

Factors affecting learners' perception of e-learning during the COVID-19 pandemic

R.H.A.T. Perera and Nalin Abeysekera

*Department of Marketing Management, Open University of Sri Lanka,
Nugegoda, Sri Lanka*

Received 22 October 2021
Revised 9 March 2022
13 April 2022
Accepted 20 April 2022

Abstract

Purpose – The purpose of this paper is to identify the factors affecting learners' perception of e-learning during the Coronavirus-2019 (Covid-19) pandemic. Furthermore, it investigates mechanisms that enhance students' engagement in e-learning, especially under the constraints created by the pandemic.

Design/methodology/approach – Quantitative research approach was used, and data were collected using a structured questionnaire. The sample consisted of 163 undergraduates registered at the Faculty of Management Studies of the Open University of Sri Lanka (OUSL). The structured questionnaire was designed taking into consideration learners attached to different regional centers and study centers of the OUSL.

Findings – As per the findings, performance expectancy, social influence, effort expectancy and service quality are the factors which have significant effects on students' "intention to use" e-learning as a method of pursuing education. Furthermore, it was observed that 65.6% of the students had access to technology through mobile phones, while 53.4% of the students had engaged in e-learning for the first time. This was mainly due to restrictions that were imposed during the Covid-19 pandemic.

Practical implications – The study will help in formulating policies and introducing procedures in relation to online teaching-learning models to be used by both teachers and learners, especially in similar pandemic situations in the future.

Originality/value – This study will assist to determine the effectiveness of the e-learning system used by the OUSL. The findings highlighted the importance of improving information technology (IT) facilities available at all the regional and study centers across Sri Lanka.

Keywords Covid-19, e-learning, Learners' perception, Sri Lanka

Paper type Research paper

1. Introduction

The coronavirus (Covid-19) outbreak has become a major stumbling block to the education system, and technology has now started playing a more vital role in overcoming this obstacle in providing education all over the world. The pandemic has compelled universities and higher educational institutions to rely more on advanced technologies to conduct their respective study programs and create new educational opportunities for everyone. It has led to the opening up of vast opportunities to those involved in the field of education across the globe. Technological advancement is taking place at a rapid pace, and access to digital tools such as mobile phones and the Internet is growing, leading to most institutions canceling physical contact sessions and encouraging the utilization of online resources instead.

This global scenario has created a situation in which learners can use e-learning to learn from home, and more importantly, update their knowledge and skills using various technological



devices such as computers and mobile phones. Learners are provided with enormous flexibility and freedom with regard to most aspects of learning; for example, in terms of

- (1) the place they login from,
- (2) the time they login to their network and
- (3) the content they access (tools, materials, etc.).

Furthermore, learning management systems (LMS) utilize rich multimedia content, and the best online teachers, equipped with the latest updates, could be relied upon in delivery. Also, learning processes in this system can be offline, online or a combination of these (Al-Busaidi, 2013), and students and learners can gain knowledge and disseminate it digitally (Tetteh, 2016). In e-learning, learners have flexibility and convenience in the contexts of time and location, hence online learning can be defined as the distribution of learning materials and methods for learning, teaching or acquiring knowledge anytime, anywhere using information technology (IT) (Turban *et al.*, 2015).

Online learning has broadened its horizons in different perspectives. As per Garrison (2011), the method of online learning not only enables students to study at home, but also helps employees learn and expand their knowledge and skills while at work. Furthermore, with the enhancement of technology, e-learning systems have facilitated learners with a platform where they can avoid face-to-face interaction (Ashrafi *et al.*, 2020). This specifically helps learners who are socially inept or do not have physical access to meet people in person, or to engage and interact physically with others to learn. e-learning is not just about web-based learning. There are multiple facets of e-learning; these include mobile learning with smartphones, tablets and other equipment. The term e-learning also includes a wide range of activities such as computer-based training and instruction, and education delivered online. Therefore, enabling e-learning in educational institutions is considered useful (Samsudeen and Mohamed, 2019; Turban *et al.*, 2015). More importantly, Zalat *et al.* (2021) argued that prior to Covid-19, e-learning was underutilized by developing countries and the current pandemic forced countries across the globe to rely on e-learning for education. In this context, it is worthwhile to discuss how the Open University of Sri Lanka (OUSL) has practiced e-learning in this crisis situation.

The OUSL was established in 1980 as the leading Open and Distance Learning (ODL) establishment in Sri Lanka where students and adults could pursue their education through ODL methodologies. ODL can be considered as an established mechanism for teaching and learning which offers flexible learning and “access to learning opportunities” to anyone, anywhere and at any time (Jayatilleke and Gunawardena, 2016). The OUSL has made a remarkable transition to online education in response to the Covid-19 pandemic. According to Liyanagama *et al.* (2015), the initiation of online learning can be seen in the year 2003/2004 with the Capacity Enhancement (OUSL) unit of the Asian Development Bank supported Distance Education Modernization Project. And also, the OUSL has continuously adopted many strategies to promote online learning (Chathurika and Rajapaksha, 2017). As per Hayashi *et al.* (2020), even though the OUSL had adopted a distance learning method to support the largest number of students through a network of regional and study centers in each district, only 69% of them managed to continue e-learning amidst the Covid situation. Prior to the emergence of the Covid-19 pandemic, the practice of the OUSL had been to conduct separate, parallel study sessions across all centers in Sri Lanka. As a result of the pandemic, the OUSL started conducting lectures centrally, utilizing e-learning and other online conferencing applications.

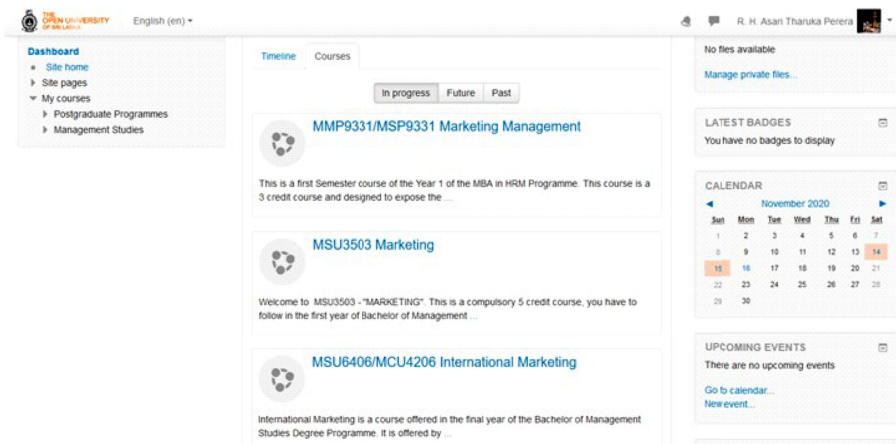
The OUSL has provided an opportunity to obtain hands-on experience of online learning technologies and upgrade skills in digital learning, training and teaching. Whereas most Sri

Lankan universities use Moodle open-source platform as their LMS, the OUSL has used the same as their e-learning system for many years. Furthermore, the university has conducted many awareness programs to promote online learning after the Covid-19 pandemic such as awards for best online submission of assignments, student awareness sessions of online learning and several supplementary resources being made available on YouTube, etc. [Figure 1](#) shows the LMS interface of the OUSL which is currently in use.

As per [Figure 1](#), the features of e-learning include membership, classroom management, announcements, learning resources, Zoom links, learner groups, quizzes, learning records, grades and grade processing systems. Through e-learning, experts get the opportunity to deliver their knowledge and expertise to a vast number of learners, and assess learners' progress, whereas learners get the opportunity to interact with experts and gain knowledge ([Aguti et al., 2015](#)). The OUSL, with 24 study centers across the country with its online learning facility, provides a convenient and accessible platform for learners who are not willing to attend lectures in person and have face-to-face interactions with teachers and classmates.

Following the Covid-19 pandemic, the university has had to adapt solely to online learning. Hence, it is worthwhile to examine the factors affecting the effective implementation of an e-learning system. The success of implementing an e-learning system depends on the students' willingness to accept such a system ([Al-Qirim et al., 2018](#)) and also on the accessibility of the system to students at any time and in any place ([Maxwell, 1995](#); [Turban et al., 2015](#)). Even though previous researchers ([Patterson and McFadden, 2009](#); [Dodge et al., 2009](#)) argued there was a higher drop-out rate in e-learning than in face-to-face contact sessions, Covid-19 has altered the status quo of the e-learning landscape ([Zalat et al., 2021](#)). Consequently, this study intends to explore the relevance of this transformation in relation to a context within the OUSL. Furthermore, researchers have observed that limited studies have been conducted to understand what factors would affect learners' perception of e-learning during a pandemic situation. Accordingly, this study is going to *investigate the factors affecting learners' perception towards e-learning during the Covid-19 pandemic*. Thus, the following research objectives will be discussed:

- (1) To identify the factors affecting learners' perception towards e-learning during the Covid-19 pandemic.



The screenshot displays the Moodle LMS interface. The top navigation bar includes the OUSL logo, the language setting 'English (en)', and the user's name 'R. H. Asan Thanuka Perera'. The main dashboard is divided into three columns. The left column contains a 'Dashboard' sidebar with links to 'Site home', 'Site pages', 'My courses', 'Postgraduate Programmes', and 'Management Studies'. The middle column, titled 'Timeline Courses', shows a list of courses: 'MMP9331/MSP9331 Marketing Management', 'MSU3503 Marketing', and 'MSU6406/MCU4206 International Marketing'. Each course entry includes a brief description. The right column contains several widgets: 'No files available', 'LATEST BADGES', 'CALENDAR' (showing a calendar for November 2020), and 'UPCOMING EVENTS'.

Figure 1.
Sample: LMS home
page of the OUSL

Source(s): LMS Home Page

-
- (2) To identify obstacles faced by users and determine mechanisms to enhance students' engagement while using the e-learning system during the Covid-19 pandemic.

2. Theoretical framework and hypotheses

2.1 *The unified theory of acceptance and use of technology (UTAUT)*

It is important to study the intention of the learner using the information system (IS) and the usage behavior of the learner. In this regard, the unified theory of acceptance and use of technology (UTAUT) is important to this discussion. This model was introduced by Venkatesh *et al.* (2003) on user acceptance of IT. The UTAUT aims to explain user intentions in utilizing an IS and subsequent usage behavior. The theory holds that there are four key constructs: 1) performance expectancy (PE), 2) effort expectancy (EE), 3) social influence (SI) and 4) facilitating conditions. The first three are direct influences of usage intention, and the fourth is a direct determining factor of user behavior (Tan, 2013; Ain *et al.*, 2016; Zuiderwijk *et al.*, 2015). It can be seen that many researchers have investigated the UTAUT model in the context of intention to use e-learning (Kamalasena and Sirisena, 2021; Abbad, 2021; Jameel *et al.*, 2021). As the present research is focused on usage intention, the aforementioned three factors of usage intention (PE, EE and SI) would assist to provide insights into the factors that may influence the adoption of e-learning during the Covid-19 pandemic.

2.1.1 Performance expectancy (PE). The level of belief of a learner in the given online learning system is important. The learners' belief in the degree to which they have control, or better perception, of a system, can be explained by PE. PE is defined as "the degree to which an individual believes that using the system will help him or her to perform better" (Venkatesh *et al.*, 2003), which signifies the degree of belief an individual has in using a particular IS. It is similar to perceived usefulness in the technology acceptance model as well. Moreover, Murniati (2020) argued, attitude to use, perceived usefulness and perceived ease of use are the variables that mostly affect e-learning intention to use. According to Venkatesh (2000), PE can be considered as a factor that predicts the intention to use new technology in the context of operations. Furthermore, the same concept of PE acts as a predicting variable of usage intention of a newly introduced system in diverse contexts such as mobile banking (Alalwan *et al.*, 2015), e-learning (Ali *et al.*, 2018), social media (Sharma *et al.*, 2016) and online banking (Alalwan *et al.*, 2014). This study refers to PE as the extent to which users believe that the use of e-learning systems enhances educational performance. As per the literature, PE is significantly and positively associated with learners' behavior intention to use e-learning (Mensah, 2019; Nawaz *et al.*, 2020).

H1a. PE has a significant impact on learners' behavior intention to use e-learning.

2.1.2 Effort expectancy (EE). EE can be articulated as the degree of "ease of use" related to learners' use of IT (Venkatesh *et al.*, 2012). It can be aligned with the level of comfort in the usage of ISs (Venkatesh *et al.*, 2003). And also can be considered as the perception of an individual (learner) who is able to use the IS without any extra effort (Yadav *et al.*, 2016; Mafuna and Wadesango, 2016). According to Sharma *et al.* (2016) and Zuiderwijk *et al.* (2015), a positive relationship can be seen between EE and the intention to use a system, and this can be considered one of the important elements of intention to use e-learning systems (Tarhini *et al.*, 2017a, 2017b). This study also argued on the premise that "if a learner finds it easier to use e-learning, he or she is willing to adopt it."

H1b. EE has a significant impact on learners' behavior intention to use e-learning.

2.1.3 Social influence (SI). As e-learning provides learners with educational practices, SI cannot be ignored. The concept of SI argues that the person's degree of recognition depends

on whether the individuals who are important to them believe that they should often use ISs. SI relates to subjective norms in the theory of planned behavior. According to previous research, users have a tendency to communicate with others to determine their technology acceptance (Magsamen-Conrad *et al.*, 2015). The concept of SI is authenticated in numerous studies as an important factor in determining the intent of people to use innovations such as online learning (Ali *et al.*, 2018; Tarhini *et al.*, 2017a, b). Maldonado *et al.* (2010) observed a positive relationship between SI and behavioral intention. As argued by Venkatesh and Davis (2000), the impact of SI is significantly higher in a mandatory setting than in a voluntary setup. Moreover, this research works on the assumption that users' intention to use e-learning systems is affected by "SI" derived from lecturers, instructors and friends.

H1c. SI has a significant impact on learners' behavior intention to use e-learning.

2.2 DeLone and McLean IS success model

Whatever the IS, there is a need to measure its success. The IS success model identifies and describes the relationships among six critical dimensions. This model was designed by DeLone and McLean (1992, 2003), with the added variable of "service quality (SQ)" employed in the updated model in 2003. Thus, the modernized model of DeLone and McLean (1992, 2003) included six variables: 1) information quality (IQ), 2) system quality (SysQ), 3) SQ, 4) user's intention to use IS, 5) net benefits and 6) user satisfaction. It can be seen that many studies had applied the IS success model presented by DeLone and McLean (2003) for e-learning assessment and development. The updated DeLone and McLean (2003) IS success model could be adjusted to fit in assessing challenges in online learning as well. Thongsri *et al.* (2019) employed SysQ, IQ and SQ to measure e-learning systems. This can be seen as same for some other studies as well (Ramayah *et al.*, 2010; Lee and Hsieh, 2009; Park and Kim, 2013; Byrd *et al.*, 2006). This study, too, employed these variables to measure the e-learning system of OUSL.

2.2.1 System quality (SysQ). Irrespective of the many benefits provided, people may resist systems due to other reasons such as slow response times, heavy traffic causing the server or network lag, lack of accessibility, etc. Therefore, the quality of a system is of vital importance. SysQ refers to the quality of the IS, including the availability of the system, ease of utilization to the user (user experience or UX), a user-friendly interface and speed of response (feedback), etc. (DeLone and McLean, 2003). The quality and the excellence of any IS always influence the learners' intention to use the system (DeLone and McLean, 2003). If it is a system of poor quality then it can lead to the dissatisfaction of students. In case a student finds that the given system is not user-friendly, he or she might not readily accept the system. Other researchers too have indicated that SysQ influences intention to use an IS; for instance, Lee and Hsieh (2009) observed that the variable of "SysQ" directly affects the "intention to use mobile internet services," and McFarland and Hamilton (2006) argued that the "SysQ" influenced both variables of "perceived use" and "actual use of the system."

H1d. SysQ has a significant impact on learners' behavior intention to use e-learning.

2.2.2 Information quality (IQ). It is important to consider the quality, accuracy and relevance of information. In a scenario where an IS is used by learners (including students), IQ can be considered as the "quality of data received." Data quality consists of characteristics such as data relevance, data completeness, comprehensibility of data and data being up to date. Quality of information will affect intention to use and user satisfaction in the system (DeLone and McLean, 2003). Williams and Jacobs (2004) stated that IQ is an important factor for education, especially in e-learning. Furthermore, Byrd *et al.* (2006) also stated that the valuation of the quality of information is a vital and important dimension of e-learning.

H1e. IQ has a significant impact on learners' behavior intention to use e-learning.

2.2.3 Service quality (SQ). SQ is regarded as an important factor in customer orientation. Customer service is considered a particularly crucial element in e-commerce as well (Chung and Skibniewski, 2007). SQ is the assistance provided to the user, and the sincere interest, or empathy, displayed in solving users' problems by responding to questions raised by users while using the IS (DeLone and McLean, 2003). Many studies have been conducted focusing on the concept of SQ (Sharma, 2015, 2016). Notably among these, research conducted in the education sector argued that students were willing to learn from and acquire online learning applications in cases where they perceived the quality of the service they received was higher. On a further supporting note, Milosevic *et al.* (2015) indicated a direct relationship between SQ and intention to use mobile learning by learners. Park and Kim (2013) argued that SQ also has a significant impact on the level of acceptance.

H1f. SQ has a significant impact on learners' behavior intention to use e-learning.

3. Methodology

This study is based on quantitative methodology, and a questionnaire was used to collect data, including personal and research information. During the pandemic, the Faculty of Management Studies fully shifted to online mode; following this, a lesser number of students being involved in lectures was observed. A pilot survey was then conducted by interviewing a few students to investigate the factors contributing to low involvement, based upon the results of the same, the need to conduct a comprehensive study was observed.

The operationalization of variables can be seen in Table 1.

The questionnaire was developed and distributed among the sample using Google Forms. The population of this study included all management undergraduates in the OUSL, with approximately 4,000 undergraduates pursuing education in the Faculty of Management Studies. The study adopted a convenient sampling method, which was of non-probabilistic type. A sample of 163 completed questionnaires was assessed following the removal of incomplete questionnaires. The following conceptual model was advanced from the literature review.

According to Figure 2, individual acceptance and e-learning quality are considered as independent variables and intention to use e-learning is considered as the dependent variable.

In all, 35 learners were randomly selected for the pilot test to check the reliability of the questionnaire. The existence of reliability was identified by evaluating the feedback of respondents. Cronbach's alpha values were considered to ascertain the reliability of the instrument.

As per Walsh (1995), the value of Cronbach's alpha varies from zero (0) to one (1), and a value of 0.6 or above indicates acceptable internal consistency reliability. According to the reliability test (Table 2), Cronbach's alpha value for each variable is higher than 0.6, which confirms a high level of reliability.

4. Data analysis

4.1 Demographic profile of the sample

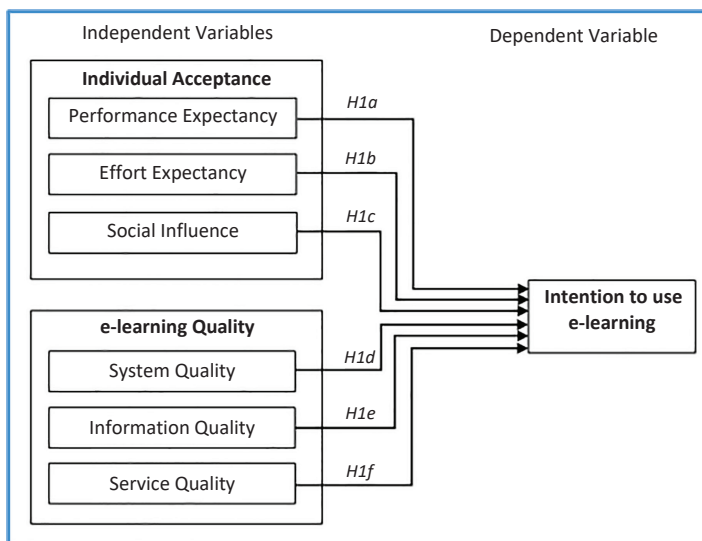
Demographic data such as gender, age, employment status, etc., were analyzed to contextualize the findings and to provide appropriate recommendations.

Table 3 discusses the demographic characteristics of the sample. According to the research findings, the majority of respondents (66.3%) are female, and the majority of respondents are between the ages of 18–25 (69.9%). The majority of students who begin their studies at OUSL after their A/L (Advanced level examination) are between the ages of 18–25.

	Variables	Statements	References	Measure
Independent variables	Performance expectancy (PE)	PE1: I find e-learning useful for my studies	(Venkatesh <i>et al.</i> , 2003; Chiu and Wang, 2008; Milošević <i>et al.</i> , 2015; Thongsri <i>et al.</i> , 2019)	5-point Likert Scale
		PE2: Using e-learning would enable me to achieve learning tasks more quickly		
		PE3: Using e-learning in my studying would increase my learning productivity		
		PE4: e-learning could improve my collaboration with classmates		
	Effort expectancy (EE)	EE1: I would find e-learning flexible and easy to use	(Venkatesh <i>et al.</i> , 2003; Chiu and Wang, 2008; Milošević <i>et al.</i> , 2015; Thongsri <i>et al.</i> , 2019)	5-point Likert Scale
		EE2: Learning to operate e-learning does not require much effort		
		EE3: My interaction with e-learning would be clear and understandable		
Social influence (SI)	SI1: I would use e-learning if it was recommended to me by my lecturers	(Venkatesh <i>et al.</i> , 2003; Chiu and Wang, 2008; Milošević <i>et al.</i> , 2015; Thongsri <i>et al.</i> , 2019)	5-point Likert Scale	
	SI2: I would use e-learning if it was recommended to me by my classmate			
	SI3: I would like to use e-learning if my lecturers' supported the use of it			
	SI4: People who are important to me think that I should use e-learning			
System quality (SysQ)	STQ1: e-learning system provides high availability	(Al-Busaidi, 2013; Chiu and Wang, 2008; Thongsri <i>et al.</i> , 2019)	5-point Likert Scale	
	STQ2: The response time of the e-learning system is reasonable			
	STQ3: e-learning system has attractive features to appeal to the users			
	STQ4: e-learning system provides interactive communication between teacher and students			
Information quality (IQ)	INTQ1: The information provided by e-learning is relevant	(Ahn <i>et al.</i> , 2007; Al-Busaidi, 2013; Thongsri <i>et al.</i> , 2019)	5-point Likert Scale	
	INTQ2: The information provided by e-learning is easy to understand			
	INTQ3: The information provided by e-learning is up to date			
	INTQ4: The information provided by e-learning is complete			
Service quality (SQ)	SERQ1: When you have a problem, the e-learning shows a sincere interest in solving it	(Ahn <i>et al.</i> , 2007; Al-Busaidi, 2013; Thongsri <i>et al.</i> , 2019)	5-point Likert Scale	
	SERQ2: e-learning is always willing to help you			
	SERQ3: e-learning service gives you individual attention			
	SERQ4: e-learning understands your specific needs			
Dependent variable	Intention to use e-learning (BI)	INT1: I intend to use an e-learning device for learning in the future	(Milošević <i>et al.</i> , 2015; Chathurika and Rajapaksha, 2017; Thongsri <i>et al.</i> , 2019)	5-point Likert Scale
		INT2: I predict that I will use e-learning frequently		
		INT3: I will enjoy using e-learning		
		INT4: I would recommend others to use e-learning		

Table 1.
Operationalization

Source(s): Developed by researcher



Source(s): Developed by author

Figure 2. Conceptual framework of the study

Variables	Cronbach's alpha
Performance expectancy	0.808
Effort expectancy	0.722
Social influence	0.818
System quality	0.835
Information quality	0.899
Service quality	0.847
Intention to use e-learning	0.892

Source(s): Survey data

Table 2. Reliability

Thus, the results are compatible with the student profile. As depicted in Table 2, three regional centers of the Open University (Colombo, Kandy and Kurunegala) represent the majority of the respondents (77.9%). Most of the respondents (93.9%) are in the ranges of good and excellent in computer literacy and they use mobile phones (65.6%) and laptops (28.8%) as their main login devices. Students primarily got to know about e-learning at OUSL from day schools, friends and emails. Many managerial implications can be observed based on the above mentioned findings as well.

A more in-depth study discovered that there were several obstacles that students encountered while using the e-learning system.

According to Table 4, around 32% of the respondents experienced problems with unstable Internet connections. And also 19.6% of the respondents indicated that "Adapting to online learning is difficult." That may be due to many reasons such as computer literacy, etc. In any case, there is a need for future researchers to investigate this further in different perspectives. More importantly, 16.6% questioned the affordability of costly Internet services in Sri Lanka. Non-availability of quality devices also was considered a problem by 14.8%. Interestingly, around 5% of respondents mentioned the importance of face-to-face interactions over online interactions, with the element of "Human Touch." Of all the

AAOUJ
17,1

92

	Frequency	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
<i>Gender</i>				
Male	55	33.7	33.7	33.7
Female	108	66.3	66.3	100.0
Total	163	100.0	100.0	
<i>Age</i>				
18-25	114	69.9	69.9	69.9
26-35	44	27.0	27.0	96.9
36-45	5	3.1	3.1	100.0
Total	163	100.0	100.0	
<i>Regional centers</i>				
Anuradhapura	9	5.5	5.5	5.5
Badulla	9	5.5	5.5	11.0
Batticaloa	4	2.5	2.5	13.5
Colombo	87	53.4	53.4	66.9
Jaffna	4	2.5	2.5	69.3
Kandy	17	10.4	10.4	79.8
Kurunegala	23	14.1	14.1	93.9
Matara	8	4.9	4.9	98.8
Rathnapura	2	1.2	1.2	100.0
Total	163	100.0	100.0	
<i>Login device - e-learning</i>				
Mobile phone	107	65.6	66.0	66.0
Desktop computer	6	3.7	3.7	69.8
Laptop	47	28.8	29.0	98.8
Tablet	3	1.8	1.8	100.0
Total	163	100.0	100.0	
<i>Computer literacy</i>				
Excellent	23	14.1	14.1	14.1
Good	130	79.8	79.8	93.9
Poor	10	6.1	6.1	100.0
Total	163	100.0	100.0	

Table 3.
Demographic
information

Source(s): Survey data

Table 4.
Have you encountered
any problems while
using e-learning?

	Frequency	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Valid				
Adapting to online learning is difficult	32	19.6	19.6	19.6
Without face-to-face interaction, learning is difficult	08	4.9	4.9	24.5
Quality devices do not exist	24	14.8	14.8	39.3
Unstable Internet connection	52	31.9	31.9	71.2
High cost of Internet service	27	16.6	16.6	87.8
No issues	20	12.2	12.2	100
<i>Total</i>	<i>163</i>	<i>100</i>	<i>100</i>	

Source(s): Survey data

participants only 12.2% “do not have any issues” using online learning. Nevertheless, this also needs to be further explored by future studies.

The above table (Table 5) indicated that 53.4% of students engaged in e-learning for the first time. This may mainly be because of restrictions imposed due to the Covid-19 pandemic.

As per Table 6, the level of influence of PE, SI and IQ is higher than that of EE, SysQ and SQ. These variables have been measured through a five-point Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree).

According to Table 7, students in Badulla, Jaffna, Kurunegala, and Matara are highly influenced by “PE” while using the e-learning system. Students in Anuradhapura, Batticaloa, and Colombo are highly influenced by the “SI” factor, whereas Kandy students are highly influenced by “SysQ” than other factors. Batticaloa and Rathnapura students are highly influenced by “IQ”.

	Frequency	Percentage (%)	Valid percentage (%)	Cumulative percentage (%)
Valid	Yes	76	46.6	46.6
	No	87	53.4	53.4
	Total	163	100.0	100.0

Table 5.
Have you had access to e-learning prior to the pandemic?

Source(s): Survey data

Descriptive statistics	Mean	Std. Deviation	Level of influence
Performance expectancy	3.7607	0.74915	Larger extent
Effort expectancy	3.5276	0.70644	Medium extent
Social influence	3.7347	0.81351	Larger extent
System quality	3.5414	0.74653	Medium extent
Information quality	3.6457	0.77221	Larger extent
Service quality	3.4095	0.77221	Medium extent
Valid N (list-wise)			

Table 6.
Mean and standard deviation

Source(s): Survey data

	Performance expectancy	Effort expectancy	Social influence	System quality	Information quality	Service quality
Anuradhapura	3.3611	3.3704	3.5278	3.2778	3.4444	3.3056
Badulla	3.6667	3.4815	3.4444	3.4722	3.6389	3.3889
Batticaloa	3.3125	3.3333	3.4375	3.2500	3.4375	2.8125
Colombo	3.8966	3.6513	3.9167	3.6437	3.7644	3.4253
Jaffna	3.9375	3.0833	3.0625	3.3750	3.2500	3.8125
Kandy	3.3088	3.1961	3.5000	3.5294	3.4118	3.3676
Kurunegala	3.9239	3.6232	3.7283	3.5652	3.6848	3.6304
Matara	3.5938	3.2917	3.4688	3.0938	3.3125	3.0625
Rathnapura	3.2500	3.0000	3.1250	3.1250	3.5000	2.8750

Table 7.
Mean and standard deviation (regional centers)

Source(s): Survey data

4.2 Multiple regression analysis

The purpose of regression analysis is to find out the level of significance of the impact or influence of the independent variables on the dependent variable. Regression analysis was used to develop the equation which described the relationship between these variables.

As depicted in Table 8, adjusted R-value of 0.670 in the model implies that 67% of the observed variability in intention to use e-learning can be explained by the independent variables considered in the model; namely PE, EE, SI, SysQ, IQ and SQ. The remaining 33% of the variance in intention to use e-learning related to other variables were not considered in the model. The R^2 value of 68.2% indicates the existence of numerous variables which can have an influence on intention to use e-learning, this could be referred to as scope for future research.

Table 9 indicates the coefficient of regression factor influence on intention to use e-learning. The coefficient of regression β is 0.229 for “PE” and the significant value is 0.005 ($0.005 < 0.05$). It indicates that if PE increases by one, then intention to use e-learning would increase by 0.229. This indicates that PE has a positive and significant impact on intention to use e-learning. The coefficient of regression β is 0.313 and Sig. value is 0.001 ($0.001 < 0.05$) for “EE”. It indicates that if EE increased by one, then intention to use e-learning would increase by 0.313. The coefficient of regression of EE has a positive impact on intention to use e-learning. The coefficient of regression β is 0.181 and Sig. value is 0.026 ($0.026 < 0.05$) for “SI”. It indicates that if SI increased by one, then intention to use e-learning would increase by 0.181 and this indicates that SI has a positive impact on intention to use e-learning. The coefficient of regression β is 0.233 and Sig. value is 0.003 ($0.003 < 0.05$) for “SQ”. Accordingly, this result indicates that SQ has a significant impact on intention to use e-learning. If SQ increased by one, then intention to use e-learning would increase by 0.233. The coefficients of regression of SysQ (Sig 0.656 > 0.05) and IQ (Sig 0.068 > 0.05) indicated that they do not significantly influence the intention to use e-learning. The summary of the hypotheses testing is depicted in Table 10.

5. Conclusion

The outbreak of the coronavirus has become a major stumbling block in providing education across the world, compelling most institutions to cancel in-person classes and shift to online teaching. The Sri Lankan higher education sector has also made the move towards the adoption of e-learning systems during the pandemic. The Faculty of Management Studies of the OUSL has consequently made a remarkable transition to online education to overcome the challenges created by the Covid-19 pandemic. Thus, in the prevailing background, this research contributes in many ways by adding value to theory and practice. Although many studies explore the same problem with alternative variables, this study incorporated two models, namely the UTAUT model to provide insights into the factors that may influence the adoption of e-learning by learners, and the IS success model of DeLone and McLean (2003) to measure the success of the e-learning system.

Model	R	R ²	Adjusted R ²	Std. error of the estimate
1	0.726 ^a	0.682	0.670	0.48456

Table 8. Model summary

Note(s): a. Predictors: (Constant), SER_IND06, SI_IND03, PE_IND01, EE_IND02, INT_IND05, STQ_IND04
Source(s): Survey data

Model		Coefficients		Standardized coefficients	<i>t</i>	Sig.
		β	Std. Error			
1	(Constant)	-0.096	0.218		-0.440	0.660
	Performance expectancy	0.229	0.081	0.204	2.816	0.005
	Effort expectancy	0.313	0.089	0.262	3.526	0.001
	Social influence	0.181	0.081	0.175	2.243	0.026
	System quality	-0.051	0.114	-0.045	-0.446	0.656
	Information quality	0.177	0.096	0.162	1.839	0.068
	Service quality	0.233	0.076	0.214	3.052	0.003

Source(s): Survey data

Table 9.
Regression analysis

H1a: Performance expectancy has a significant impact on learners' behavior intention to use e-learning	Accept	Regression analysis
H1b: Effort expectancy has a significant impact on learners' behavior intention to use e-learning	Accept	Regression analysis
H1c: Social influence has a significant impact on learners' behavior intention to use e-learning	Accept	Regression analysis
H1d: System quality has a significant impact on learners' behavior intention to use e-learning	Reject	Regression analysis
H1e: Information quality has a significant impact on learners' behavior intention to use e-learning	Reject	Regression analysis
H1f: Service quality has a significant impact on learners' behavior intention to use e-learning	Accept	Regression analysis

Source(s): Developed by researcher

Table 10.
Hypothesis testing

As per this study, "PE" was the most determinant factor of "Behavioral Intention" to use an e-learning system. Furthermore, the findings indicate that "PE" positively and significantly affects the intention to use e-learning. This can be aligned with the findings of Alalwan *et al.* (2014) and Venkatesh (2000), where "PE" is found to be a factor that affects intention to use new technologies in operation. In a pandemic situation, students with high-performance expectations are more likely to accept online learning than those with low-performance expectations. This is because learners believe that e-learning materials such as quizzes, discussion forums, as well as video tutorials, will help them to engage in productive learning. In addition to which, discussion forums and Zoom/Microsoft Teams classes will enable collaborative learning with classmates. "EE," "SI" and "SQ" also significantly influence the use of e-learning (Sharma *et al.*, 2016; Zuiderwijk *et al.*, 2015; Ali *et al.*, 2018; Tarhini *et al.*, 2017a, 2017b; Park and Kim, 2013). Although previous studies identified "SysQ" and "IQ" as important variables that affect the use of "e-learning" (Ahn *et al.*, 2007; Alla and Faryadi, 2013; DeLone and McLean, 2003), the current study concluded that "SysQ" and "IQ" do not have a significant impact on intention to use e-learning during the pandemic period.

Moreover, the current study found that 65.6% of students have access to technology through mobile phones. This can be considered an important finding, as Sung *et al.* (2016) observed that students most often used laptops to do homework, finish assignments and take notes. Furthermore, it was observed that 53.4% of students have engaged in e-learning for the first time. This can be construed as mainly due to restrictions imposed during the Covid-19 pandemic. This finding can be considered as important, as the study conducted by Zalat *et al.*

(2021) also argued that the unexpected pandemic has changed the landscape prevalent thus far in developing countries.

Most of the respondents (93.9%) were in the ranges of good and excellent in computer literacy. And interestingly, Colombo, Kurunegala and Kandy represented the majority of students who responded to this study. This aligns with the findings of the Census and Statistics of Sri Lanka (2018) as Colombo (42.6%), Kandy (34.8%) and Kurunegala (29.1%) are well above the national average (27.5%) in terms of computer literacy rate. Moreover, in the future, researchers can conduct extended studies to test this result with alternative uncertainties, using different models. In addition to this, researchers identified different factors that could have an impact on the use of e-learning in different regional centers; for example, students attached to the Anuradhapura, Batticaloa and Colombo centers are highly influenced by the “SI” factor, whereas Kandy students are highly influenced by “SysQ” than by other factors. This can be further investigated in future studies.

The above findings suggest some obstacles such as the problem of not having adequate facilities in IT (such as bandwidth problems), which may be considered as important to address. Accordingly, it is imperative to improve IT facilities available at all regional centers; this may be done by upgrading the Internet bandwidth provided and by establishing more and added Wi-Fi access points within the campus premises (Samsudeen and Mohamed, 2019). Also the ability of the students to purchase equipment such as laptops and smartphones in relation to their income levels also needs to be explored as one of the obstacles. Students could be encouraged and assisted to access and use e-learning systems by implementing mechanisms to facilitate vendors involved in the selling of laptops, smartphones, etc., for instance, to sell devices to students supported by installment payment or loan schemes backed by government-owned, or even private, banks; or other similar mechanisms put into place in collaboration with the Education Ministry of Sri Lanka.

Ultimately, these strategies would inspire and encourage students’ usage and practice of e-learning systems (Kurupparachchi *et al.*, 2017). Further, the researcher recommends conducting awareness programs on e-learning during students’ registration process, as well as at orientation programs. And also, there should be future research expanding this study to other faculties of the Open University, and throughout Sri Lanka. The following model (see Figure 3) which researchers have created from a database of collaborative studies (in the

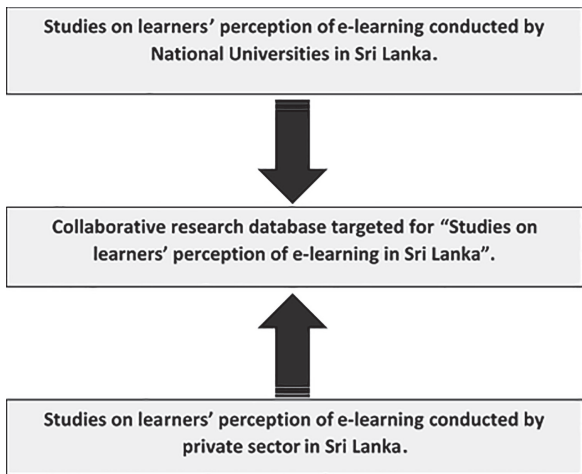


Figure 3.
Learners’ perception of e-learning in Sri Lanka

Source(s): Developed by author

public and private sectors in Sri Lanka) can be proposed for utilization to observe common problems in the education sector which are encountered in pandemic situations.

References

- Abbad, M.M. (2021), "Using the UTAUT model to understand students' usage of e-learning systems in developing countries", *Education and Information Technologies*, Vol. 26 No. 6, pp. 7205-7224.
- Aguti, B., Wills, G.B. and Walters, R.J. (2015), "An evaluation of the factors that impact on the effectiveness of blended e-learning within universities", *International Conference on Information Society*, 2014, i-Society, pp. 117-121, doi: [10.1109/i-Society.2014.7009023](https://doi.org/10.1109/i-Society.2014.7009023).
- Ahn, T., Ryu, S. and Han, I. (2007), "The impact of Web quality and playfulness on user acceptance of online retailing", *Journal of Information and Management*, Vol. 44 No. 3, pp. 263-275.
- Ain, N.U., Kaur, K. and Waheed, M. (2016), "The influence of learning value on learning management system use: an extension of UTAUT2", *Information Development*, Vol. 32 No. 5, pp. 1306-1321, doi: [10.1177/0266666915597546](https://doi.org/10.1177/0266666915597546).
- Al-Busaidi, K.A. (2013), "An empirical investigation linking learners adoption of blended learning to their intention of full e-learning", *Behaviour and Information Technology*, Vol. 32 No. 11, pp. 1168-1176, doi: [10.1080/0144929X.2013.774047](https://doi.org/10.1080/0144929X.2013.774047).
- Al-Qirim, N., Rouibah, K., Tarhini, A., Serhani, M.A., Yammahi, A.R. and Yammahi, M.A. (2018), "Towards a personality understanding of information technology students and their IT learning in UAE university", *Education and Information Technologies*, Vol. 23 No. 1, pp. 29-40.
- Alalwan, A., Dwivedi, Y. and Williams, M. (2014), "Examining factors affecting customer intention and adoption of internet banking in Jordan", *UK Academy for Information Systems Conference Proceedings 2014*, p. 3, available at: <http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1002&context=ukais2014>.
- Alalwan, A.A., Dwivedi, Y.K., Rana, N.P., Lal, B. and Williams, M.D. (2015), "Consumer adoption of internet banking in Jordan: examining the role of hedonic motivation, habit, self-efficacy and trust", *Journal of Financial Services Marketing*, Nature Publishing Group, Vol. 20 No. 2, pp. 145-157, doi: [10.1057/fsm.2015.5](https://doi.org/10.1057/fsm.2015.5).
- Ali, M., Khaled, S.M.H. and Ahmed, T. (2018), "Effectiveness of E-learning for university students: evidence from Bangladesh", *Asian Journal of Empirical Research*, Asian Economic and Social Society, Vol. 08 No. 10, pp. 352-360.
- Alla, M.M., Faryadi, Q. and Fabil, N.B. (2013), "The impact of system quality in e-learning system", *Journal of Computer Science and Information Technology*, Vol. 1 No. 2, pp. 14-23.
- Ashrafi, A., Zareravasan, A., Rabiee Savoji, S. and Amani, M. (2020), "Exploring factors influencing students' continuance intention to use the learning management system (LMS): a multi-perspective framework", *Interactive Learning Environments*, Taylor & Francis, Vol. 28, pp. 1-23, doi: [10.1080/10494820.2020.1734028](https://doi.org/10.1080/10494820.2020.1734028).
- Byrd, T.A., Thrasher, E.H., Lang, T. and Davidson, N.W. (2006), "A process-oriented perspective of IS success: examining the impact of IS on operational cost", *Omega*, Vol. 34 No. 5, pp. 448-460.
- Chathurika, P.R.D. and Rajapaksha, P.L.N.R. (2017), "Learner's perception on online learning in open and distance education mode in the diploma in early childhood and primary education, the Open University of Sri Lanka", *International Journal of Scientific Research*, Vol. 2 No. 4, pp. 42-52.
- Chiu, C.M. and Wang, E.T. (2008), "Understanding Web-based learning continuance intention: the role of subjective task value", *Information & Management*, Vol. 45 No. 3, pp. 194-201.
- Chung, B. and Skibniewski, M. (2007), "An implementation strategy for integrated enterprise systems in construction", *Proceedings of the ASCE/CIB Construction Research Congress*, Newport, Bahamas, May 6-8.
- DeLone, W.H. and McLean, E.R. (1992), "Information systems success: the quest for the dependent variable", *Information Systems Research*, Vol. 3 No. 1, pp. 60-95.

- 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.
- Dodge, T.M., Mitchell, M.F. and Mensch, J.M. (2009), "Student retention in athletic training education programs", *Journal of Athletic Training*, Vol. 44 No. 2, pp. 197-207, doi: [10.4085/1062-6050-44.2.197](https://doi.org/10.4085/1062-6050-44.2.197).
- Garrison, D.R. (2011), *E-Learning in the 21st Century: a Framework for Research and Practice*, Routledge, New York, Vol. 2, doi: [10.4324/9780203838761](https://doi.org/10.4324/9780203838761).
- Hayashi, R., Garcia, M. and Maddawin, A. (2020), "Online learning in Sri Lanka's higher education institutions during the COVID-19 pandemic", Asian Development Bank.
- Jameel, A.S., Karem, M.A. and Ahmad, A.R. (2021), "Behavioral intention to use E-learning among academic staff during COVID-19 pandemic based on UTAUT model", *International Conference on Emerging Technologies and Intelligent Systems*, pp. 187-196.
- Jayatilake, B.G. and Gunawardena, C. (2016), "Cultural perceptions of online learning: transnational faculty perspectives", *Asian Association of Open Universities Journal*, Vol. 11 No. 1, pp. 50-63, doi: [10.1108/aaouj-07-2016-0019](https://doi.org/10.1108/aaouj-07-2016-0019).
- Kamalasena, B.D.T.M. and Sirisena, A.B. (2021), "Factors influencing the adoption of E-learning by university students in Sri Lanka: application of UTAUT-3 model during covid-19 pandemic", *Wayamba Journal of Management*, Vol. 12 No. 2, pp. 99-124.
- Kurupparachchi, K.A.J.M. and Karunanayake, K.O.L. (2017), "Student characteristics and knowledge on ODL concepts at first registration", *Asian Association of Open Universities Journal*, Vol. 12 No. 1, pp. 41-51, doi: [10.1108/aaouj-11-2016-0004](https://doi.org/10.1108/aaouj-11-2016-0004).
- Lee, C.C. and Hsieh, M.C. (2009), "The influence of mobile self-efficacy on attitude towards mobile advertising", *International Conference on New Trends in Information and Service Science (NISS'09)*, Beijing, China, pp. 1231-1236.
- Liyangama, J., Kulasekera, G.U. and Vidanapathirana, U. (2015), "The effectiveness of the online conversion strategy of the Open University of Sri Lanka; what, how and why", *Proceedings of the 29th Annual Conference on Asian Association of Open Universities*.
- Mafuna, L. and Wadesango, N. (2016), "Exploring lecturers' acceptance level of learning management system (LMS) at applying the extended technology acceptance model (TAM)", *Journal of Social Sciences*, Vol. 48 Nos 1/2, pp. 63-70, doi: [10.1080/09718923.2016.11893571](https://doi.org/10.1080/09718923.2016.11893571).
- Magsamen-Conrad, K., Upadhyaya, S., Joa, C.Y. and Dowd, J. (2015), "Bridging the divide: using UTAUT to predict multigenerational", *Computers in Human Behaviour*, Vol. 01 No. 50, pp. 186-196, doi: [10.1016/j.chb.2015.03.032](https://doi.org/10.1016/j.chb.2015.03.032).
- Maldonado, M., Khan, G., Moon, J. and Rho, J. (2010), "E-learning motivation and educational portal acceptance in developing countries", *Online Information Review*, Vol. 35 No. 1, pp. 66-85.
- Maxwell, L. (1995), "Integrating open learning and distance education", *Educational Technology*, Vol. 35 No. 6, pp. 43-48.
- McFarland, D.J. and Hamilton, D. (2006), "Adding contextual specificity to the technology acceptance model", *Computers in Human Behavior*, Vol. 22 No. 3, pp. 427-447.
- Mensah, I.K. (2019), "Factors influencing the intention of university students to adopt and use e-government services: an empirical evidence in China", *SAGE Open Journal*, Vol. 2 No. 1, pp. 1-19, doi: [10.1177/2158244019855823](https://doi.org/10.1177/2158244019855823).
- Milosevic, I., Zivkovic, D., Manasijevic, D. and Nikolic, D. (2015), "The effects of the intended behavior of students in the use of M-learning", *Computers in Human Behavior*, Vol. 51, pp. 207-215.
- Murniati, C.T., Hartono, H. and Widiatoro, A.D.Y. (2020), "Factors affecting E-learning intention to use among college students: a case in Indonesia", *Journal of Education and Social Science*, Vol. 16 No. 1, pp. 42-48.

-
- Nawaz, S.S. and Mohamed, R. (2020), "Acceptance of mobile learning by higher educational institutions in Sri Lanka: an UTAUT2 approach", *Journal of Critical Reviews*, Vol. 7 No. 12, pp. 1036-1049, doi: [10.31838/jcr.07.12.183](https://doi.org/10.31838/jcr.07.12.183).
- Park, E. and Kim, K.J. (2013), "User acceptance of long-term evolution (LTE) services: an application of extended technology acceptance model", *Program; Electronic Library and Information Systems*, Vol. 47 No. 2, pp. 188-205, doi: [10.1108/00330331311313762](https://doi.org/10.1108/00330331311313762).
- Patterson, B. and McFadden, C. (2009), "Attrition in online and campus degree programs", *Online Journal of Distance Learning Administration*, Vol. 12 No. 2, pp. 1-8.
- Ramayah, T., Ahmad, N.H. and Lo, M.C. (2010), "The role of quality factors in intention to continue using an e-learning system in Malaysia", *Procedia - Social and Behavioral Sciences*, Vol. 2 No. 2, pp. 5422-5426, doi: [10.1016/j.sbspro.2010.03.885](https://doi.org/10.1016/j.sbspro.2010.03.885).
- Samsudeen, S.N. and Mohamed, R. (2019), "University students' intention to use e-learning systems: a study of higher educational institutions in Sri Lanka", *Interactive Technology and Smart Education*, Vol. 16 No. 3, pp. 219-238, doi: [10.1108/ITSE-11-2018-0092](https://doi.org/10.1108/ITSE-11-2018-0092).
- Sharma, S.K. (2015), "Adoption of e-government services: the role of service quality dimensions and demographic variables", *Transforming Government: People, Process and Policy*, Vol. 9 No. 2, pp. 207-222.
- Sharma, S.K., Al-Badi, A.H., Govindaluri, S.M. and Al-Kharusi, M.H. (2016), "Predicting motivators of cloud computing adoption: a developing country perspective", *Journal of Computers in Human Behaviour*, Vol. 62, pp. 61-69.
- Sung, Y.T., Chang, K.E. and Liu, T.C. (2016), "The effects of integrating mobile devices with teaching and learning and students' learning performance: a meta-analysis and research synthesis", *Computers & Education*, Vol. 94, pp. 252-275.
- Tan, P.J.B. (2013), "Applying the UTAUT to understand factors affecting the use of English e-learning websites in Taiwan", Vol. 3 No 4, pp. 1-12.
- Tarhini, A., Hone, K., Liu, X. and Tarhini, T. (2017a), "Examining the moderating effect of individual level cultural values on users' acceptance of E-learning in developing countries: a structural equation modeling of an extended technology acceptance model", *Interactive Learning Environments*, Vol. 25 No. 3, pp. 306-328, doi: [10.1080/10494820.2015.1122635](https://doi.org/10.1080/10494820.2015.1122635).
- Tarhini, A., Masa'deh, R.E., Al-Busaidi, K.A., Mohammed, A.B. and Maqableh, M. (2017b), "Factors influencing students' adoption of e-learning: a structural equation modeling approach", *Journal of International Education in Business*, Vol. 10 No. 2, pp. 164-182.
- Tetteh, G.A. (2016), "Effects of business school student's study time on the learning process", *Journal of International Education in Business*, Vol. 9 No. 2, pp. 90-110.
- Thongsri, N., Shen, L. and Bao, Y. (2019), "Investigating factors affecting learner's perception toward online-learning: evidence from Class-Start application in Thailand", *Behaviour and Information Technology*, Vol. 38 No. 12, pp. 1243-1258, doi: [10.1080/0144929X.2019.1581259](https://doi.org/10.1080/0144929X.2019.1581259).
- Turban, E., King, D., Lee, J.K., Liang, T.P. and Turban, D.C. (2015), *Electronic Commerce: A Managerial and Social Networks Perspective*, Springer, Cham Heidelberg, New York.
- Venkatesh, V. and Davis, F.D. (2000), "A theoretical extension of the technology acceptance model: four longitudinal field studies", *Journal of Management Science*, Vol. 46 No. 2, pp. 186-204.
- Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: towards a unified view", *Journal of MIS Quarterly*, Vol. 27 No. 3, pp. 425-478.
- Venkatesh, V., Thong, J.Y. and Xu, X. (2012), "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology", *Journal of MIS Quarterly*, Vol. 36 No. 1, pp. 157-178.
- Walsh, W.B. (1995), *Tests and Assessment*, 3rd ed., Prentice-Hall, New Jersey.

- Williams, J.B. and Jacobs, S. (2004), "Exploring the use of blogs as learning spaces in the higher education sector", *Australasian Journal of Educational Technology*, Vol. 20 No. 2, pp. 232-247.
- Yadav, R., Sharma, S.K. and Tarhini, A. (2016), "A multi-analytical approach to understand and predict the mobile commerce adoption", *Journal of Enterprise Information Management*, Vol. 29 No. 2, pp. 222-237, doi: [10.1108/JEIM-04-2015-0034](https://doi.org/10.1108/JEIM-04-2015-0034).
- Zalat, M.M., Hamed, M.S. and Bolbol, S.A. (2021), "The experiences, challenges, and acceptance of e-learning as a tool for teaching during the COVID-19 pandemic among university medical staff", *Plos One*, Vol. 16 No. 3, doi: [10.1371/journal.pone.0248758](https://doi.org/10.1371/journal.pone.0248758).
- Zuiderwijk, A., Janssen, M. and Dwivedi, Y.K. (2015), "Acceptance and use predictors of open data technologies: drawing upon the unified theory of acceptance and use of technology", *Journal of Government Information Quarterly*, Vol. 32 No. 4, pp. 429-440.

Corresponding author

R.H.A.T. Perera can be contacted at: tharukaperera91@gmail.com