[3]	Survey		System use, users' satisfaction	System quality; information quality; service quality	
	Prasetyo *et al.* (2021)	TAM[4], IS success model	Survey		Perceived usefulness	System quality; information quality; perceived ease of use; user interface	
	Al-Fraihat *et al.* (2020)	TAM, IS success model	Survey	Instructor quality	Learner quality, perceived satisfaction, perceived usefulness	Technical system quality; information quality; service quality; educational system quality; support system quality	

(*continued*)

Table 1.

Context	Research	Theory	Method	Teacher factors	Student factors	System factors	Lecture factors
	Subaeki *et al.* (2020)	IS success model	Survey		Use, user satisfaction	System quality; information quality; service quality	
	Priatna *et al.* (2020)	Multi-attribute Utility theory	Observation, survey		Organization, Human resources	Technology	
	Freeze *et al.* (2019)	IS success model	Survey		User satisfaction	System quality; information quality; system usage	
	Mohammadi (2015)	TAM, IS success model	Survey		Perceived usefulness, satisfaction	Educational quality; service quality; technical system quality; information quality; perceived ease of use	
	Cidral *et al.* (2018)		Survey		Perceived user satisfaction	Collaboration quality; service quality; information quality; system quality	
	Al-Samarraie *et al.* (2018)		Meta-analysis		Attainment value, intrinsic value, Utility value	System quality, information quality; service quality	Task-technology fit
	Aparicio *et al.* (2016)		In-depth literature review		Grit, user satisfaction	System quality; information quality; service quality	
	Lee *et al.* (2005)	TAM, Motivational model	Survey		Perceived Enjoyment	Perceived usefulness; perceived ease of use	
	Piccoli *et al.* (2001)		Survey		Self-Efficacy, performance, satisfaction		

Note(s): [1]Unified Theory of Acceptance and Use of Technology, [2]Massive Open Online Courses, [3]Information Systems success model, [4]Technology Acceptance Model

(Hero and Lindfors, 2019). This study defines a student's experience as their cognitive and emotional responses to an educational service over an entire learning journey.

Research methodology using a mixed-methods approach

This study applied a mixed-methods approach to obtain and test an in-depth understanding of the research model. Mixed-methods research overcomes the limitations of a single method and provides an integrative view of its findings (Lee *et al.*, 2020; Venkatesh *et al.*, 2013, 2016). This study closely follows the approach suggested by Venkatesh *et al.* (2016) for leveraging the full potential of mixed-methods research. As for the mixed-methods research design, this study adopts developmental and complementary purposes by using a sequential design.

To answer our research questions, we conducted the research procedure illustrated in Figure 1. First, as an exploratory study, we undertook a text-mining analysis of the review data to extract e-Learning topics. Second, we used the IS success model (DeLone and McLean, 2003) to identify an integrated framework drawn from the results of the text-mining analysis. Third, we proposed an e-Learning experience-based success model and corresponding hypotheses. Fourth, a confirmatory study was conducted with a survey to validate the proposed research model. Fifth, as a complementary study, the authors conducted in-depth interviews to better identify the phenomenon of interest (Srivastava and Chandra, 2018). Lastly, we found and developed integrative inferences (i.e. meta-inferences) obtained from the mixed-methods research (Tashakkori and Teddlie, 2008; Venkatesh *et al.*, 2013).

Stage 1: exploratory study

Research methods

We used text mining to pursue a topic modeling approach for the exploratory study. With the recent increase in online communication, many researchers have attempted information exploration and topic extraction using text mining (Ghosh and Guha, 2013; Zhao *et al.*, 2011). Therefore, we also applied topic modeling, a text analysis method that extracts and summarizes information from documents (Li *et al.*, 2019). Topic modeling supposes that a document's words are grouped into a specific topic, calculates the probability of each topic occurring and extracts topics as sets of words likely to correspond to each topic (Blei, 2012). This method is beneficial for collecting and analyzing extensive opinions without the risk of reflexivity.

We thus applied latent Dirichlet allocation (LDA) topic modeling to extract and summarize document information (Blei, 2012). This topic modeling enables observations to be explained by unobserved groups that reveal why some parts of the data are similar. Using this method, significant issues and unknown e-Learning factors can be discerned from learners' experiences embedded in the text of their reviews of classes. To collect textual data from e-Learning reviews, researchers explored the reviews on Class Central, a search engine and review site for the various e-Learning courses provided by MOOC platforms. Notably, we used web crawling to collect review data from the Top 50 courses from Udemy and Class Central. Our collection via web crawling amassed 21,697 reviews on Udemy and 22,512 reviews on Class Central.

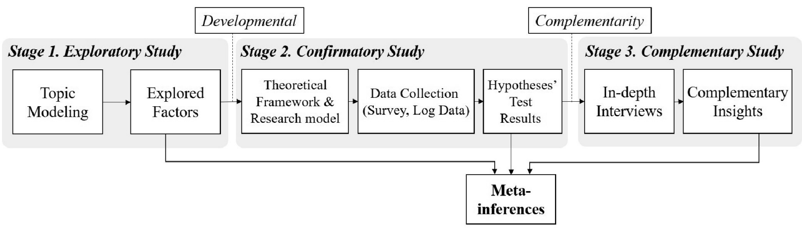


Figure 1. Research procedure

Topic modeling analysis requires the determination of numerous topics. Perplexity and coherence scores were calculated to determine the exact number of topics needed (Khalifa *et al.*, 2013). *Perplexity score* measures how well a topic model reflects a document's content; the lower the perplexity value, the better the outcome. The *coherence score* measures the similarity between words in a topic; the higher this score, the more semantically consistent a topic is (Khalifa *et al.*, 2013). The perplexity and coherence scores were analyzed using Python's TEANAPS package to set the number of topics. Topic modeling between 2 and 15 topics demonstrates that perplexity (−7.47) decreases rapidly, and the coherency score of 0.48 increases when the number of topics increases from 9 to 10. Therefore, nine were chosen as the appropriate number of topics for topic modeling analysis.

Results

Based on these 44,209 items of review data, the researchers extracted topics mentioned in e-learners' experiences, as shown in Table 2. The nine topics selected are as follows: *time management*, *user interface (UI) quality*, *video quality*, *learning material*, *certification*, *lecture quality*, *interaction within the class*, *interaction with the lecturer* and *self-development*. A final step consisted of extraction through deductive logic of the five exploratory factors of system quality, lecture content, teaching quality, online interaction and achievement (Eickhoff and Wieneke, 2018). *System quality* relates to time management, UI quality and video quality from the text-mining analysis. *Lecture content* relates to the learning material and personal needs. *Instructor quality* is linked to lecture quality from the results of topic modeling. *Online interaction* is related to interactions within the class and interaction with the lecturer. *Achievement* is related to self-development from topic modeling results. The IS success model can be used to explain the four components of e-Learning: students, teachers, lecturers and systems (DeLone and McLean, 2003).

IS success model and integrated framework

This study adopted the IS success model to interpret the factors derived from the exploratory study and to connect with the IS success model. In the e-Learning context, system quality is explained by its appropriateness for its intended use and users' needs. Information quality describes content issues with e-Learning (Freeze *et al.*, 2019). From an educational viewpoint, e-Learning service quality explains how well an instructor delivers knowledge to learners (i.e. the instructor's skills and online interactions during the course delivery). These three dimensions – system quality, information quality and service quality – affect both e-Learning use and users' satisfaction; use can influence users' satisfaction, according to DeLone and McLean's model. Lastly, use and users' satisfaction are direct determinants of net benefit. Net benefit can measure e-Learning outcomes at the individual level, such as learning performance. This study adopts the IS success model as a foundational theory for the integrative framework with meta-inferences from this exploratory study. Using an integrative framework, this study proposes and validates an e-Learning success model to identify the critical factors for successful e-Learning.

The integrated framework of this study was developed based on the IS success model, as illustrated in Figure 2. This study identified five constructs from the exploratory study as belonging to the four dimensions of the IS success model – system quality, information quality, service quality and net benefits. System quality refers to the desired characteristics of an IS system, such as usability and availability. The information quality is related to the content issue. For example, the content provided by an IS should be complete, relevant and easy to understand. Service quality refers to the overall support or services the provider delivers. Net benefits are the success measures used within the IS success model. In the e-Learning context, system quality should be measured based on the characteristics of the e-Learning system. And

Table 2. Topic modeling results

Explored factors	Topic modeling results Topic (Weight)	Keywords	Sample reviews
System Quality (system)	Time management (0.40)	minute, time, pace, week, hour, forward, period, fashion, speed, course	It is a great course of exploring webpack in-depth and putting everything you need together; it saves me a lot of *time* for surfing each piece of information from various blogs online – It would also be nice to have *playback speed control*
	UI quality (0.51)	Online, design, guidance, documentation, interface, GUI, browser, Internet, feature, pattern	– Can do the course work with easy-to-use simple GUI – the entire class is online, and no files need to be submitted – The service provided by CodeSkulptor (a browser-based programming environment) was an *excellent feature*
	Video quality (0.41)	Video, end, file, environment, excellent, format, picture, audio, support	– The *video quality* could be better as the text can be a bit fuzzy – *Audio and video quality* of the course is very professional
Lecture Content (Lecture)	Learning material (0.46)	Material, example, explanation, assignment, book, practice, overview, theory	– I have seen more practice *assignments* here than other courses, which I am very thankful for – The course *material* and *examples* are excellent. The material is engaging, and the examples help you understand the concepts
	Certification (0.54)	certification, degree, job, success, hope	– I have been studying to take the Microsoft C# *certification* – Wonderful course, helped me in *getting my job* and still helping me become a better developer
Instructor Quality (instructor)	Lecture quality (0.70)	Teacher, instructor, quiz, example, topic, exercise, lesson, solution, teaching	– The *instructors* have constructed a well-planned process of learning Python and building complexity! – The *instructors* make lots of effort to be entertaining and informative. I hope to take more of his courses soon

(*continued*)

Table 2.

Explored factors	Topic modeling results Topic (Weight)	Keywords	Sample reviews
Online Interaction (student-teacher)	Interaction within the class (0.63)	The question, answer, react, community, tutorial, game, learning, project	– There was a really supportive *community* active on the forums, with fellow students offering each other advice and support, as well as community TAs adding extra help, so there was always help if needed – Expect to spend about 10 h per week on the course between lectures, quizzes, a mini-project, and grading *other students' projects*
	Interaction with the lecturer (0.36)	Study, professor, student, thanks, feedback, explanation, ease, approach	– One of the best things about the lecturer, he *responded to our questions* promptly. So, no waiting time (Maximum 12 h) – I Am aware of what it takes to put together good training material, and lecturers do an excellent job of executing this class. I Admire that they continue to evolve the course, given the *feedback* they receive
Achievement (student)	Self-development (0.45)	Opportunity, knowledge, progression, skill, experience, development, experience, effort, challenge	– While it is hard to achieve perfection, there is no doubt that that was the target here in developing the course and framework. I have learned a lot. From it despite sometimes being *challenged* – I cannot wait to keep learning more and applying my *skills* to complex business problems

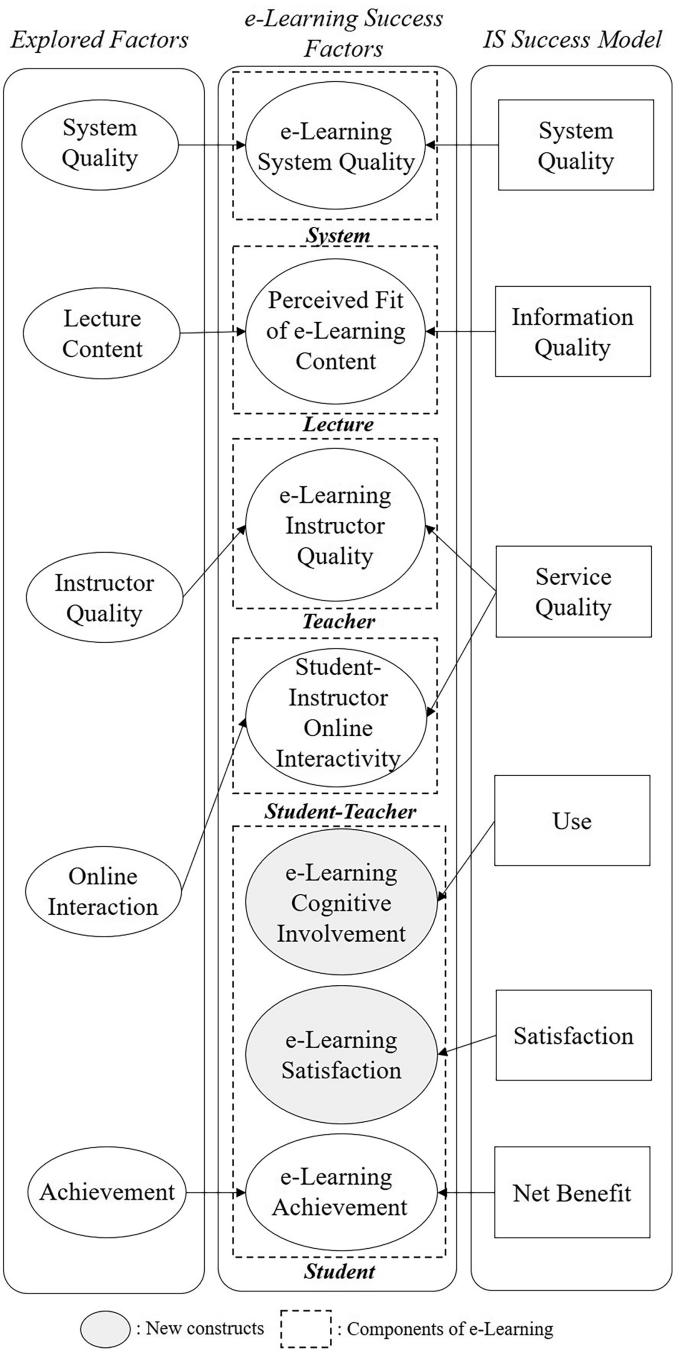


Figure 2.
Integrated framework

lecture content, such as the learning material and personal needs, relate to the e-Learning content issue. Also, e-Learning provides educational services according to its essential purpose. For example, a teacher lectures and students interact with the teacher in an e-Learning course. From the perspective that e-Learning is an information system, five explored factors were matched to the four dimensions of the IS success model. Two constructs, e-Learning cognitive involvement and e-Learning satisfaction, were added based on the IS success model's functioning as the overarching theoretical basis of this study.

Stage 2: confirmatory study

Research model and hypotheses

Based on the integrated framework from the exploratory study, this study proposes an e-Learning success model as depicted in Figure 3. According to the integrated framework of the IS success model and the constructs extracted from the exploratory study, four constructs (system quality reflected in "e-Learning system quality," information quality reflected in 'perceived fit of e-Learning content', service quality reflected in "e-Learning instructor quality" and "student-instructor online interactivity") affect the use and users' satisfaction. According to the IS success model (DeLone and McLean, 2003), instructor quality and online interaction are not necessarily exclusive. For this reason, we propose *contactless learning quality* as a second-order construct composed of two dimensions, e-Learning instructor quality and student–instructor online interactivity.

The construct of use (e-Learning cognitive involvement) affects users' satisfaction (e-Learning satisfaction). The research model includes five control variables (gender, age, occupation, main e-Learning platform and prior experience in taking courses). Finally, e-Learning cognitive involvement and e-Learning satisfaction affect net benefit (e-Learning achievement). The proposed hypotheses are detailed below.

As one of the critical dimensions influencing IS success, system quality affects the use of IS (DeLone and McLean, 2003). System quality in e-Learning includes audio and video quality as well as the features of the website interface (Novak and Hoffman, 1997). *e-Learning system quality* refers to *the extent to which the technical aspect of the system supports e-Learning* (Gorla *et al.*, 2010). Prior research posits that student involvement in an e-Learning system is influenced by the quality of the website interface and the support structure provided (Weaver *et al.*, 2013). During a student's use of a higher-quality learning system, higher levels of e-Learning cognitive involvement are experienced. *e-Learning system quality* beliefs shape attitudes about information and system satisfaction (Wixom and Todd, 2005). Prior research

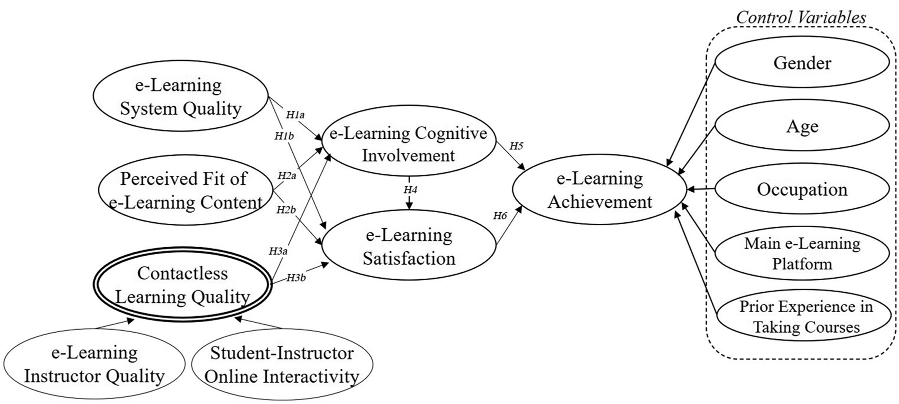


Figure 3.
Research model

has also indicated that system quality positively affects users' satisfaction (Ho *et al.*, 2010; Rai *et al.*, 2002). From the perspective of a student's experience, most contact points with e-Learning are through the system. In the e-Learning context, a student cannot experience in the absence of the technical system itself. Thus, increasing the e-Learning system quality may increase learners' satisfaction and involvement.

H1a. e-Learning system quality has a positive effect on e-Learning cognitive involvement.

H1b. e-Learning system quality has a positive effect on e-Learning satisfaction.

Information quality, the fitness for using the information provided, affects IS use (DeLone and McLean, 2003). As one type of data provided in the e-Learning context of the educational field, instructional content is discussed as a unique element of e-Learning (Seok, 2008). Information quality beliefs shape attitudes about system satisfaction (Wixom and Todd, 2005). Many studies have found strong support for a positive relationship between information quality and users' satisfaction (Chae *et al.*, 2001; Chiu and Chen, 2005). Thus, an increase in the quality of e-Learning content should increase learners' satisfaction. Information quality is also linked to the perceived fit of e-Learning content. *Perceived fit of e-Learning content* refers to *the extent to which the content of an e-Learning course matches a user's learning goal* (Goodhue and Thompson, 1995). The task-technology fit model supports the significance of perceived fit in determining users' motivations and IS usage (Goodhue and Thompson, 1995). Prior studies have found that perceived fit in the e-Learning context is one of its core determinative factors (Al-Samarraie *et al.*, 2018). Therefore, how an e-Learning course matches a student's personal learning goal is essential in promoting student involvement. Users' perceptions that a system can help them perform tasks promote positive attitudes (Al-Samarraie *et al.*, 2018). Task-technology fit is one of the main predictors of satisfaction with e-Learning (Gu and Wang, 2015). Thus, an increase in the perceived fit of e-Learning content should increase learners' satisfaction.

H2a. Perceived fit of e-Learning content has a positive effect on e-Learning cognitive involvement.

H2b. Perceived fit of e-Learning content has a positive effect on e-Learning satisfaction.

Service quality reflects customers' needs for support from providers within IS (DeLone and McLean, 2003). In the educational field, quality teaching is the primary objective of higher education (Byrne and Flood, 2003). Teaching quality refers to providing students with feedback, explaining issues and concepts, making a program enjoyable, motivating students and understanding their problems (Byrne and Flood, 2003). For all these elements to co-occur within the context of teaching, a course demands high-quality instructors, high-quality communication and interaction between the instructor and students. However, the single most notable feature of e-Learning is the lack of face-to-face contact between instructor and student(s), which drastically complicates the already difficult job of evaluating quality teaching. Some studies have approached this overall problem of instructional quality by emphasizing knowledgeability (e.g. Owlia and Aspinwall, 1996), but others attribute instructional success to an instructor's ability to create a learning atmosphere and build good relationships with students (Fauth *et al.*, 2014; Praetorius *et al.*, 2018). The perspective in this study is that contactless learning [1] quality refers to the extent of online activities that promote student learning well. The quality of contactless learning also has been evaluated in various ways, but no consensus exists on measurement methods and dimensions. Thus, contactless learning quality in this study consists of two dimensions: e-Learning instructor quality and student–instructor online interactivity. In terms of dimensionality, contactless learning quality is a formative second-order construct composed of two dimensions: instructor quality and student–instructor online interactivity. These dimensions represent an aspect of learning quality that could be a separate construct but remains integral to contactless learning quality at a more abstract level (Bruhn *et al.*, 2008).

e-Learning instructor quality refers to the extent to which an instructor teaches an e-Learning course well (Byrne and Flood, 2003). It represents the instructor's teaching ability. Students are considered the primary customers of higher education, so teaching them is one of the e-Learning's primary services and objectives (Hill, 1995). Therefore, an instructor's teaching ability is an essential factor influencing learning effects and e-Learning satisfaction (Sun *et al.*, 2008). Meanwhile, student–instructor and student–student interactions should be assessed for their contribution to learning outcomes (Dwyer *et al.*, 2004; Ettinger *et al.*, 2006). Student–instructor online interactivity refers to interactivity between the learner and instructor in an e-Learning course (Sher, 2009). In the context of e-Learning, student–instructor interactions are critical and occur more frequently than in a traditional class. An instructor (i.e. teacher) must manage students enrolled in an e-Learning course. If a student needs help related to the course, the instructor should respond and help. In e-Learning courses, student–instructor interactivity occurs in online forums, posts, comments, direct messages and e-mail. According to the previous study, students were more involved in online class discussions when interactive learning was conducted (Jin, 2005). In addition, web-based learning supports the assumption that interaction is vital to a course's success (Picciano, 2002). Students were delighted with learning in a highly interactive environment (Jin, 2005). An increase in interactivity might increase learners' satisfaction and involvement.

Practical teaching and quality learning in a university setting promote students' involvement in their courses (Biggs, 2011). Among the four components of e-Learning, teaching is a major e-Learning service and is related to two main actors: instructor and student. When discussing e-Learning success, we should consider contactless learning quality that reflects instructors' abilities and their relationships with students. Therefore, this study suggests that high-quality contactless learning promotes learners' satisfaction and involvement.

H3a. Contactless learning quality has a positive effect on e-Learning cognitive involvement.

H3b. Contactless learning quality has a positive effect on e-Learning satisfaction.

The involvement construct is used to study stimulus objects such as consumers' satisfaction and purchase intention (Beldona *et al.*, 2005). Learning involvement promotes students' effort and enhances learning (Tinto, 1987). The more involved students are in academics, the more they benefit from learning and personal development (Huang and Chang, 2004). Both concepts of involvement and satisfaction explain consumers' purchasing behavior in a marketing context (Beldona *et al.*, 2005). For students in an e-Learning context, the ultimate goal of learning as consumers of educational services is a high level of academic achievement (Lee and Lee, 2008). The best description of e-Learning success should, therefore, include achievement. e-Learning cognitive involvement [2] refers to the perceived relevance of an e-Learning course based on interest in thinking about and learning information pertinent to an offering (Jiang *et al.*, 2010). e-Learning satisfaction refers to the degree of favorability of a student's subjective evaluation of the e-Learning experience (Gu and Wang, 2015). e-Learning achievement refers to the extent of a student's perceived attainment in e-Learning (Lee and Lee, 2008). This study suggests the following hypotheses related to the relationships between e-Learning cognitive involvement, e-Learning satisfaction and e-Learning achievement.

H4. e-Learning cognitive involvement has a positive effect on e-Learning satisfaction.

H5. e-Learning cognitive involvement has a positive effect on e-Learning achievement.

H6. e-Learning satisfaction has a positive effect on e-Learning achievement.

Research methods

This study developed a survey instrument that adopted existing validated scales wherever possible. e-Learning system quality was constructed based on four concepts resulting from the exploratory study – ubiquity, video quality, audio quality and UI quality. This study used the exploratory study and previous literature to model the interactivity between instructors and students. The items for e-Learning cognitive involvement were also adopted from previous literature (Jiang *et al.*, 2010). According to Jiang *et al.* (2010), involvement consists of two dimensions: affective and cognitive involvement. However, students choose an e-Learning course based on practical needs rather than pure interest and fun in our context. Thus, this study adopted only cognitive involvement. In the e-Learning context, cognitive involvement better understands students' experiences and their solid, practical learning motivations.

To assess and verify the content validity of the measurement items, four experts in the field reviewed the survey instrument and checked its face validity (Zikmund *et al.*, 2013). We then conducted a sorting exercise. The sorting results indicated that the inter-judge agreement scores averaged 0.87, and the overall placement ratio of items within the targeted constructs was 0.94. Lastly, we conducted a presurvey with 10 potential participants and interviewed them about our survey items. All measurement instruments are listed in Appendix 1. The final measurement items were anchored using a seven-point Likert scale in which one indicated strongly disagree and seven denoted strongly agree.

Based on the measurement instrument items, individuals who had previous e-Learning experience (i.e. who had taken any e-Learning course) were surveyed, securing 201 valid responses. The male-to-female participant ratio indicated a relatively equal distribution of 89 (44.3%) to 112 (55.7%). Most of the respondents were in their 20s (mean = 23.0, standard deviation = 4.7). Most respondents reported their occupation as "undergraduate student" with the highest distribution rate of 79.6% (160 out of 201 respondents). Lastly, 75.1% of the participants (151 of 201 respondents) indicated they had taken five or fewer online courses (mean = 6.7, standard deviation = 13.8). Table 3 provides a detailed description of the respondents' demographic information.

Demographic variable		Frequency	Percentage
Gender	Male	89	44.3%
	Female	112	55.7%
Age (years) (mean = 23.0, S.D. = 4.7)	10–19	35	17.4%
	20–29	150	74.6%
	30–39	11	5.5%
	Older than 40	5	2.5%
Occupation	Undergraduate students	160	79.6%
	Graduate students	12	6.0%
	Office workers	24	11.9%
	Others	5	2.5%
Main e-Learning platform	University	106	52.7%
	Private institute	74	36.8%
	MOOCs and others	21	10.5%
Prior experience in taking courses (mean = 6.7, S.D. = 13.8)	Fewer than 6	151	75.1%
	6–10	30	14.9%
	11–20	13	6.5%
	More than 20	7	3.5%

Table 3. Respondents' descriptive demographic statistics

Data analysis

Principal component analysis with varimax rotation was used to conduct exploratory factor analysis for all measures. All but seven items were loaded into distinct factors. Because those seven showed low factor loadings (lower than 0.60), they were dropped from further analysis. All items loaded highest into their factors when compared across factors (cross-loadings < 0.40).

Convergent validity is the degree to which the items that comprise a given construct measure the same underlying latent variable. Convergent validity is assessed using three criteria. First, standardized path loadings, indicators of the degree of association between the underlying latent factor and each item, should exceed 0.70 and be statistically significant (Gefen *et al.*, 2000). Second, composite reliabilities (CRs) and Cronbach's alphas should both exceed 0.70 (Nunnally, 1978). Third, each factor's average variance extracted (AVE) should exceed 50% (Fornell and Larcker, 1981). As shown in Table 4, all path loadings exceed 0.70, all Cronbach's alphas and CRs exceed 0.80, and all AVEs exceed 0.60. Thus, reliability and convergent validity are supported.

We next assessed the measurement model's discriminant validity by comparing the AVE's square root for each construct with the correlations between the construct and other constructs. If the square root of the AVE exceeds the correlation between the construct and other constructs, this demonstrates discriminant validity. The square root of the AVE for each construct (i.e. the diagonal terms) exceeded the correlations between the construct and other constructs (i.e. off-diagonal terms). As shown in Table 5, the square root of AVE for each construct exceeded the correlation coefficient between the construct and other constructs. Hence, the discriminant validity of the measures was established (Hair *et al.*, 2006).

Factor scores for both first-order dimensions of contactless learning quality were obtained and then used as inputs for the second-order construct. According to the guidelines, we then evaluated whether the second-order construct was appropriately modeled as a formative latent construct (Petter *et al.*, 2007). The correlation between the two variables was significant

Table 4.
Convergent validity testing results

Construct	Standard loading of each item	AVE	CR	Cronbach's α
e-Learning system quality (LSQ)	0.81, 0.85, 0.90	0.83	0.94	0.89
Perceived fit of e-learning content (PFL)	0.85, 0.91, 0.87	0.87	0.95	0.91
e-Learning instructor quality (LNQ)	0.81, 0.73, 0.87, 0.84	0.77	0.93	0.89
Student-instructor online interactivity (SNT)	0.91, 0.72, 0.86	0.78	0.97	0.86
e-Learning cognitive Involvement (LVM)	0.96, 0.96, 0.73	0.87	0.95	0.91
e-Learning satisfaction (LSF)	0.87, 0.93, 0.96	0.92	0.97	0.94
e-Learning Achievement (LCM)	0.91, 0.93, 0.84	0.89	0.96	0.92

Table 5.
Descriptive statistics and correlations between latent variables

	Mean	S.D.	LSQ	PFL	LNQ	SNT	LVM	LSF	LCM
LSQ	5.11	1.19	**0.91**						
PFL	4.76	1.33	0.46	**0.93**					
LNQ	4.26	1.33	0.41	*0.64*	**0.88**				
SNT	2.83	1.36	0.20	0.37	0.51	**0.88**			
LVM	4.79	1.47	0.53	*0.73*	0.53	0.35	**0.93**		
LSF	4.70	1.34	0.55	*0.75*	*0.63*	0.39	*0.72*	**0.96**	
LCM	4.66	1.34	0.46	*0.78*	*0.63*	0.43	*0.68*	*0.76*	**0.94**

Note(s): (1) Leading diagonal (bold font) shows the square root of AVE of each construct, (2) Italics font show over 0.6 value of correlations and showed a modest correlation (0.51). Because a reflective model would produce a high correlation (often above 0.80), a formative model seems more proper. Next, we checked multicollinearity among the first-order constructs. The variance inflation factor (VIF) values were less than 10, indicating that multicollinearity is not a concern (Alin, 2010). In addition, the weights of first-order constructs on contactless learning quality also were significant. To sum up, these tests supported our model with a second-order formative construct and verified its construct validity.

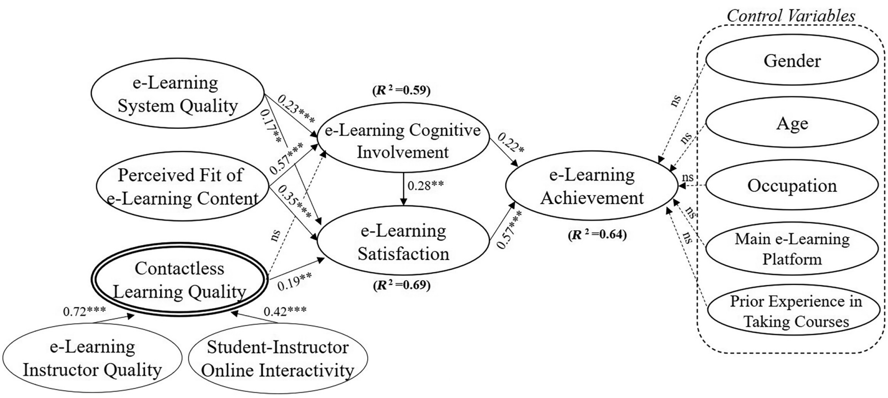
Hypothesis testing and results

We used SmartPLS 3.0 to examine structural models for hypothesis testing. We selected the partial least square (PLS) method to analyze multiphase models and the formative second-order construct (Gefen *et al.*, 2000). We tested our structural model by applying a bootstrapping resampling technique with 201 cases; 5,000 bootstrap samples; and no significant change option (Figure 4).

Each e-Learning system quality (H1a) and perceived fit of e-Learning content (H2a) positively affect e-Learning cognitive involvement. e-Learning system quality (H1b), perceived fit of e-Learning content (H2b) and contactless learning quality (H3b) all positively affect e-Learning satisfaction. e-Learning cognitive involvement positively affects e-Learning satisfaction (H4) and e-Learning achievement (H5). e-Learning satisfaction (H6) also has a positive effect on e-Learning achievement. However, contactless learning quality has no direct impact on e-Learning cognitive involvement (H3a). Thus, Hypotheses H1a, H1b, H2a, H2b, H3b, H4, H5 and H6 are supported. No significant effect of any control variable (i.e. gender, age, occupation, main e-Learning platform and prior experience taking a course) on e-Learning achievement was found.

To further explore the mediation effect of e-Learning achievement, we conducted a mediation test like that of Zhao *et al.* (2010). We adopted the PROCESS macro (Hayes, 2012) with a 95% confidence interval and 5000 bootstraps resample that used bias-corrected bootstrapping in SPSS, Version 24. The test results showed significant indirect effects of e-Learning system quality, perceived fit of e-Learning content and contactless learning quality on e-Learning achievement through e-Learning cognitive involvement and e-Learning satisfaction.

Additionally, we conducted an ANOVA analysis on the differences between different respondent groups attributable to control variables. As a result, we found a significant difference in e-Learning achievement on the main e-Learning platform ($p < 0.001$). As shown



Note(s): *: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$, ns: non-significant at the 0.05 level

Figure 4. Structural model testing results

in Table 6, when the respondent's main e-Learning platform is a university, e-Learning achievement is lower than with other platforms. A possible reason is that some university classes are mandatory regardless of students' motivations, so in this case, e-Learning achievement may be lowered. As for the other control variables, no groups registered significant differences in e-Learning achievement.

Stage 3: complementary study

Research methods

A complementary study offers complementary inferences and a richer understanding of the phenomenon through a holistic approach. Srivastava and Chandra (2018) also contended that using a qualitative method provides a complementary perspective on phenomena in a mixed-methods procedure. To do so, we conducted in-depth interviews as a complementary study. In recruiting interviewees, the snowball sampling technique was used as a nonprobability sampling approach (Biernacki and Waldorf, 1981). The interviewer first hired four interviewees and then referred them to other potential subjects. The sample size was 34. The male-to-female interviewee ratio was 52.9% to 47.1%, and most of the interviewees were in their 20s (44.1%) and 30s (41.2%). Details of participants' backgrounds are shown in Table 7.

Interviews used a semi-structured format with open-ended questions. Each of the 34 one-on-one interviews was 20–40 min in length to obtain detailed responses. We asked each participant two questions: (1) Is there a difference in the e-Learning experience before and after the COVID-19 pandemic? (2) If so, how has your e-Learning experience changed? Based on the responses to the questions, we used both open and axial coding for the interview transcripts, according to established guidelines (Corbin and Strauss, 2008). Three researchers performed the coding; to avoid potential bias, one of the coders was not involved in the data collection. In addition, each coder performed a line-by-line examination of the interview transcripts during open coding to identify changed post-pandemic experiential factors.

Thirty-two participants said their e-Learning experience changed after the pandemic. We collected 40 instances, with similar instances grouped for each research model factor. The interrater agreement scores averaged 0.86. Interrater disagreements were reconciled through discussion with a separate coder uninvolved in data collection.

Table 6.
ANOVA analysis results with the main e-Learning platform

Main e-Learning platform	Mean	SD	*F*	*p-value*
University	4.17	1.24	18.08	0.00
Private Institute	5.24	1.14		
MOOCs and others	5.13	1.52		

Table 7.
Participants' backgrounds in the complementary study

Demographic variable		Frequency	Percentage
Gender	Male	18	52.9%
	Female	16	47.1%
Age (years) (mean = 32.1, S.D. = 5.9)	20–29	15	44.1%
	30–39	14	41.2%
	Older than 40	5	14.7%
Occupation	Graduate students	12	35.3%
	Office Workers	20	58.8%
	Others	2	5.9%

Results

Table 8 presents experiential factors, sample responses and frequency by course category. First, most participants said (21 instances, 52.5%) their e-Learning experiences related to *contactless learning quality* have changed since the coronavirus pandemic. Specifically, the number of responses related to student–instructor online interactivity was the highest (17 instances, 42.5%). Interviewees said e-Learning has become common, and competition in the online education market has intensified since the coronavirus pandemic. As a result, online specialized education courses differentiated from offline classes are increasing. Moreover, they answered that online interaction between students and instructors was significantly improved because instructors' online teaching quality was better than before the pandemic.

Second, *e-Learning system quality* is the e-Learning experience factor that has changed since the pandemic, according to the second-largest number of responses (11 instances, 27.5%). According to the interviewees' responses, considerable investment has gone into the online education platform to improve system quality such as video quality and functions significantly. However, as the number of students increased, some responded that network quality was worse than before the COVID-19 outbreak.

Third, a few participants answered (6 instances, 15.0%) that their e-Learning experiences related to the *perceived fit of e-Learning content* have changed since the pandemic. Responses indicated that self-development opportunities have increased because the number of e-Learning courses and programs has increased significantly since the outbreak of COVID-19. According to the complementary study results, this study illustrated that the e-Learning experience has changed since the pandemic.

Additionally, we asked participants whether the e-Learning experience varied depending on the course. Based on the results of 34 interviews, we collected 41 instances with similar instances being grouped for each course category and classified as research model factors. The interrater agreement scores averaged 0.92. As a result, we identified that the main experiential factors differ, depending on the e-Learning course category (Appendix 2).

Discussion and implications

Discussion of findings

This study made several significant findings. Our results are summarized in Appendix 3. During the exploratory study with text mining, five experiential e-Learning factors were extracted based on the students' experiences. Based on the IS success model, two factors were added to e-Learning success factors: *e-Learning cognitive involvement* and *e-Learning satisfaction*. Learning involvement and satisfaction have been considered as significant factors in educational research (Huang and Chang, 2004).

First, a notable result of this study is the emergence of the significant relationships between e-Learning success factors. *e-Learning system quality* (H1a, H1b), *perceived fit of e-Learning content* (H2a, H2b) and *contactless learning quality* (H3b) function as major experiential factors in inspiring high satisfaction among students. *e-Learning cognitive involvement* (H4) generates strengthened e-Learning satisfaction. *e-Learning cognitive involvement* and *e-Learning satisfaction* positively and significantly impact *e-Learning achievement* (H5, H6). Therefore, when a student of e-Learning is more involved and satisfied, it leads to achieving students' educational goals, and e-Learning success will be higher (Seta *et al.*, 2018). In addition, through ANOVA analysis, we identified a significant difference in e-Learning achievement by the main e-Learning platform.

Second, *contactless learning quality* has no direct impact on *e-Learning cognitive involvement* (H3a). This lack of impact could be related to e-Learning context-specific issues. Therefore, we have selected the variable corresponding to *Use* in the IS success model

Table 8.
Result of the complementary study

Experience factor		Frequency of participants (instances, %)	Sample response (User-ID)
e-Learning system quality		9 (11 instances, 27.5%)	After the corona pandemic, the online education platform has made a lot of investment, and the *video quality and sound quality* have significantly improved (M2) As real-time online education increases, more students take classes simultaneously, causing problems such as *network buffering and connection instability* (F15) After the COVID-19 outbreak, *user convenience features* such as sound quality, playback speed, and lecture recommendation by learning level have been greatly improved on the university's online education service (M27)
Perceived Fit of e-learning content		4 (6 instances, 15.0%)	I feel that the opportunities for *self-development* have expanded as lectures that were difficult to find before the coronavirus have been created in various ways after the coronavirus (M6) Because the *certification-related* lectures that were previously opened offline were conducted through e-Learning, I can take the classes I want (F34)
Contactless Learning Quality	e-Learning instructor quality	2 (4 instances, 10.0%)	In the past, e-Learning was watching videos, but after the corona pandemic, e-Learning services provided *various additional materials* such as projects, quizzes, and assignments. These are very useful and helpful (M18) In the early corona pandemic, e-Learning instructors taught in the same way they did offline. Still, recently, instructors have *specialized in online teaching to* utilize examples, pop-up quizzes, and online materials to differentiate their classes (F26)
	Student-Instructor online interactivity	17 (17 instances, 42.5%)	As the e-Learning service has changed significantly compared to the past, it is possible to communicate with the instructor in *real-time and receive feedback quickly* (F14) While adapting to e-Learning after the corona pandemic, sending *direct messages or chatting with instructors* has become commonplace (M16) As e-Learning becomes more common, I felt that instructors have an *active online interaction* with students. My satisfaction with online education has increased because I can ask questions anytime (M23)
	Subtotal	19 (21 instances, 52.5%)	
No change		2 (2 instances, 5.0%)	
Total		34 (40 instances)	

as e-Learning cognitive involvement in the e-Learning context. H3a was not supported despite the importance of contactless learning quality because e-Learning does not play a sufficient role in *Use*. In other words, this result suggests the possibility of other appropriate variables (e.g. participation, attendance) corresponding to *Use* in applying the IS success model to the e-Learning context.

Third, the results of the complementary study described how the e-Learning experience has changed because of the COVID-19 pandemic. Students' e-Learning experiences related to *contactless learning quality, e-Learning system quality and perceived fit of e-Learning content* have changed since the pandemic. These results gave us the idea that we achieved better e-Learning success in the new normal. In the implications section, we present the details of this idea derived from the complementary study. Therefore, the complementary study identified the complementary inferences applicable to our theoretical research model in the second-stage confirmatory study. This result was achieved by following the guidelines of the mixed-methods approach (Srivastava and Chandra, 2018).

Implications for research

This study has several implications for research. First is the proposal of an e-Learning success model based on student experiences and the IS success model (DeLone and McLean, 2003). This is important because it is a step toward a comprehensive framework to achieve e-Learning success in the new normal (Belleflamme and Jacqmin, 2016). At the beginning of this study, e-Learning experiential factors were extracted from an exploratory study to understand e-Learning better. This exploration considered the previous e-Learning literature and students' experiential factors derived from online reviews. In other words, this study has been hardened to reflect reality and can apply the proposed e-Learning success model to education in the new normal era. Specifically, as early research of e-Learning in the new normal, this study fills the gaps in the existing studies by proposing a holistic e-Learning success model that overcomes the limitations of recent post-pandemic papers whose authors focused only on the technological aspects of e-Learning. It also validated the e-Learning success model and revealed the importance of the instructor–student online interactivity constructs in the new normal era.

Second, our study validated the e-Learning success model from a mixed-methods approach. This approach and meta-inferences from exploratory, confirmatory and complementary analyses explained the e-Learning success model. By combining various methodologies (i.e. text mining, a survey and in-depth interviews) with a theoretical background (Lee *et al.*, 2020; Venkatesh *et al.*, 2013, 2016), we created a robust model and conducted discussions based on the study's findings. Moreover, the third-stage study presented complementary insights that the e-Learning experience has changed because of the COVID-19 pandemic. Thus, our study is an example of the capabilities of the mixed-methods approach in helping to obtain complementary inferences and in furthering a richer understanding of the phenomena of interest.

Third, our work extended the IS success model into the e-Learning context. A previous study sought to identify the key success factors in e-Learning without considering lectures (Wang *et al.*, 2007). Because of the lack of research considering all components of e-Learning (i.e. students, teachers and systems) together, this study applied the IS success model in the e-Learning context to create a holistic e-Learning model. We further conducted *post-hoc* analyses to determine if e-Learning cognitive involvement and e-Learning satisfaction mediate the effects on *e-Learning achievement.* Most e-Learning studies were conducted by limiting "service" to those services provided by the system. However, e-Learning is a type of educational service. This service is more related to lectures and instructors than the e-Learning system itself. Thus, from a student's point of view, this study considered the system and its lecturers and instructors in creating an e-Learning success model.

Implications for practice

This study offers several practical implications for e-Learning service providers, instructors and students in the new normal. First, e-Learning service providers should be aware of the criticality of system quality. In line with system quality affecting the *Use* of IS (DeLone and McLean, 2003), e-Learning is a type of information system that should guarantee its quality. For example, a high-quality website, user interface and video are indispensable. Since a low-quality system reduces satisfaction and involvement, they must be managed.

Second, this study discovered the major experiential factors that influence students. It can help students to be involved in an e-Learning course and improve their knowledge acquisition and skills through e-Learning. Because this study suggests seven experiential factors necessary, from a student's perspective, to create successful e-Learning systems, students can figure out how to improve themselves through them. For example, to achieve a successful e-Learning system, operators of e-Learning systems need to enhance the perceived relevance of a course (e-Learning cognitive involvement), the favorability of a course (e-Learning satisfaction) and students' perceived attainment (e-Learning achievement). This study provides a direction for students to manage the seven student experiential factors and their relationships.

Third, this study suggests guidance for instructors to achieve e-Learning success. From an instructor's perspective, our results are useful for practical application. For example, e-Learning systems need to match teaching materials with students' learning goals and align lectures with the proper teaching methods (Gu and Wang, 2015). In addition, they operate with an awareness of the key role of instructors and their online relationships with the students. To overcome the limits of one-way communication in e-Learning, providers must promote better presentation skills in lectures, improve lecture materials and encourage more interaction with students to succeed in the new normal. According to the results of our interviews, instructor–student online interactivity is essential in this new era. Achieving this interaction and interactivity requires researching, embracing and investing in the new tools and technological enhancements that increase the possibility of replicating the sense of face-to-face communication. For example, to increase e-Learning cognitive involvement, new technologies such as metaverse, virtual reality (VR) and augmented reality (*AR*) could be applied to e-Learning in the new normal.

Limitations and future research directions

Despite the significant findings of this study, there are some limitations. First, each data collection involved different subjects. For example, we recruited university students who enrolled in online courses in South Korea in the second stage. The Korean educational system may have influenced the results. Korean students have more compulsory courses than electives.

For this reason, our research may not have revealed the influence of contactless learning quality on e-Learning cognitive involvement. Because the importance of instructors' teaching abilities and instructor–student interactivity has been confirmed in both the previous studies and in the first and third stages of this study, it is necessary to reanalyze our data with a generalizable subject.

Second, a longitudinal study design might better understand the dynamic changes that occur during a student's entire e-Learning journey. For example, a future study should collect objective data (e.g. the participation rate of e-Learning, grades) at the end of an e-Learning course to measure students' actual achievement and identify any causal relationships between e-Learning success factors.

Third, a study should consider the types of subjects in future research. This study proposed and validated a comprehensive e-Learning success model. Each e-Learning success factor and their relationship should be changed in different subjects because subject-specific factors can exist. So, future research should consider the influence of subject-specific factors on the e-Learning success model.

Lastly, this study considered only one dimension of involvement. When university students enroll in compulsory courses, pure interest or fun may not have much effect in general. e-Learning involvement can be regarded as affective involvement when analyzing other datasets from different research contexts.

Notes

1. An instructor's teaching is *learning* from a student's perspective. This study is based on a student's perspective of the learning experience, so the variable was named "contactless learning quality" as measured by students.
2. According to Jiang *et al.* (2010), involvement consists of two dimensions: affective and cognitive involvement. However, in the e-Learning context, most university students choose an e-Learning course based on practical needs rather than on pure interest and for fun (e.g. compulsory courses). This study adopted cognitive involvement only to get a better understanding of the experiences of students who have a strong practical motivation to learn.

References

Adedoyin, O.B. and Soykan, E. (2020), "Covid-19 pandemic and online learning: the challenges and opportunities", *Interactive Learning Environments*, pp. 1-13, doi: 10.1080/10494820.2020.1813180 (In press).

Aggelidis, V.P. and Chatzoglou, P.D. (2012), "Hospital information systems: measuring end user computing satisfaction (EUCS)", *Journal of Biomedical Informatics*, Vol. 45 No. 3, pp. 566-579.

Ajzen, I. and Fishbein, M. (1977), "Attitude-behavior relations: a theoretical analysis and review of empirical research", *Psychological Bulletin*, Vol. 84 No. 5, pp. 888-918.

Al-Fraihat, D., Joy, M. and Sinclair, J. (2020), "Evaluating e-learning systems success: an empirical study", *Computers in Human Behavior*, Vol. 102, pp. 67-86.

Al-Samarraie, H., Teng, B.K., Alzahrani, A.I. and Alalwan, N. (2018), "e-Learning continuance satisfaction in higher education: a unified perspective from instructors and students", *Studies in Higher Education*, Vol. 43 No. 11, pp. 2003-2019.

Alhumaid, K., Ali, S., Waheed, A., Zahid, E. and Habes, M. (2020), "COVID-19 & e-Learning: perceptions & attitudes of teachers towards e-Learning acceptance in the developing countries", *Multicultural Education*, Vol. 6 No. 2, pp. 100-115.

Alin, A. (2010), "Multicollinearity", *Wiley Interdisciplinary Reviews: Computational Statistics*, Vol. 2 No. 3, pp. 370-374.

Allen, I.E. and Seaman, J. (2008), *Staying the Course: Online Education in the United States, 2008*, Sloan Consortium, Newburyport, MA.

Almaiah, M.A., Al-Khasawneh, A. and Althunibat, A. (2020), "Exploring the critical challenges and factors influencing the e-Learning system usage during COVID-19 pandemic", *Education and Information Technologies*, Vol. 25, pp. 5261-5280.

Anderson, T. (2008), *The Theory and Practice of Online Learning*, Athabasca University Press, Athabasca.

Aparicio, M., Bacao, F. and Oliveira, T. (2016), "An e-Learning theoretical framework", *An E-Learning Theoretical Framework*, Vol. 19 No. 1, pp. 292-307.

Arbaugh, J.B. and Duray, R. (2002), "Technological and structural characteristics, student learning and satisfaction with web-based courses: an exploratory study of two on-line MBA programs", *Management Learning*, Vol. 33 No. 3, pp. 331-347.

Ayu, M. (2020), "Online learning: leading e-learning at higher education", *The Journal of English Literacy Education: The Teaching and Learning of English As a Foreign Language*, Vol. 7 No. 1, pp. 47-54.

Bacca, J., Baldiris, S., Fabregat, R., Graf, S. and Kinshuk (2014), "Augmented reality trends in education: a systematic review of research and applications", *Journal of Educational Technology and Society*, Vol. 17 No. 4, pp. 133-149.

Bates, A.W. and Bates, T. (2005), *Technology, E-Learning and Distance Education*, Psychology Press, London.

Beldona, S., Morrison, A.M. and O'Leary, J. (2005), "Online shopping motivations and pleasure travel products: a correspondence analysis", *Tourism Management*, Vol. 26 No. 4, pp. 561-570.

Belleflamme, P. and Jacqmin, J. (2016), "An economic appraisal of MOOC platforms: business models and impacts on higher education", *CESifo Economic Studies*, Vol. 62 No. 1, pp. 148-169.

Bhattacherjee, A. (2001), "Understanding information systems continuance: an expectation-confirmation model", *MIS Quarterly*, Vol. 25 No. 3, pp. 351-370.

Biernacki, P. and Waldorf, D. (1981), "Snowball sampling: problems and techniques of chain referral sampling", *Sociological Methods and Research*, Vol. 10 No. 2, pp. 141-163.

Biggs, J.B. (2011), *Teaching for Quality Learning at University: what the Student Does*, McGraw Hill Education, Buckingham.

Blei, D.M. (2012), "Probabilistic topic models", *Communications of the ACM*, Vol. 55 No. 4, pp. 77-84.

Bozkurt, A. and Sharma, R.C. (2020), "Education in normal, new normal, and next normal: observations from the past, insights from the present and projections for the future", *Asian Journal of Distance Education*, Vol. 15 No. 2, pp. i-x.

Brox, C., Painho, M., Bação, F. and Kuhn, W. (2004), "International exchange of e-Learning courses", *Proceedings of EUGISES*, Austria, 2-5 September, Villach, pp. 1-7.

Bruhn, M., Georgi, D. and Hadwich, K. (2008), "Customer equity management as formative second-order construct", *Journal of Business Research*, Vol. 61 No. 12, pp. 1292-1301.

Byrne, M. and Flood, B. (2003), "Assessing the teaching quality of accounting programmes: an evaluation of the course experience questionnaire", *Assessment and Evaluation in Higher Education*, Vol. 28 No. 2, pp. 135-145.

Chae, Y.M., Lee, J.H., Ho, S.H., Kim, H.J., Jun, K.H. and Won, J.U. (2001), "Patient satisfaction with telemedicine in home health services for the elderly", *International Journal of Medical Informatics*, Vol. 61 Nos 2-3, pp. 167-173.

Chen, R.-S. and Liu, I.-F. (2013), "Research on the effectiveness of information technology in reducing the rural–urban knowledge divide", *Computers and Education*, Vol. 63, pp. 437-445.

Cheng, Y.-M. (2012), "Effects of quality antecedents on e-Learning acceptance", *Internet Research*, Vol. 22 No. 3, pp. 361-390.

Chiu, S.-F. and Chen, H.-L. (2005), "Relationship between job characteristics and organizational citizenship behavior: the mediational role of job satisfaction", *Social Behavior and Personality: An International Journal*, Vol. 33 No. 6, pp. 523-540.

Cidral, W.A., Oliveira, T., Di Felice, M. and Aparicio, M. (2018), "E-learning success determinants: brazilian empirical study", *Computers and Education*, Vol. 122, pp. 273-290.

Contini, D., Cugnata, F. and Scagni, A. (2018), "Social selection in higher education. Enrolment, dropout and timely degree attainment in Italy", *Higher Education*, Vol. 75 No. 5, pp. 785-808.

Corbin, J. and Strauss, A. (2008), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, Sage Publications, Newbury Park.

Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319-340.

DeLone, W.H. and McLean, E.R. (2003), "The DeLone and McLean model of information systems success: a ten-year update", *Journal of Management Information Systems*, Vol. 19 No. 4, pp. 9-30.

Dwyer, K.K., Bingham, S.G., Carlson, R.E., Prisbell, M., Cruz, A.M. and Fus, D.A. (2004), "Communication and connectedness in the classroom: development of the connected classroom climate inventory", *Communication Research Reports*, Vol. 21 No. 3, pp. 264-272.

Eickhoff, M. and Wieneke, R. (2018), “Understanding topic models in context: a mixed-methods approach to the meaningful analysis of large document collections”, *Proceedings of the 51st Hawaii International Conference on System Sciences*, Hawaii, 3-6 January, pp. 903-912.

Elhaty, I.A., Elhadary, T., Elgamil, R. and Kilic, H. (2020), “Teaching university practical courses online during COVID-19 crisis: a challenge for eLearning”, *Journal of Critical Reviews*, Vol. 7 No. 8, pp. 1-10.

Elnaj, S. (2021), “Council post: the ‘new normal’ and the future of technology after the covid-19 pandemic”, available at: https://www.forbes.com/sites/forbestechcouncil/2021/01/25/the-new-normal-and-the-future-of-technology-after-the-covid-19-pandemic/ (accessed 5 January 2022).

Ettinger, A., Holton, V. and Blass, E. (2006), “E-learner experiences: what is the future for e-Learning?”, *Industrial and Commercial Training*, Vol. 38 No. 4, pp. 208-212.

Farhan, W., Razmak, J., Demers, S. and Laflamme, S. (2019), “e-Learning systems versus instructional communication tools: developing and testing a new e-Learning user interface from the perspectives of teachers and students”, *Technology in Society*, Vol. 59, pp. 1-12.

Fauth, B., Decristan, J., Rieser, S., Klieme, E. and Büttner, G. (2014), “Student ratings of teaching quality in primary school: dimensions and prediction of student outcomes”, *Learning and Instruction*, Vol. 29, pp. 1-9.

Fornell, C. and Larcker, D.F. (1981), *Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics*, SAGE Publications Sage, Los Angeles, CA.

Freeze, R.D., Alshare, K.A., Lane, P.L. and Wen, H.J. (2019), “IS success model in e-Learning context based on students’ perceptions”, *Journal of Information Systems Education*, Vol. 21 No. 2, pp. 173-184.

Gefen, D., Straub, D. and Boudreau, M.-C. (2000), “Structural equation modeling and regression: guidelines for research practice”, *Communications of the Association for Information Systems*, Vol. 4 No. 1, pp. 1-70.

Ghosh, D. and Guha, R. (2013), “What are we ‘tweeting’ about obesity? Mapping tweets with topic modeling and Geographic Information System”, *Cartography and Geographic Information Science*, Vol. 40 No. 2, pp. 90-102.

Goodhue, D.L. and Thompson, R.L. (1995), “Task-technology fit and individual performance”, *MIS Quarterly*, Vol. 19 No. 2, pp. 213-236.

Gorla, N., Somers, T.M. and Wong, B. (2010), “Organizational impact of system quality, information quality, and service quality”, *The Journal of Strategic Information Systems*, Vol. 19 No. 3, pp. 207-228.

Gu, L. and Wang, J. (2015), “A task technology fit model on e-Learning”, *Issues in Information Systems*, Vol. 16 No. 1, pp. 163-169.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. and Tatham, R.L. (2006), *Multivariate Data Analysis*, Pearson, London.

Hayes, A.F. (2012), “PROCESS: a versatile computational tool for observed variable mediation, moderation, and conditional process modeling”, available at: http://www.afhayes.com/public/process2012.pdf (accessed 5 January 2022).

Hero, L.-M. and Lindfors, E. (2019), “Students’ learning experience in a multidisciplinary innovation project”, *Education + Training*, Vol. 61 No. 4, pp. 500-522.

Hill, F.M. (1995), “Managing service quality in higher education: the role of the student as primary consumer”, *Quality Assurance in Education*, Vol. 3 No. 3, pp. 10-21.

Ho, L.-A., Kuo, T.-H. and Lin, B. (2010), “Influence of online learning skills in cyberspace”, *Internet Research*, Vol. 20 No. 1, pp. 55-71.

Horton, W.K. (2001), *Leading E-Learning*, American Society for Training and Development, Alexandria, VA.

Huang, Y.-R. and Chang, S.-M. (2004), “Academic and cocurricular involvement: their relationship and the best combinations for student growth”, *Journal of College Student Development*, Vol. 45 No. 4, pp. 391-406.

Islam, A.N. (2016), “e-Learning system use and its outcomes: moderating role of perceived compatibility”, *Telematics and Informatics*, Vol. 33 No. 1, pp. 48-55.

Jiang, Z., Chan, J., Tan, B.C. and Chua, W.S. (2010), "Effects of interactivity on website involvement and purchase intention", *Journal of the Association for Information Systems*, Vol. 11 No. 1, pp. 34-59.

Jin, S.H. (2005), "Analyzing student-student and student-instructor interaction through multiple communication tools in web-based learning", *International Journal of Instructional Media*, Vol. 32 No. 1, pp. 59-68.

Khalifa, O., Corne, D.W., Chantler, M. and Halley, F. (2013), "Multi-objective topic modeling", *International Conference on Evolutionary Multi-Criterion Optimization*, Sheffield, UK, 19-22 March, Vol. 7811, pp. 51-65.

Kim, H.-W. and Gupta, S. (2014), "A user empowerment approach to information systems infusion", *IEEE Transactions on Engineering Management*, Vol. 61 No. 4, pp. 656-668.

Kim, Y.J., Garrity, E.J. and Sanders, G.L. (2003), "Success measures of information systems", *Encyclopedia of Information Systems*, Vol. 4, pp. 299-313.

Laurillard, D. (2004), "e-Learning in higher education. Changing higher education", *The Journal of Interactive Online Learning*, Vol. 2 No. 3, pp. 71-84.

Lederman, D. (2019), "Why MOOCs didn't work, in 3 data points", available at: https://www.insidehighered.com/digital-learning/article/2019/01/16/study-offers-data-show-moocs-didnt-achieve-their-goals (accessed 5 January 2022).

Lee, H.C. (2001), *Virtual University? Educational Environments of the Future*, Portland Press, London.

Lee, J.-K. and Lee, W.-K. (2008), "The relationship of e-Learner's self-regulatory efficacy and perception of e-Learning environmental quality", *Computers in Human Behavior*, Vol. 24 No. 1, pp. 32-47.

Lee, M.K., Cheung, C.M. and Chen, Z. (2005), "Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation", *Information & Management*, Vol. 42 No. 8, pp. 1095-1104.

Lee, S.-H., Choi, S. and Kim, H.-W. (2020), "Unveiling the success factors of BTS: a mixed-methods approach", *Internet Research*, Vol. 31 No. 5, pp. 1518-1540.

Lemon, K.N. and Verhoef, P.C. (2016), "Understanding customer experience throughout the customer journey", *Journal of Marketing*, Vol. 80 No. 6, pp. 69-96.

Li, C. and Lalani, F. (2020), "The COVID-19 pandemic has changed education forever. This is how", available at: https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/ (accessed 5 January 2022).

Li, L., Ren, G., Hong, T. and Yang, S.-B. (2019), "Exploring simultaneous presentation in online restaurant reviews: an analysis of textual and visual content", *Asia Pacific Journal of Information Systems*, Vol. 29 No. 2, pp. 181-202.

Ludvigsen, S. and Mørch, A. (2010), "Computer-supported collaborative learning: basic concepts, multiple perspectives, and emerging trends", *The International Encyclopedia of Education*, Vol. 5, pp. 290-296.

Martínez-Torres, M.R., Toral Marín, S.L., Garcia, F.B., Vazquez, S.G., Oliva, M.A. and Torres, T. (2008), "A technological acceptance of e-Learning tools used in practical and laboratory teaching, according to the european higher education area", *Behaviour and Information Technology*, Vol. 27 No. 6, pp. 495-505.

Mohammadi, H. (2015), "Investigating users' perspectives on e-Learning: an integration of TAM and IS success model", *Computers in Human Behavior*, Vol. 45, pp. 359-374.

Mohammadyari, S. and Singh, H. (2015), "Understanding the effect of e-Learning on individual performance: the role of digital literacy", *Computers and Education*, Vol. 82, pp. 11-25.

Müller, A.M., Goh, C., Lim, L.Z. and Gao, X. (2021), "COVID-19 emergency e-Learning and beyond: experiences and perspectives of university educators", *Education Sciences*, Vol. 11 No. 1, pp. 1-15.

Naddeo, A., Califano, R. and Fiorillo, I. (2021), "Identifying factors that influenced wellbeing and learning effectiveness during the sudden transition into eLearning due to the COVID-19 lockdown", *Work*, Vol. 68 No. 1, pp. 45-67.

Novak, T.P. and Hoffman, D.L. (1997), "New metrics for new media: toward the development of web measurement standards", *World Wide Web Journal*, Vol. 2 No. 1, pp. 213-246.

Nunnally, J.C. (1978), *Psychometric Theory*, 2d ed., McGraw-Hill, NY.

Oliver, R. and Herrington, J. (2003), "Exploring technology-mediated learning from a pedagogical perspective", *Interactive Learning Environments*, Vol. 11 No. 2, pp. 111-126.

Owlia, M.S. and Aspinwall, E.M. (1996), "A framework for the dimensions of quality in higher education", *Quality Assurance in Education*, Vol. 4 No. 2, pp. 12-20.

O'Hara, M.T., Watson, R.T. and Kavan, C.B. (1999), "Managing the three levels of change", *Information Systems Management*, Vol. 16, pp. 63-70.

Packham, G., Jones, P., Miller, C. and Thomas, B. (2004), "e-Learning and retention: key factors influencing student withdrawal", *Education + Training*, Vol. 46 Nos 6-7, pp. 335-342.

Petter, S., Straub, D. and Rai, A. (2007), "Specifying formative constructs in information systems research", *MIS Quarterly*, Vol. 31 No. 4, pp. 623-656.

Pham, H.-H. and Ho, T.-T.-H. (2020), "Toward a 'new normal' with e-Learning in Vietnamese higher education during the post COVID-19 pandemic", *Higher Education Research and Development*, Vol. 39 No. 7, pp. 1327-1331.

Phuthong, T. (2021), "Antecedents influencing the adoption of collaborative learning social-media platforms among Thai university students during the covid-19 'new normal' era", *International Journal of Emerging Technologies in Learning*, Vol. 16 No. 13, pp. 108-127.

Picciano, A.G. (2002), "Beyond student perceptions: issues of interaction, presence, and performance in an online course", *Journal of Asynchronous Learning Networks*, Vol. 6 No. 1, pp. 21-40.

Piccoli, G., Ahmad, R. and Ives, B. (2001), "Web-based virtual learning environments: a research framework and a preliminary assessment of effectiveness in basic IT skills training", *MIS Quarterly*, Vol. 25 No. 4, pp. 401-426.

Praetorius, A.-K., Klieme, E., Herbert, B. and Pinger, P. (2018), "Generic dimensions of teaching quality: the German framework of three basic dimensions", *ZDM*, Vol. 50 No. 3, pp. 407-426.

Prasetyo, Y.T., Tanto, H., Mariyanto, M., Hanjaya, C., Young, M.N., Persada, S.F., Miraja, B.A. and Redi, A.A.N.P. (2021), "Factors affecting customer satisfaction and loyalty in online food delivery service during the covid-19 pandemic: its relation with open innovation", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 7 No. 1, pp. 1-16.

Priatna, T., Maylawati, D., Sugilar, H. and Ramdhani, M. (2020), "Key success factors of e-learning implementation in higher education", *International Journal of Emerging Technologies in Learning*, Vol. 15 No. 17, pp. 101-114.

Rai, A., Lang, S.S. and Welker, R.B. (2002), "Assessing the validity of IS success models: an empirical test and theoretical analysis", *Information Systems Research*, Vol. 13 No. 1, pp. 50-69.

Rashid, S. and Yadav, S.S. (2020), "Impact of Covid-19 pandemic on higher education and research", *Indian Journal of Human Development*, Vol. 14 No. 2, pp. 340-343.

Schmitt, B., Brakus, J.J. and Zarantonello, L. (2015), "From experiential psychology to consumer experience", *Journal of Consumer Psychology*, Vol. 25 No. 1, pp. 166-171.

Seok, S. (2008), "Teaching aspects of e-Learning", *International Journal on E-Learning*, Vol. 7 No. 4, pp. 725-741.

Seta, H.B., Wati, T., Muliawati, A. and Hidayanto, A.N. (2018), "e-Learning success model: an extension of DeLone & McLean IS' success model", *Indonesian Journal of Electrical Engineering and Informatics*, Vol. 6 No. 3, pp. 281-291.

Shahzad, A., Hassan, R., Aremu, A.Y., Hussain, A. and Lodhi, R.N. (2021), "Effects of COVID-19 in e-Learning on higher education institution students: the group comparison between male and female", *Quality and Quantity*, Vol. 55 No. 3, pp. 805-826.

Sher, A. (2009), "Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in web-based online learning environment", *Journal of Interactive Online Learning*, Vol. 8 No. 2, pp. 102-120.

Srivastava, S.C. and Chandra, S. (2018), "Social presence in virtual world collaboration: an uncertainty reduction perspective using a mixed methods approach", *MIS Quarterly*, Vol. 42 No. 3, pp. 779-804.

Subaeki, B., Manaf, K., Pitoyo, D., Setiawan, H., Sugiri, T. and Effendi, A. (2020), "New normal concept in e-Learning context: an application of the DeLone and McLean information system model", *2020 14th International Conference on Telecommunication Systems, Services, and Applications*, Indonesia, 18-19 November, Bandung, pp. 1-6.

Sun, P.-C., Tsai, R.J., Finger, G., Chen, Y.-Y. and Yeh, D. (2008), "What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction", *Computers and Education*, Vol. 50 No. 4, pp. 1183-1202.

Tashakkori, A. and Teddlie, C. (2008), "Quality of inferences in mixed methods research: calling for an integrative framework", *Advances in Mixed Methods Research*, Vol. 53 No. 7, pp. 101-119.

Thompson, E. and Kolsky, E. (2004), "How to approach customer experience management", available at: https://www.gartner.com/en/documents/466017/how-to-approach-customer-experience-management/ (accessed 5 January 2022).

Tinto, V. (1987), *Leaving College: Rethinking the Causes and Cures of Student Attrition*, University of Chicago Press, Chicago, IL.

Tria, J.Z. (2020), "The COVID-19 pandemic through the lens of education in the Philippines: the new normal", *International Journal of Pedagogical Development and Lifelong Learning*, Vol. 1 No. 1, pp. 2-4.

Venkatesh, V., Brown, S.A. and Bala, H. (2013), "Bridging the qualitative-quantitative divide: guidelines for conducting mixed methods research in information systems", *MIS Quarterly*, Vol. 37 No. 1, pp. 21-54.

Venkatesh, V., Brown, S.A. and Sullivan, Y.W. (2016), "Guidelines for conducting mixed-methods research: an extension and illustration", *Journal of the Association for Information Systems*, Vol. 17 No. 7, pp. 435-495.

Wang, Y.-S., Wang, H.-Y. and Shee, D.Y. (2007), "Measuring e-Learning systems success in an organizational context: scale development and validation", *Computers in Human Behavior*, Vol. 23 No. 4, pp. 1792-1808.

Weaver, R., Salamonson, Y., Koch, J. and Jackson, D. (2013), "Nursing on television: student perceptions of television's role in public image, recruitment and education", *Journal of Advanced Nursing*, Vol. 69 No. 12, pp. 2635-2643.

Wixom, B.H. and Todd, P.A. (2005), "A theoretical integration of user satisfaction and technology acceptance", *Information Systems Research*, Vol. 16 No. 1, pp. 85-102.

Wu, J., Tsai, R.J., Chen, C.C. and Wu, Y. (2006), "An integrative model to predict the continuance use of electronic learning systems: hints for teaching", *International Journal on E-Learning*, Vol. 5 No. 2, pp. 287-302.

Yang, J., KinshukYu, H., Chen, S.-J. and Huang, R. (2014), "Strategies for smooth and effective cross-cultural online collaborative learning", *Journal of Educational Technology and Society*, Vol. 17 No. 3, pp. 208-221.

Zhao, X., Lynch, J.G. Jr and Chen, Q. (2010), "Reconsidering Baron and Kenny: myths and truths about mediation analysis", *Journal of Consumer Research*, Vol. 37 No. 2, pp. 197-206.

Zhao, W.X., Jiang, J., Weng, J., He, J., Lim, E.-P., Yan, H. and Li, X. (2011), "Comparing twitter and traditional media using topic models", *European Conference on Information Retrieval*, Dublin, Ireland, 18-21 April, Vol. 6611, pp. 338-349.

Zikmund, W.G., Carr, J.C. and Griffin, M. (2013), *Business Research Methods*, Oxford University Press, Oxford.

Corresponding author
Sang-Hyeak Yoon can be contacted at: yoonsh@koreatech.ac.kr

Appendix 1

Construct	Item	Wording	Reference
e-Learning System Quality (LSQ)	*LSQ1	e-Learning system supports to take the course anytime anywhere	Self-developed
	LSQ2	Audio quality of the e-Learning system is appropriate to support taking the course	
	*LSQ3	e-Learning system is well-organized to find what I need easily	
	LSQ4	Video quality of the e-Learning system is appropriate to support taking the course	
	LSQ5	Overall, the quality of the e-Learning system is excellent	
Perceived Fit of e-Learning Content (PFL)	PFL1	I can learn what I need in the e-Learning course	Kim and Gupta (2014)
	PFL2	The e-Learning course gives me what I want to learn	
	PFL3	Overall, the e-Learning course meets my expectation	
e-Learning Instructor quality (LNQ)	*LNQ1	The instructor of the e-learning course is extremely good at explaining things via the e-learning system	Byrne and Flood (2003)
	LNQ2	The instructor of the e-learning course helps me to understand the difficult contents easily via the e-Learning system	
	LNQ3	The instructor of the e-learning course gives me helpful feedback on how I am going via the e-Learning system	
	LNQ4	The instructor of the e-learning course leads students to the interest in this course via the e-Learning system	
	LNQ5	The instructor of the e-Learning course motivates me to do my best on this course via the e-learning system	
Student-instructor Online Interactivity (SNT)	SNT1	I communicate a lot with the instructor taking the e-Learning course	Sher (2009)
	SNT2	I receive help from the instructor taking the e-Learning course	
	*SNT3	I obtain a variety of information from the instructor taking the e-Learning course	
	SNT4	Overall, I interact a lot with the instructor taking the e-Learning course	
e-Learning Cognitive involvement (LVM)	*LVM1	Taking the course in the e-Learning system is important to me	Jiang *et al.* (2010)
	LVM2	Taking the course in the e-learning system means a lot to me	
	LVM3	Taking the course in the e-Learning system is valuable to me	
	LVM4	Taking the course in the e-Learning system is relevant to my interests	
	*LVM5	Taking the course in the e-Learning system is needed for me	

(*continued*)

Table A1. Measurement items

Construct	Item	Wording	Reference
e-Learning Satisfaction (LSF)	LSF1	I am satisfied with taking the course via the e-Learning system	Chiu and Chen (2005)
	LSF2	I Am pleased with taking the course via the e-Learning system	
	LSF3	I am contented with taking the course via the e-learning system	
	*LSF4	I Am delighted at taking the course via the e-learning system	
e-Learning Achievement (LCM)	LCM1	I Gain knowledge through taking the e-Learning course	Self-developed
	LCM2	I learn a lot through taking the e-learning course	
	LCM3	I gain confidence about what I learned taking the e-learning course	
	*LCM4	Overall, I achieve a lot taking the e-learning course	

Table A1.

Note(s): *Dropped after the exploratory factor analysis

Appendix 2

Course category	Experience factor (instances, %)	Sample response	Number of Respondents (%)
Humanities	e-Learning system Quality (7, 58.3%), contactless learning quality (5, 41.7%)	I often take e-classes in the humanities. It is great to be able to take them online *anytime, anywhere* I took a Greek philosophy online class recently. With online education, the most important thing is that the classes are *organized well* by category. In that sense, the last class I took at MOOC was good I like history classes. History classes are entirely different, *depending on who teaches* them. The last lecturer I had in e-Learning was by the most famous person in Korea	12 (35.3%)
Language learning	Contactless learning Quality (6, 66.7%), e-learning system quality (3, 33.3%)	I recently took an English conversation class. It was beneficial when I recorded English pronunciation and received *feedback* from the instructor When I studied English online recently, I could get a *proper assignment and answers quickly from the instructor* I am an office worker in the trade business. I am too busy to make time for myself, but the online English classes I am taking are excellent because I can study *regardless of the time and place*	7 (20.6%)

Table A2.
Additional results of the complementary study

(*continued*)

Course category	Experience factor (instances, %)	Sample response	Number of Respondents (%)
Certification	Perceived fit of e-learning content (6, 100.0%)	I have taken an e-Learning class to obtain a computer *certificate* to get a job. Looking back on my experience, studying via e-Learning was the most efficient way to get a certificate I got a real estate certificate through e-Learning. I needed a license to work in the real estate business. It was most useful to take classes online to *get a certificate*	6 (17.6%)
Business	e-Learning System quality (5, 62.5%), perceived fit of e-Learning content (3, 37.5%)	I have taken an online MBA course. Since I am an office worker, I took classes whenever I had the time, and it was good to take classes with good quality *whenever and wherever* Since I am a business administration student, I tend to take a small part of my university class online. Online training has the advantage of being able to *find and study what I want* I work in finance. When I am in an online class, it is essential to take a finance class that *fits my level*	5 (14.7%)
Computer Science	e-Learning System Quality (4, 66.7%), Perceived Fit of e-Learning Content (2, 33.3%)	The online engineering courses provide the best experience when implementing *level* learning. I want to learn *what I need* I took a machine learning class online recently. The e-Learning system *supports me appropriately* so that I can follow the code provided by the class I often take Python classes online. I could concentrate on the class because the *e-Learning system UI* is useful	4 (11.8%)
Total	41		34 (100%)

Table A2.

Appendix 3

Table A3. Joint display of research results

Exploratory study Explored factors	Topics	Confirmatory study e-Learning success factors	Quantitative inference	Complementary study Experience factor	Qualitative inference
System Quality	Time management, UI quality, video quality	*e-Learning system quality*	e-Learning system quality has a positive effect on achievement indirectly through both cognitive involvement and satisfaction	*e-Learning System Quality*	The considerable investment has gone into the online education platform to significantly improve system quality such as video quality and functions since the outbreak of the pandemic
Lecture Content	Learning material, certification	*Perceived fit of e-Learning content*	Perceived fit of e-learning content has a positive effect on achievement indirectly through both cognitive involvement and satisfaction	*Perceived Fit of e-Learning Content*	Self-development opportunities have increased because the number of e-Learning courses and programs has increased significantly since the outbreak of COVID-19
Instructor Quality	Lecture quality	*Contactless learning quality*	Contactless learning quality has a positive effect on achievement indirectly through satisfaction	*Contactless Learning Quality*	Online interaction between students and instructors was significantly improved because instructors' online teaching quality was better than before the pandemic
Online Interaction	Interaction within the class, interaction with the lecturer				
–	–	*e-Learning cognitive involvement*	• e-learning cognitive involvement has a positive effect on e-learning satisfaction • e-learning cognitive involvement has a positive effect on e-learning achievement	–	–
–	–	*e-Learning satisfaction*	e-Learning satisfaction has a positive effect on e-learning achievement	–	–
Achievement	Self-development	*e-Learning achievement*	–	–	–