International Journal of Higher Education and Sustainability

ISSN online: 2056-4031 - ISSN print: 2056-4023
https://www.inderscience.com/ijhes

Study from home: modelling the factors facilitating online education during and post-COVID-19

Sabikun Nahar Bipasha, Md. Tanvir Alam Himel, Tama Saha

DOI: 10.1504/IJHES.2023.10063004

Article History:

Received:	12 July 2023
Last revised:	02 October 2023
Accepted:	25 October 2023
Published online:	21 March 2024

Study from home: modelling the factors facilitating online education during and post-COVID-19

Sabikun Nahar Bipasha

Department of Marketing,
Comilla University,
Cumilla – 3506, Bangladesh
Email: sabikunnaharbipasha@cou.ac.bd

Md. Tanvir Alam Himel*

Department of Marketing,
University of Dhaka,
Dhaka – 1000, Bangladesh
Email: tanvir.alam@du.ac.bd
*Corresponding author

Tama Saha

Department of Marketing,
Comilla University,
Cumilla – 3506, Bangladesh
Email: tama.saaha@gmail.com

Abstract: This study focused on the effectiveness of the online education system at the tertiary level of one of the fastest growing economies in the world, namely Bangladesh. The main objective of the study is to examine different facilitating factors of the online education system from the perspective of university students. To acquire the objective, primary data were collected by surveying the respondents (n = 339) through a close-ended questionnaire. An explanatory research was used to analyse the data; performed reliability and validity tests; generated frequency and percentage tables, and measured the structural equation model using SPSS and Smart-PLS software. The results showed that convenience, ease of participation, computer literacy, ease of access and navigation, and cost-effectiveness have a significant positive relationship with the online education system. The findings of the paper may inspire the universities as well as the students to adopt the online education system in the new normal era. Online learning not only enhances growth and sustainability in higher education but also contributes to sustainable development by minimising access barriers and ensuring navigation and cost-effectiveness. The findings of the study will aid in fostering a better educational and learning environment in universities.

Keywords: online education; synchronous learning; asynchronous learning; COVID-19 pandemic; information technology.

Reference to this paper should be made as follows: Bipasha, S.N., Himel, M.T.A. and Saha, T. (2023) 'Study from home: modelling the factors facilitating online education during and post-COVID-19', *Int. J. Higher Education and Sustainability*, Vol. 4, Nos. 3/4, pp.227–250.

Biographical notes: Sabikun Nahar Bipasha is an Assistant Professor of Comilla University. She has BBA and MBA major in Marketing. She has more than two and half years of online teaching experience and around three years of teaching experience at Comilla University. Her research interests include education, branding, entrepreneurship, and services marketing.

Md. Tanvir Alam Himel is an Assistant Professor of University of Dhaka. He completed BBA and MBA (major in Marketing) from the University of Dhaka. He has around six years of teaching experiences. His research interests are diversified but located at the intersection of tertiary education, tourism, branding, and services marketing.

Tama Saha is an independent researcher. Recently, she has completed MBA from the Comilla University major in Marketing. She has recently co-authored a paper that was published in the *Heliyon Journal*.

1 Introduction

In education, advancements in technology have opened numerous possibilities. One of the goals of advanced technological devices is to make educational assignments more efficient. Education is influenced by changes in the environment in a universal way, and it progresses in parallel with the advancement of human society. All of today's society's changes and transformations have resulted in the restructuring and upgrading of educational systems (Castro et al., 2001). The use of computer-based learning in education gives students several options, such as visualising abstract concepts, which can help them comprehend them better. Therefore, the environmental pressure created by commercially contending systems and educational institutions is changing. The online education system has lately expanded to include pedagogically sound features such as student observation, virtual assessment, learner feedback, and community features. This is frequently part of a larger effort to address several common issues with online education, such as high drop-out rates because of frustration and a lack of incentive to maintain studying (Parker, 2003).

Higher education's growth of online courses does not happen overnight. According to 2008 study by the National Centre for Educational Statistics (NCES) noticed that the key factors affecting higher-educational institutions to offer online courses attached meeting learner's expectations for flexible schedules, providing access to higher education for learners who have geographical barriers, trying to make more courses available, seeking to enhance student engagement (Parsad et al., 2008). Instead of emphasising affective outcomes of values, attitudes, and behaviours, the majority of higher education teaching and evaluation focuses on cogitative abilities of knowledge and comprehension (Shephard, 2008). The use of digital technologies in the learning process, as well as the transition from a traditional classroom to an online learning system both are critical parts of the educational system's digitalisation. The computer and network-enabled sharing of skills and knowledge are known as the online education system (Mahanta and Ahmed, 2012). Online education systems bring together a variety of resources, such as writing, communication, visualisation, and storage. Online courses are growing at a rate of 65% every year (Means et al., 2009).

Online learning is self-paced or instructor-led, and it incorporates text, graphics, streaming video, and audio as well as other material (Mahanta and Ahmed, 2012). Online learning participation has a number of requirements, along with a reliable strong network, high-speed internet connection, uninterrupted electricity supply, comfortable living space at home, and so forth (Rahman, 2021).

Online education is quickly changing the face of higher education because it attracts students of all ages (Truluck, 2007). Both within and without higher education, online education has sparked a significant interest. For some, it has the potential to reach new audiences with learning opportunities; for others, it can fundamentally revolutionise learning delivery techniques and shift the competitive environment (Poehlein, 1996). Morrison et al. (2007) proposed that for both education and training environments, online education has demonstrated additional strengths over physical classrooms as students can join classes without geographic constraints and it has self-paced instruction. Nowadays computer-mediated distance learning creates a virtual interactive learning atmosphere that lively teaches a large number of students who virtually live in any corner of the world (Fedynich, 2013). For learners and teachers mobile assisted language education especially use of WhatsApp also offers tremendous opportunities (Alberth et al., 2020). Tomar and Daruwala (2022) highlighted that professionals are highly satisfied with going online as there is more flexibility in terms of time and place, they have to travel less.

According to a UNESCO report by the end of 2019, coronavirus (COVID-19) started rapidly spreading worldwide. As a result, some governments began implementing appropriate tactics to combat the virus, including the shutdown of educational institutions. The majority of higher education institutions have switched from conventional teaching to online instruction in response to the COVID-19 pandemic (Kummitha et al., 2021). As a result, several education institutions around the world, including Bangladesh began to close systematically around this time, which closed educational institutions on 17 March and depopulated the student population instantly. Since April, a few private universities have begun to offer online courses, whereas public universities and many other educational institutions have not started online activities till then. Preservation of educational continuance through technology has both commercial and humanitarian objectives. A protracted break in schooling, or the bulk of academic years, is a payable loss for late-stage economies in a slow-growth era. Bangladesh, on the other hand, does not have time to waste (Khan et al., 2021). Teachers have received support from the Ministry of Education in their attempts to keep online classrooms running and information flowing freely. The concerned authorities have begun airing distant learning shows for schools, colleges, and universities. Online education has been the emphasis of Bangladesh's highest level of education. Students can pursue higher education at 46 public universities and 105 private universities in Bangladesh. In addition, almost 1,500 colleges affiliated with Bangladesh's national university provide a wide range of tertiary-level classes and activities (Khan et al., 2021). As a result, the only way to stop the global educational catastrophe brought on by the COVID-19 pandemic is to adopt online teaching-learning (Basilaia et al., 2020). As online education is an important part of during and after COVID-19 era, it urges us to study the most impactful factors affecting the effectiveness of the online education system.

1.1 Research gap

The online education system has been an interesting and trending topic for researchers all over the world. Nowadays, the structure of education is changing. Students demand a relaxing environment of online learning. In the modern age, most students are engaged in online education and they are ready to get more knowledge frequently through the internet. Moreover, many scholars are using the online education system to explain their research framework, these framework leads to there are many different pros and cons of an online education system. Thus, in this research, the researchers will use the five benefits that influence the online education system and these may facilitate the online education system a future of education. Internet was developed and has had rapid growth in these few years and it might have the problem of a lack of studies in all countries since it is an early stage in the field of the education system. Bangladesh has a large number of university students and day by day they prefer online education. But, Bangladesh still lacks research on the trends of the online education system. Thus, educational institutions could capitalise on the most significant benefits those have an effective online education system.

1.2 Purpose of the study

The primary goal of this research is to identify the facilitating factors influencing online education and assess the effectiveness of those factors on the online education system, from the perspective of university students.

1.3 Research questions

To conduct the literature analysis, this study applied a series of guided questions to prior studies.

RQa How is convenience relevant to the effectiveness of the online education system?

RQb What is the relationship between ease of participation and the online education system?

RQc What is the relationship between computer literacy and the effectiveness of the online education system?

RQd What is the relationship between ease of access and navigation and the online education system?

RQe How is cost-effectiveness relevant to the effectiveness of the online education system?

The paper has the following structure: initially, to draw the theoretical basis authors included theoretical perspectives of different scholars that also helped to articulate the hypotheses. After that, there is a detailed discussion about the research methodology. Subsequently, researchers enlisted the findings, discussion, and implications of the study. Lastly, the paper outlined the limitations of the study and highlighted future directions.

2 Literature review

2.1 Theoretical background

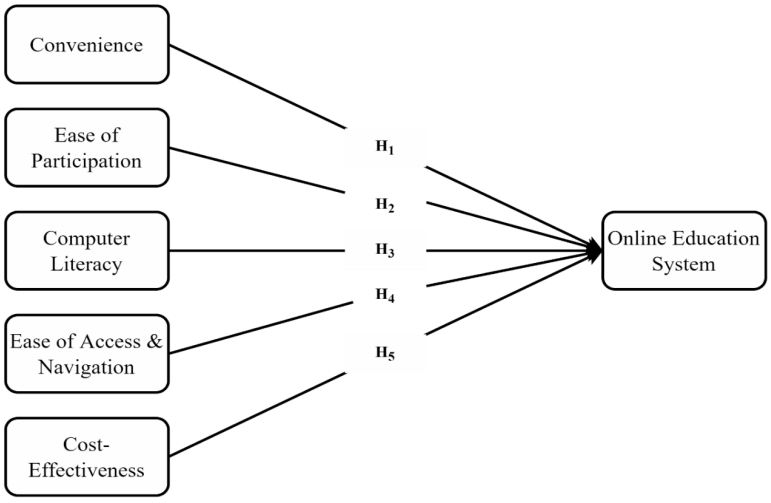
This study develops an integrative proposed theoretical research model (see Figure 1) based on self-directed learning (Candy, 1991) and computer assisted interaction (Kemeny and Kurtz, 1967) to determine whether these factors strongly affect the online education system. Some scholars have acknowledged the significance of the learning situation for SDL (e.g., Candy, 1991), highlighting that learners can exhibit varying amounts of self-direction in different learning settings. According to Candy (1991), students may have a high level of self-direction, in a subject area where they are well-liked or that is similar to previous experiences. According to research on online learning, SDL skills may aid the learner's learning process in these situations (Hartley and Bendixen, 2001). Various researchers have provided various opinions on SDL. Some scholars regard SDL as a method of structuring education (e.g., Harrison, 1978), emphasising the degree of student control over the learning process. Individual qualities and processes interact in crucial ways, and this has been the central objective of SDL research and theory to date (Merriam and Caffarella, 1999; Brookfield, 1984). Evaluating SDL from the personal attribute and procedure perspectives is important because it reveals how learners differ in terms of their level of identity (Grow, 1991) and how they take charge of the learning process. The model depicts the interaction between knowledge construction and personal characteristics. According to research, active participation in learning processes can help students increase their capacity to use resources and techniques successfully (Vonderwell and Turner, 2005). Bayrak (2022) found that learners preferring online learning format had higher satisfaction than that of learners preferring face-to-face learning format.

In 1955, computer-assisted instruction (CAI) was introduced as a method of online problem-solving learning (Zinn, 2000). CAI has been combined and compared with programmed instruction/distance learning procedures by researchers (Thyer et al., 1998; Harrington, 1999). CAI has been explored in the teaching of statistics at various levels, including mathematical statistics, biostatistics, social statistics, and even commercial statistics (Spinelli, 2001). Some parts of CAI, such as teaching statistics with laboratories (Prvan et al., 2002) and using spreadsheets, were also investigated in the investigations. Because it was the first and is still widely utilised till 2022, the CAI concept is the most commonly used and popular. According to the CAI, computer utilisation was mostly centred on programming teaching and learning in a variety of subjects, including arithmetic, engineering, sociology, physics, business management, and statistics (Anderson and Petch-Hogan, 2001). When analysing the efficacy of CAI, various design challenges arise, according to Worthington et al. (1996). In another assessment of literature, Harrington (1999) stressed the need of observing and accounting for the quality of the learner-instructor connection throughout training. According to Duncan (1993), a few participant characteristics should be controlled: self-interest in the subject, prior knowledge of an area, generalised anxiety (Tobias, 1987), and computer experience (Lambert and Lenthall, 1989). In their related research, Liefeld and Herrmann (1990) evaluated academic major, numerous prior topics in the significant, performance on an English assessment test, and test grade point average. Several researchers have compared subgroups for equality on crucial variables, according to the literature.

In different research papers, the researcher finds out several advantages of online education based on university learners. Based on the theoretical background researchers

find out various advantages of the online education system. For this study researchers take convenience, ease of participation, computer literacy, ease of access and navigation, and cost-effectiveness. In this paper, Figure 1 shows the proposed theoretical research model.

Figure 1 Proposed theoretical model for online education system (authors' developed)



Source: Authors' constructed

Several researchers work on the topic of online education especially during and after COVID-19. Moreover, many researchers are using online education to explain their framework, this lead there are many different sources of factors such as social, personal, environmental, pros and cons, country or state-based advantages of online education, worldwide challenges, and implications of online education and others that will lead e-learning objectives, tools, and limitations. Various researchers use one or two factors in their paper but in this paper, researchers try to integrate those five factors. Convenience, ease of participation, computer literacy, ease of access and navigation, and cost-effectiveness are the most used factors in different papers. So, the authors try to accumulate these famous factors in this paper and try to make it comprehensive.

2.2 Online education system

Rapid developments in technology have made online education or distance teaching easy (McBrien et al., 2009). Online learning is defined as "learning experiences in synchronous or asynchronous environments using several devices (e.g., mobile phones, laptops, tablets, etc.) with internet access" (Singh and Thurman, 2019). A synchronous learning environment is structured in the sense that learners attend live lectures at designated times, and there is a possibility of instant feedback (Murphy et al., 2011). Asynchronous learning environments are not properly structured and it includes learners or students working with online curricular materials on their own time, under the guidance of a teacher (Murphy et al., 2011). So, students can be anywhere (independent) to learn and interact with instructors and other students (Singh and Thurman, 2019). Due to the fact that all student communications are handled via email, blackboard, and

Moodle forums, lecturers are happy to see that e-learning sustainability concepts are successfully promoted in their instructional and educational techniques (Isaias and Issa, 2013).

Online learning can be termed as a tool that can build the teaching-learning process more student-centred, more innovative, and even more flexible. Online learning requires the use of a computer connected to a network, which helps the possibility to learn from anywhere, anytime, in any rhythm, with any means (Cojocariu et al., 2014). Online education provided the chance to teach and learn in creative ways compared to traditional classroom settings (Pokhrel and Chhetri, 2021). Virtual classrooms have become more popular in the past few years. Parents and policymakers are finding the value of this alternative to traditional 'bricks and mortar' education, and policymakers are commending time to evaluate the overall quality of online education (Carnahan and Fulton, 2013). Several traditional institutions only enrol students within their district, and now have a broad range of possibilities for learner's education via online education all over the world (Cavanaugh, 2009). Kirby et al. (2010) have shown that online/e-learning experiences can help learners become better communicators and can further develop communication skills needed in an ever-changing, global, twenty-first-century economy. Online platforms are needed where video or audio conferencing with at least 50 to 60 students is possible, internet connections are good, lectures are accessible on smartphones, not just computers, the possibility of watching recorded audio or video lectures, and lastly need instant feedback from students can be achieved and assignments can be taken (Basilaia et al., 2020). Web enhanced learning satisfaction is influenced by usability, self-efficacy of technology, quality of the content, and interaction quality (Barri, 2020). Under the presence of the pandemic catastrophe, online education and evaluation would be promoted as the new norm (Gurukkal, 2020).

2.3 Convenience

The convenience of online education enables quick communication between educators and students in virtual classrooms. For both educators and students, online learning delivers convenience and flexibility (Fedynich, 2013). Lecturers and students achieve more benefits from online education because it is time and location-independent. Professors and students can appear at conferences and deliver recent papers since the job environment is less demanding (Jingyu, 2014). Usually, online education has a lot of opportunities available but in a pandemic situation, online learning will flourish at every level of an educational institution. Due to the COVID-19 pandemic e-collaborations exploded and the opportunity of online education creates it extra convenient over traditional classrooms (Favale et al., 2020).

In online learning, the convenience factor is considered the most momentous benefit. In the present situation, learners are increasingly finding themselves online learning more convenient rather than in physical classrooms. There are several knowledge sources available in a digital classroom, and the flow of knowledge and information is extensive (Singh, 2021). As per Liu (2014), workplace flexibility and lower space requirement are two significant aspects of online education. The other advantages of online education are that students can study in their own space, take as abundant time as they need to finish lessons and tasks and take as many breaks as they need (Allday and Allday, 2011). Instructors and learners must actively participate and engage to achieve convenient goals,

which means they must be available to each other and earn their trust and confidence (Brocato et al., 2015). According to the study, university students prefer to take online programs since they are more convenient. The literature suggests that convenience increases the possibility of participation in online classes for university learners. Hence, this study hypothesised that:

H_1 There is a positive relationship between convenience and the online education system.

2.4 Ease of participation

One of the many flexible characteristics of cyberlearning is the ability of students to participate in asynchronous or synchronous learning modes (Anderson and Petch-Hogan, 2001). Students can interact in real-time, in chat rooms, or asynchronously through bulletin boards or forums (Morrison et al., 2007).

Many students prefer online learning because it encourages them to engage in their own time. Introverts, who really are quiet and shy in face-to-face classes, contribute significantly online (Garnham and Kaleta, 2002). Student participation was emphasised in the asynchronous environment, according to Kupczynski et al. (2008), because there is no set time to post information, read and respond to emails, reflect on responses, rewrite meanings, and modify original perceptions, whereas this would not be the case in a face-to-face class. Students in online education receive adaptive advice and feedback, similar to the tailored engagement between an educator and a student (Li and Lee, 2016). Learners who require one-on-one interaction with peers that in-class face time might need to think twice about completing the majority of their online education. However, a learner who enjoys having complete control over their time and resources may feel right at home in a virtual classroom, as that learner can easily participate in an online class or e-learning program (Jingyu, 2014). The literature suggests that ease of participation increases the possibility of participation in online classes for university learners. Hence, this study hypothesised that:

H_2 There is a positive relationship between ease of participation and the online education system.

2.5 Computer literacy

The ability to use a computer is a prerequisite for online learning. Computer literacy is the ability to utilise computers and related technologies effectively. Familiarity with computer programs and applications is another definition of computer literacy. In the early 1980s, the marketing of computer systems to both individuals and businesses inspired the computer literacy movement. The cyber classroom is a moot point without computer literacy ability. The demand for learners and lecturers with critical abilities is growing in tandem with the rapid advancement of technological development (Li and Lee, 2016).

Students with strong technological knowledge and expertise in areas such as educational technologies have assisted in the appropriate implementation of the digital system of education (Jou and Wu, 2012; Anderson and Petch-Hogan, 2001). Self-efficacy of faculty members has a significant impact on their acceptance of learning platforms (Ogbodoakum et al., 2022). Gender plays a significant impact in the field of technology

due to differences in nature and cultural factors. Experience with technology on a computer improves and facilitates the learning of abilities (Jayasuriya and Chapman, 1997). According to Lai (2002), computer literacy is related to computer ownership and computer usage time. Shih and Cifuentes (2000) more sessions of computing usage time spent online resulted in higher computer knowledge and achievement. The literature supports that computer literacy increases the possibility of participation in online classes for learners. Hence, this study hypothesised that:

H_3 There is a positive relationship between computer literacy and the online education system.

2.6 Ease of access and navigation

Online education necessitates both computer literacy and online access. Ease of access and navigation means that classes or material may be found quickly on the first visit with only a few 'clicks' from the institution's home page, and is logically organised and designated (Schudde et al., 2018). Websites are an important tool for communicating organisational and program-specific knowledge to students, but the quality and ease of access to information appear to differ significantly among schools (Jaggars and Fletcher, 2014; Khlaisang, 2017).

Most scholars characterise online learning as using current technologies to access learning activities. Because it provides quick access and navigation, online learning attracts a significant number of students (Alawamleh et al., 2020). Many educational institutions definitely improve the functionality and usability of the online material they provide to students concerning the transfer at this time. Because one approach to assist college students in navigating the transfer process is to provide easy-to-access and reliable online transfer information (Schudde et al., 2018). Teachers can modify the motion and emphasis of instruction to fit the particular learning needs of students with more quick access to individual performance data (Bienkowski et al., 2012). Learners also adopted multimedia, which combines two or more media, such as writing, illustrations, graphics, audio, or video, to create interesting content that can be accessed and navigated simply via a personal computer (Ruiz et al., 2006). The literature suggests that ease of access and navigation increase the possibility of participation in online classes for learners. Hence, this study hypothesised that:

H_4 Ease of access and navigation positively influences the online education system.

2.7 Cost-effectiveness

Cost-effectiveness is an economics concept that describes evaluating different methods to accomplish the same goal, with the most cost-effective option being the least expensive of the options under evaluation (Euzent et al., 2011). The usage of online and distance learning has eliminated the requirement for travel to gather together and learn and study (Cornford and Pollock, 2003). This leads to major cost and time savings.

There are several types of benefits when it comes to online learning, and cost-effectiveness is just one of them. According to Ng (2000), online learning is less expensive and as effective as traditional classroom instruction. Moore (1990) conducted a study on cost-effectiveness and online education, and he discovered that effectiveness is

judged by learning accomplishment, student and teacher attitudes or behaviours, and cost-effectiveness. Online learning is more inexpensive than face-to-face learning methods, educational institutions save money that could be used to construct massive infrastructure and travelling expenses (Ntshwarang et al., 2021). According to Hjeltnes and Hansson (2005), when it comes to the cost-effectiveness of web-based learning from the perspective of students, students are satisfied with the cost-effectiveness. The literature suggests that cost-effectiveness increases the possibility of participating in online classes for learners. Hence, this study hypothesised that:

H_5 There is a positive relationship between cost-effectiveness and the online education system.

3 Research methodology

The study adopted explanatory research supported by quantitative research. The researchers collected the secondary data for this study by searching electronic databases from renowned publishers, including Inderscience, Elsevier Science Direct, Sage, and Emerald. Different bibliographic database like Web of Science and Scopus, and several other relevant leading journals (e.g., *International Journal of Higher Education and Sustainability*, *Journal of Special Education Technology*, *Electronic Journal of E-Learning*, *Journal of the Scholarship of Teaching and Learning*, *South African Journal of Higher Education*, *Journal of Information Technology Education: Research*, *Journal of Management Education*, and *British Journal of Educational Technology*) were also delved into to find the expediting factors of online learning.

For data collection, the researchers used a close-ended questionnaire. Primary data were collected through the distribution of online self-administrative questionnaires. The research used a non-probability technique and respondents were selected through convenience sampling (Malhotra and Birks, 2007). Researchers used convenience sampling and collected data from 350 respondents who are aged more than 16 years Bangladeshi students. Among the responses, 339 questionnaires were usable for the analysis, 97% response rate. To avoid ambiguity a pilot survey was conducted on 30 respondents to test the reliability.

In order to ensure validity, measurement scale were adopted from previous literature. The items of the convenience were adapted from Baleni (2015), Jingyu (2014), Olson (2005) and Volery (2001) and modified to the context of this study. the conceptualisation of ease of participation was measured using items adapted from Baleni (2015), Marks et al. (2005) and Volery (2001), computer literacy from Li and Lee (2016) and Selim (2007); ease of access and navigation from Olson (2005) and Volery (2001); cost-effectiveness from Hjeltnes and Hansson (2005) and Marks et al. (2005); online education system from Ullah et al. (2017).

This study uses the questions from the adopted questionnaires, a total of 20 items under independent variables, five items on demographic characteristics of the respondents, and five items on the online education system covered in the questionnaire. Hence, the standardised five-point Likert scale was used for survey purposes. This study involves three scales of measurement as Likert scale, the nominal scale, and the ordinal scale. In the demographic section gender, and marital status is applied to the nominal

scale while age applies to the ordinal scale. SPSS (version 25.00) and Smart-PLS (version 3.00) was used for data entry and analysis of the data.

4 Analysis, findings, and discussion

4.1 Frequency distribution and analysis

As shown in Table 1, of the sample of 350 questionnaires, 339 were valid, yielding a response rate of 97%. Table 1 depicts the demographic characteristics of the samples. The study observed that online education has attracted university students. Because, 71.4% of respondents are from the age group of 21 to 25 years, 74.6% of respondents have post-graduation. In addition, 58.7% of respondents have more than ten times online classes experience, five times experience (24.8%), and 16.5% of respondents have ten times online classes experience. Other relevant demographic information is included in Table 1.

Table 1 Demographic profile of respondents

No.	*Characteristics*	*Category*	*Frequency*	*Percentage*
1	Gender	Female	125	36.9%
		Male	214	63.1%
2	Age	16–20	55	16.2%
		21–25	242	71.4%
		26–30	23	6.8%
		Above 30	19	5.6%
3	Marital status	Unmarried	299	88.2%
		Married	40	11.8%
4	Education level	Bachelors	62	18.3%
		Masters	253	74.6%
		Other diplomas	24	7.1%
5	Class attend times	5 times	84	24.8%
		10 times	56	16.5%
		More than 10 times	199	58.7%

Source: SPSS output from primary data

4.2 Assessing measurement model (internal reliability and validity test)

- *Indicator reliability:* 'Factor loading' that ranges more than 0.50 fulfils the requirements of the reliability test (Truong and McColl, 2011). All the outer loadings of the reflective constructs are well above the minimum threshold value of 0.50 (Table 2). The loading ranged from 0.730 to 0.867, which was highly significant.

Table 2 Construct reliability and validity

Research construct	*Items*	*Factor loading value*	*Cronbach's alpha (α)*	*CR*	*AVE*
Convenience			0.842	0.894	0.678
	C1	0.812			
	C2	0.844			
	C3	0.829			
	C4	0.806			
Ease of participation			0.862	0.906	0.707
	EP1	0.855			
	EP2	0.837			
	EP3	0.848			
	EP4	0.823			
Computer literacy			0.751	0.842	0.571
	CL1	0.741			
	CL2	0.730			
	CL3	0.816			
	CL4	0.733			
Ease of access and navigation			0.836	0.890	0.669
	EAV1	0.829			
	EAV2	0.825			
	EAV3	0.770			
	EAV4	0.845			
Cost-effectiveness			0.854	0.901	0.696
	CE1	0.835			
	CE2	0.792			
	CE3	0.867			
	CE4	0.839			
Online education system			0.887	0.917	0.689
	OES1	0.858			
	OES2	0.812			
	OES3	0.808			
	OES4	0.820			
	OES5	0.852			

Notes: a Average variance extracted (AVE) = (summation of the square of the factor loadings) / {(summation of the square of the factor loadings) + (summation of the error variances)}.

b Composite reliability (CR) = (square of the summation of the factor loadings) / {(square of the summation of the factor loadings) + (square of the summation of the error variances)}.

Source: Output from SmartPLS (PLS algorithm)

- *Measurement of the reliability (construct level):* The internal consistency was assessed using Cronbach's alpha values and composite reliability. Cronbach's alpha values between 0.70 and 0.90 range from satisfactory to good. Values of 0.95 and higher are problematic, as they indicate that the items are unnecessary, thereby reducing construct validity (Diamantopoulos et al., 2012). The minimum cut-off value suggested is 0.60 (Cronbach, 1951). Cronbach's alpha (α) ranged from 0.751 to 0.887, all-surpassing the minimum limit of 0.70. Composite reliability was higher than recommended, '0.70 value' (Nunnally, 1994). CR ranged from 0.842 to 0.917, all exceeding the minimum limit of 0.70. When the reliability result is more than 0.7, it means the questions are reliable and valid (Malhotra and Birkas, 2007). So, all the requirements are fulfilled.
- *Measurement of the validity (convergent validity):* The average variance extracted (AVE) was higher than 0.5 (Fornell and Larcker, 1981) assuring convergent validity. It also shows that each hypothesis can explain more than half the variance for its measuring items. AVE estimates ranged from 0.571 to 0.707, all exceeding the suggested minimum limit of 0.50.

4.3 Measurement of the validity (discriminant validity)

To assess discriminant validity, the Fornell Larcker criterion and heterotrait-monotrait (HTMT) ratio criterion were evaluated. It showed that all diagonal numbers were larger than the corresponding off-diagonal numbers, indicating adequate discriminant validity. Discriminant validity was supported, as the square root of the AVE was higher than the shared variance among the constructs (Fornell and Larcker, 1981). In Table 3, all the diagonals are higher than the off-diagonal. According to Henseler et al. (2015), the HTMT ratio ranges below 0.85. Table 4 also shows that all values of HTMT are lower than the threshold of 0.85, fulfilling the condition of HTMT.

Table 3 Discriminant validity-Fornell-Larcker criterion

	CL	*C*	*CE*	*EAN*	*EP*	*OES*
CL	*0.756*					
C	0.445	*0.823*				
CE	0.524	0.496	*0.834*			
EAN	0.472	0.316	0.531	*0.818*		
EP	0.541	0.439	0.681	0.649	*0.841*	
OES	0.600	0.671	0.655	0.563	0.669	*0.830*

Notes: The off-diagonal values in the above matrix are the square correlations between the latent constructs and italic scores (diagonal) are AVEs.

Source: Output from SmartPLS (PLS algorithm)

4.4 Assessing structural equation model

The measurement model was assessed and established; the second step was to assess the structural relationship. The structural model has been assessed as shown in Table 5. Path coefficient (structural relationships), t-statistics, and the values of R^2 for endogenous

variables to assess the structural equation model (Hair et al., 2013). In addition to the assessment of the size of the path coefficients, their significance was obtained using the bootstrapping procedure with 5,000 subsamples.

Table 4 Discriminant validity – HTMT ratio

	CL	*C*	*CE*	*EAN*	*EP*	*OES*
CL						
C	0.554					
CE	0.649	0.581				
EAN	0.574	0.364	0.624			
EP	0.667	0.509	0.793	0.757		
OES	0.724	0.766	0.750	0.643	0.762	

Source: Output from SmartPLS (PLS algorithm)

Path coefficient values are standardised in a range from –1 to +1 (Helm et al., 2010). Table 5 shows that all the values fulfil the requirements. Thus, the path coefficient for convenience, ease of participation, computer literacy, ease of access and navigation, and cost-effectiveness is 0.380, 0.212, 0.165, 0.142, and 0.160 respectively. In other words, for each unit increase in convenience, the effectiveness of online education will also increase by 0.380 units. Also, if there is an enhancement in each unit of ease of participation, the effectiveness of online education will increase by 0.212 units. In addition, for each unit increase in computer literacy, there is an increase of 0.165 in the effectiveness of online education. Again, for each unit increase in ease of access and navigation, the effectiveness of online education will also increase by 0.142 units. Lastly, if there is an increase in each unit of cost-effectiveness, the effectiveness of online education will also increase by 0.160 units. By analysing the path coefficient, it shows that convenience is the most influential and significant variable of the online education system since this variable gets the highest path coefficient of 0.380. Besides, the t-test is one of many tests used for hypothesis testing in statistics. All the independent variable's t-test value is more than 1.96, which are respectively 7.269, 3.594, 2.936, 3.825 and 3.201. Based on Table 5, it could find that convenience, ease of participation, computer literacy, ease of access and navigation, and cost-effectiveness have a significant positive relationship with the effectiveness of the online education system. This is because their P-value are lower than 0.05 which are 0.000, 0.000, 0.003, 0.000 and 0.001 respectively. The biggest benefit of the online education system is convenience, followed by ease of access and navigation, ease of participation, cost-effectiveness, and computer literacy.

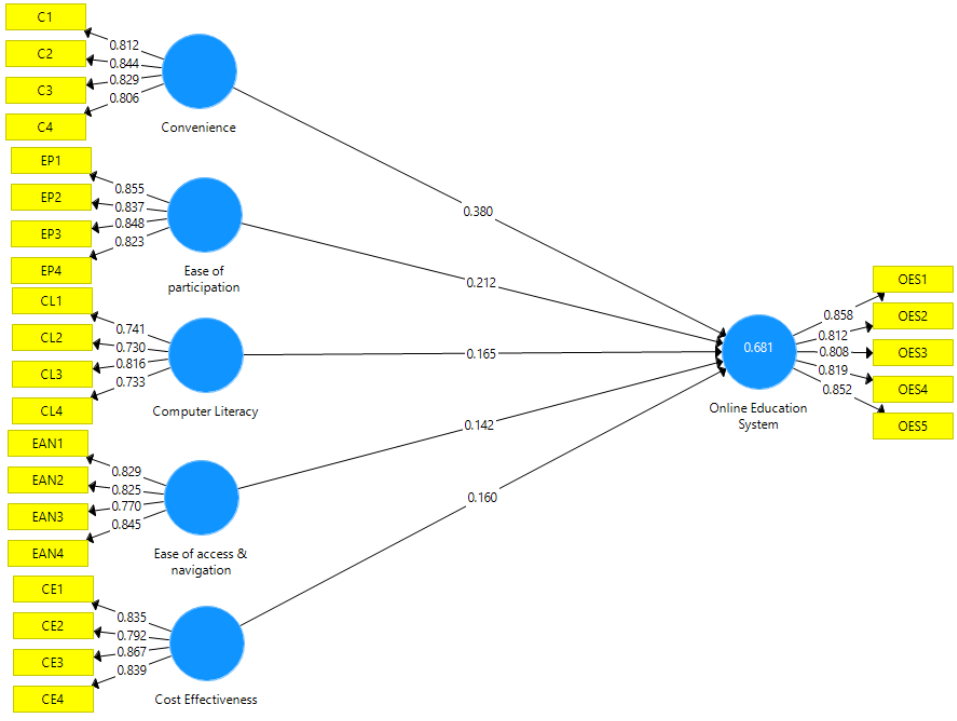
The R^2 value of 0.681 is higher than the 0.26 value that Cohen (1988) suggested would indicate an authentic model. Moreover, R^2 is 0.681 which means that there is about 68.1% of the dependent variable (online education system) can be explained by five independent variables (convenience, ease of participation, computer literacy, ease of access and navigation, and cost-effectiveness). According to Hair et al. (2013) and Henseler et al. (2015) a 'rough' rule of thumb regarding an acceptable R^2, with 0.75, 0.50, and 0.25, respectively, describes substantial, moderate, or weak levels of predictive accuracy. The results of this study suggested that the model describes the most prominent impact on the online education system by the independent variable.

Table 5 Result of hypothesis testing and structural relationships

Hypothesis		*Path coefficient (–1 to +1)*	*t value (>1.96)*	*Significance level (≤0.05)*
H_1	C-OES	0.380	7.269	0.000
H_2	EP-OES	0.212	3.594	0.000
H_3	CL-OES	0.165	2.936	0.003
H_4	EAN-OES	0.142	3.825	0.000
H_5	CE-OES	0.160	3.201	0.001

Source: Output from SmartPLS (bootstrapping)

Figure 2 Measurement and structural model by Smart-PLS (see online version for colours)



The results of the hypothesis testing and structural relationships exhibit that, the significance value of each independent variable: convenience (0.000), ease of participation (0.000), computer literacy (0.003), ease of access and navigation (0.000), and cost-effectiveness (0.001) is below the p-value of 0.05. It gives enough evidence that there is a positive relationship between convenience, ease of participation, computer literacy, ease of access and navigation, cost-effectiveness, and the effectiveness of the online education system. Therefore, hypotheses: H_1, H_2, H_3, H_4 and H_5 are accepted.

The findings of studies conducted by Hussein and Hilmi (2021), Kupczynski et al. (2012) and Benbunan-Fich and Hiltz (2003) likewise confirmed the conclusion of H_1. Researchers by Nikou and Maslov (2021) and Chen and Tseng (2012) also supported the findings of H_2. Results of the analysis support this Hypothesis H_3 as proved in the past performed by Yustika and Iswati (2020), Li and Lee (2016) and Prior et al. (2016). The

outcome of H_4 was also supported by researchers performed by Volery and Lord (2000), Malanga et al. (2022) and Peterson et al. (2007). H_5 is supported in the study as proved by the studies performed by Singh et al. (2021) and Lee et al. (2009).

4.5 Discussion

Following analysis, it was discovered that the online education system is significantly benefited from convenience, ease of use, computer literacy, ease of access and navigation, and cost-effectiveness characteristics. The results showed that convenience had a significant value of 0.000, less than the p-value of 0.05. Students who take part in the online education system can take charge of their education and progress at their own rate. Online learning gives students greater control over their learning environment by letting them choose from a variety of options and resources. Connecting with professors online enables students from all walks of life to access education, including working adults, service members, seniors, and students with impairments. With a significant value of 0.000, which is less than the p-value of 0.05, the ease of participation was supported. Respondents believe that online education best fits their learning style because it gives them more time to think over their answers before answering questions and enables them to communicate with peers they might not get along with in a social setting. One of the biggest advantages of the online education system is how simple it is to take part. In an asynchronous setting, student interaction is encouraged even though this would not be the case in a face-to-face class since there is no predetermined time to send messages, read and respond to messages, reflect on responses, amend interpretations, and adjust initial impressions. Since the significant value for this variable is 0.003, which is less than 0.05, there is a substantial positive relationship between computer literacy and the online education system. Computer literacy may also aid in the development of new skills. The research revealed that computer knowledge and proficiency are a prerequisite for online learning programs. Students with better grades and more positive attitudes regarding technology spend more time online and utilising computers. Despite the fact that computer proficiency is a necessary prerequisite for online learning courses, neither gender nor age group appeared to differ from one another. A significant value of 0.000, which is less than the p-value of 0.05, was used to support the ease of access and navigation. This suggests that the effectiveness of the online education system is significantly influenced by how simple it is to access and navigate. A good internet connection enables users to readily access the system, including the login process and course content. Participants are being attracted to convenient internet access because of the features like the use of several platforms, a rapid login process, speedy downloads, and proper text usage. Since the significant value of this variable is lower than 0.001 and is less than 0.05, there is a substantial positive relationship between cost-effectiveness and the online education system. Online programs incur little to no expense for classroom space, travel, and necessary personnel. Nearly everyone will be impacted by this new approach to learning.

5 Implications

5.1 Theoretical implications

A significant technological advancement, affecting not only societies in general, but also the education sector in a particular way. Educational institutions have to use the internet for teaching and develop online delivery strategies. Different scholars use those five factors in their different studies. In this study, researchers explored the cumulative impact of five variables to enhance the effectiveness of the online education system. Based on those researchers developed a model that convenience, ease of participation, computer literacy, ease of access and navigation, and cost-effectiveness have a significant positive impact to increase the effectiveness of the online education system.

5.2 Managerial implications

Day by day, the use of online education is increasing and it is facilitating the activities of our daily life. The research paper yields several managerial implications for the course facilitators, administrators, and learners. The above findings exhibit, that convenience is facilitating the effectiveness of the online education system. Convenience minimises geographic constraints and saves energy and effort for instructors and learners, it is also supported by Hussein and Hilmi (2021), Kupczynski et al. (2012) and Benbunan-Fich and Hiltz (2003). Tomar and Daruwala (2022) also researched on empirical benefits of going online and identified it ensures higher convenience for professionals as well. Online lectures can be recorded, archived, and shared for the future. Ease of participation has a significant positive relationship to enhance the effectiveness of the online education system. Introverted students can easily participate in online classes and enjoy the lectures. Nikou and Maslov (2021) and Chen and Tseng (2012) also supported that online education system makes it feasible for the students to participate from anywhere anytime. Computer literacy has a positive connection with the online education system. A high level of computer literacy is a prerequisite for educators and learners to participate in online classes. If students do not have any experience using technologies to interact with teachers, friends, and other classmates they cannot efficiently respond in online classes. Yustika and Iswati (2020), Li and Lee (2016) and Prior et al. (2016) also reported a noticeable implication of computer literacy on online learning. Ease of access and navigation has a positive relationship with the online education system. The ease of navigation requires a strong internet connection and it is necessary for participants' smooth login, session joining, and quick access to relevant class contents, scholars Volery and Lord (2000), Malanga et al. (2022) and Peterson et al. (2007) highlighted that implication in their studies. Cost-effectiveness in online learning is the fact that it facilitates saving transportation costs and staff-related and institutional expenses. Singh et al. (2021) and Lee et al. (2009) emphasised the cost effectiveness in case of online education. These factors have positive implications e-learning thus contributing to new path of sustainable higher education and sustainable development. Azeiteiro and Davim (2021) also highlighted that e-learning facilitates the role of universities in sustainable development and sustainability in higher education. Transformation to going online education has long-term implications for improving continuous learning practice, thus

affecting all stakeholders during and post-COVID situation also supported that implication.

6 Conclusions, limitations and future research

6.1 Conclusions

One of the major implications of the creation of the internet is online education. This allows users to receive information and education utilising both asynchronous and synchronous approaches to address the requirement for quick acquisition of up-to-date knowledge. The study sought to highlight the factors affecting the effectiveness of online education and a comprehensive model is used to cover a wide range of areas in that regard. Travel effort, time and place flexibility, structured information, speedy and instant feedback are the major affecting components enhancing the effectiveness of online education. Other factors such as easy navigation, cost-effectiveness, ease of participation and computer literacy are also aiding as contributing factors to enhance the effectiveness of online education. To deliver content, online education makes use of electronic information and communication technology. The COVID-19 epidemic has had a huge influence on education, requiring instructors to adopt new techniques and advancements. Traditional face-to-face lectures are now less accessible, which has an impact on students from less affluent households and those who are on a tight budget. The digital divide can cause inequality disparities to grow. The epidemic has helped children learn how to solve problems and exercise critical thinking and adaptation. In order to prioritise these talents, educational institutions must develop resilience. The availability of live lectures, webinars, video chats, and meetings thanks to tools like Zoom has boosted online learning. Throughout lockdowns and remote work, these tools support maintaining connectivity. For staff and students to be able to cope with social exclusion in situations of new or repeated pandemics, further research on creative teaching and communication techniques is required.

A computer-based operating network, a systematised feedback system, internet international websites, video and audio conferencing, and computer-assisted training are all examples of how these skills are put to use. To grow used to the online course, e-learners appeared to require previous training, notably in ICT abilities. Teachers can use online education to personalise lesson content and they can also provide extra resources in a wide range of technology formats to assist learners in better understanding course themes in their own way. Online students can also take a range of other examinations to determine their level, and choose from a variety of interest-specific possibilities. However, the social repercussions of online learning may have to be addressed separately and in more depth in order to fully appreciate the contrasts between online and conventional classrooms.

6.2 Limitations and future research

As to prior studies, the study is not without limitations. Throughout the progress of conducting this study, there are some limitations. Firstly, we are not shielded from the common limitations of literature analysis. There is a lack of potential additional knowledge in practitioner books and magazines. Online data collection may have the

disadvantages of data errors, unavailable technology, and other technical issues. Respondent biasness might occur as the convenience sampling method is used. As this is explanatory research, it could not identify the cause behind the described phenomenon. Lastly, the data collection of the survey also suffered from time limitations.

Consequently, to improve the quality of this study in the future, there are some guidelines by the researcher to overcome the limitations that are helpful for future researchers. Further research should use large, representative samples, using probabilistic sampling methods to confirm or refute this study's findings. Using these methods could increase the reliability, validity, consistency, and accuracy of the research. Future research concerns the influence of other significant factors on the effectiveness of the online education system using multiple physical and virtual communities to collect data.

References

Alawamleh, M., Al-Twait, L.M. and Al-Saht, G.R. (2020) 'The effect of online learning on communication between instructors and students during COVID-19 pandemic', *Asian Education and Development Studies*, Vol. 11, No. 2, pp.380–400.

Alberth, N., Wiramihardja, E. and Uden, L. (2020) 'WhatsApp with English language teaching some practical ideas and strategies', *International Journal of Technology Enhanced Learning*, Vol. 12, No. 3, p.262, DOI: 10.1504/ijtel.2020.10027925.

Allday, C.M. and Allday, R. (2011) 'Effects of pacing options on final grades of students with disabilities in virtual high school', *Quarterly Review of Distance Education*, Vol. 12, No. 4, pp.223–234.

Anderson, C.L. and Petch-Hogan, B. (2001) 'The impact of technology use in special education field experience on preservice teachers' perceived technology expertise', *Journal of Special Education Technology*, Vol. 16, No. 3, pp.27–39.

Azeiteiro, U.M. and Davim, J.P. (2021) *In Higher Education and Sustainability: Opportunities and Challenges for Achieving Sustainable Development Goals*, Essay, CRC Press, Boca Raton.

Baleni, Z.G. (2015) 'Online formative assessment in higher education: Its pros and cons', *Electronic Journal of e-Learning*, Vol. 13, Vol. 4, pp.228–236.

Barri, M. (2020) 'What makes web-enhanced learning successful: four key elements', *International Journal of Technology Enhanced Learning*, Vol. 12, No. 4, p.426, DOI: 10.1504/ijtel.2020.110051.

Basilaia, G., Dgebuadze, M., Kantaria, M. and Chokhonelidze, G. (2020) 'Replacing the classic learning form at universities as an immediate response to the COVID-19 virus infection in Georgia', *International Journal for Research in Applied Science and Engineering Technology*, Vol. 8, No. 3, pp.101–108.

Bayrak, F. (2022) 'Associations between university students' online learning preferences, readiness, and satisfaction', *Knowledge Management & E-Learning*, Vol. 14, No. 2, pp.186–201.

Benbunan-Fich, R. and Hiltz, S.R. (2003) 'Mediators of the effectiveness of online courses', *IEEE Transactions on Professional Communication*, Vol. 46, No. 4, pp.298–312.

Bienkowski, M., Feng, M. and Means, B. (2012) *Enhancing Teaching and Learning through Educational Data Mining and Learning Analytics: An Issue Brief*, SRI International, Washington, DC.

Brocato, B.R., Bonanno, A. and Ulbig, S. (2015) 'Student perceptions and instructional evaluations: a multivariate analysis of online and face-to-face classroom settings', *Education and Information Technologies*, Vol. 20, No. 1, pp.37–55, http://dx.doi.org/10.1007/s10639-013-9268-6.

Brookfield, S. (1984) 'Self-directed learning: a critical paradigm', *Adult Education Quarterly*, Vol. 35, No. 2, pp.59–71, DOI: 10.1177/0001848184035002001.

Candy, P.C. (1991) *Self-direction for Lifelong Learning: A Comprehensive Guide to Theory and Practice*, Jossey-Bass, San Francisco.

Carnahan, C. and Fulton, L. (2013) 'Virtually forgotten: special education students in cyber schools', *TechTrends*, Vol. 57, No. 4, pp.46–52.

Castro, M., Africa, L.R., Clara, P.M., Colmenar, A., Mora, C. and Yeves, F. (2001) 'Examples of distance learning projects in the European community', *IEEE Transactions on Education*, Vol. 44, pp.406–411, http://dx.doi.org/10.1109/13.965791.

Cavanaugh, C. (2009) 'Effectiveness of cyber charter schools: a review of research on learnings', *TechTrends: Linking Research & Practice to Improve Learning*, Vol. 53, No. 4, pp.28–31.

Chen, H.R. and Tseng, H.F. (2012) 'Factors that influence acceptance of web-based e-learning systems for the in-service education of junior high school teachers in Taiwan', *Evaluation and Program Planning*, Vol. 35, No. 3, pp.398–406.

Cohen, J. (1988) *Statistical Power Analysis for the Behavioral Sciences*, L. Erlbaum Associates, Hillsdale, NJ.

Cojocariu, V-M., Lazar, I., Nedeff, V. and Lazar, G. (2014) 'SWOT analysis of e-learning educational services from the perspective of their beneficiaries', *Procedia-Social and Behavioral Sciences*, Vol. 116, No. 2014, pp.1999–2003, DOI: 10.1016/j.sbspro.2014.01.510.

Cornford, J. and Pollock, N. (2003) *Putting the University Online: Information, Technology and Organizational Change*, Routledge Customer Service, 10650 Toebben Drive, Independence, KY 41051 (hardback: ISBN-0-3352-1006-6, $95; paperback: ISBN-0-3352-1005-8, $30.95).

Cronbach, L.J. (1951) 'Coefficient alpha and the internal structure of tests', *Psychometrika*, Vol. 16, No. 3, pp.297–334.

Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P. and Kaiser, S. (2012) 'Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective', *Journal of the Academy of Marketing Science*, Vol. 40, No. 3, pp.434–449.

Duncan, N.C. (1993) 'Evaluation of instructional software: design considerations and recommendations', *Behavioral Research Methods, Instruments & Computers*, Vol. 23, No. 2,, pp.324–327, DOI: 10.3758/bf03204501.

Euzent, P., Martin, T., Moskal, P. and Moskal, P.D. (2011) 'Assessing student performance and perceptions in lecture capture vs. face-to-face course delivery', *Journal of Information Technology Education: Research*, Vol. 10, No. 1, pp.295–307.

Favale, T., Soro, F., Trevisan, M., Drago, I. and Mellia, M. (2020) 'Campus traffic and eLearning during COVID-19 pandemic', *Computer Networks*, Vol. 176, No. 2020, p.107290.

Fedynich, L.V. (2013) 'Teaching beyond the classroom walls: the pros and cons of cyber learning', *Journal of Instructional Pedagogies*, Vol. 13, No. 1, pp.1–7.

Fornell, C.G. and Larcker, D.F. (1981) 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of Marketing Research*, Vol. 18, No. 1, pp.39–50.

Garnham, C. and Kaleta, R. (2002) 'Introduction to hybrid courses', *Teaching with Technology Today*, Vol. 8, No. 6, pp.1–5.

Grow, G. (1991) 'Teaching learners to be self-directed: a stage approach', *Adult Education Quarterly*, Vol. 41, No. 3, pp.125–149.

Gurukkal, R. (2020) 'Will COVID 19 turn higher education into another mode?', *Higher Education for the Future*, Vol. 7, No. 2, pp.89–96.

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2013) 'Partial least squares structural equation modeling: rigorous applications, better results and higher acceptance', *Long Range Planning*, Vol. 46, Nos. 1–2, pp.1–12.

Harrington, D. (1999) 'Teaching statistics: a comparison of traditional classroom and programmed instruction/distance learning approaches', *Journal of Social Work Education*, Vol. 35, No. 3, pp.343–352.

Harrison, R. (1978) 'How to design and conduct self-directed learning experiences', *Group and Organization Studies*, Vol. 3, No. 2, pp.149–167.

Hartley, K. and Bendixen, L.D. (2001) 'Educational research in the internet age: examining the role of individual characteristics', *Educational Researcher*, Vol. 30, No. 9, pp.22–26.

Helm, S., Eggert, A. and Garnefeld, I. (2010) 'Modeling the impact of corporate reputation on customer satisfaction and loyalty using partial least squares', in *Handbook of Partial Least Squares*, pp.515–534, Springer, Berlin, Heidelberg.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015) 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy of Marketing Science*, Vol. 43, No. 1, pp.115–135.

Hjeltnes, T.A. and Hansson, B. (2005) 'Cost effectiveness and cost efficiency in e-learning', *QUIS – Quality, Interoperability and Standards in E-Learning*, Norway.

Hussein, L.A. and Hilmi, M.F. (2021) 'The influence of convenience on the usage of learning management system', *Electronic Journal of e-Learning*, Vol. 19, No. 6, pp.504–515.

Isaias, P. and Issa, T. (2013) 'E-learning and sustainability in higher education: an international case study', *The International Journal of Learning in Higher Education*, Vol. 20, No. 4, pp.77–90.

Jaggars, S.S. and Fletcher, J. (2014) *Redesigning the Student Intake and Information Provision Processes at a Large Comprehensive Community College*, CCRC Working Paper No. 72.

Jayasuriya, R. and Chapman, R. (1997) 'Computerized information systems in community nursing: factors related to computer skills and computer training', *Informatics in Healthcare Australia*, Vol. 6, No. 5, pp.191–196.

Jingyu, L. (2014) 'Pros and cons: web-based education', in *International Conference on Education, Management and Computing Technology*, pp.459–461.

Jou, M. and Wu, Y.S. (2012) 'Development of a web-based system to support self-directed learning of micro-fabrication, technologies', *Educational Technology & Society*, Vol. 15, No. 4, pp.205–213.

Kemeny, J. and Kurtz, T.E. (1967) 'Dartmouth time sharing', *Science*, Vol. 162, No. 3850, pp.223–238.

Khan, M.M., Rahman, S.T. and Islam, S.T.A. (2021) 'Online education system in Bangladesh during COVID-19 pandemic', *Creative Education*, Vol. 12, No. 2, pp.441–452.

Khlaisang, J. (2017) 'Proposing a new pedagogy-based website design: a usability test with lifelong learners', *Education and Information Technologies*, Vol. 22, No. 4, pp.1713–1735, DOI: 10.1007/s10639-016-9514-9.

Kirby, D., Sharpe, D., Bourgeois, M. and Greene, M. (2010) 'Graduates of the new learning environment: a follow-up study of high school distance e-learners', *Quarterly Review of Distance Education*, Vol. 11, No. 3, pp.161–173.

Kummitha, H., Kolloju, N., Chittoor, P. and Madepalli, V. (2021) 'Coronavirus disease 2019 and its effect on teaching and learning process in the higher educational institutions', *Higher Education for the Future*, Vol. 8,. No. 1, pp.90–107.

Kupczynski, L., Brown, M. and Davis, R. (2008) 'The impact of instructor and student interaction in internet-based courses', *Journal of Instruction Delivery Systems*, Vol. 22, No. 1, pp.6–11.

Kupczynski, L., Mundy, M.A., Goswami, J. and Meling, V. (2012) 'Cooperative learning in distance learning: a mixed methods study', *International Journal of Instruction*, Vol. 5, No. 2, pp.81–90.

Lai, C.Y. (2002) *A Study on Teachers' Computer Literacy on Industrial Vocational High School in Taiwan*, Unpublished Master's thesis, National Changhua University of Education, Changhua, Taiwan.

Lambert, M.E. and Lenthall, G. (1989) 'Effects of psychology courseware use on computer anxiety in students', *Computers in Human Behavior*, Vol. 5, No. 3, pp.207–214.

Lee, B.C., Yoon, J.O. and Lee, I. (2009) 'Learners' acceptance of e-learning in South Korea: theories and results', *Computers & Education*, Vol. 53, No. 4, pp.1320–1329.

Li, L.Y. and Lee, L.Y. (2016) 'Computer literacy and online learning attitude toward GSOE students in distance education programs', *Higher Education Studies*, Vol. 6, No. 3, pp.147–156.

Liefeld, J.P. and Herrmann, T.F. (1990) 'Learning consequences for university students using computerized mastery testing', *Educational Technology, Research & Development*, Vol. 38, No. 2, pp.19–25.

Liu, J. (2014) 'Pros and cons: web based education', in *2014 International Conference on Education, Management and Computing Technology (ICEMCT-14)*, Atlantis Press, June, pp.459–461.

Mahanta, D. and Ahmed, M. (2012) 'E-learning objectives, methodologies, tools and its limitation', *International Journal of Innovative Technology and Exploring Engineering*, Vol. 2, No. 1, pp.46–51.

Malanga, A.C.M., Bernardes, R.C., Borini, F.M., Pereira, R.M. and Rossetto, D.E. (2022) 'Towards integrating quality in theoretical models of acceptance: an extended proposed model applied to e-learning services', *British Journal of Educational Technology*, Vol. 53, No. 1, pp.8–22.

Malhotra, N.K. and Birks, D.F. (2007) *Marketing Research: An Applied Approach*, Pearson Education Limited, Harlow.

Marks, R.B., Sibley, S.D. and Arbaugh, J.B. (2005) 'A structural equation model of predictors for effective online learning', *Journal of Management Education*, Vol. 29, No. 4, pp.531–563.

McBrien, J.L., Cheng, R. and Jones, P. (2009) 'Virtual spaces: employing a synchronous online classroom to facilitate student engagement in online learning', *The International Review of Research in Open and Distributed Learning*, Vol. 10, No. 3, pp.1–17.

Means, B., Toyama, Y., Murphy, R., Bakia, M. and Jones, K. (2009) *Evaluation of Evidence-based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies*, US Department of Education [online] http://www.ed.gov/about/offices/list/opepd/ppss/reports.html (accessed 3 April 2023).

Merriam, S.B. and Caffarella, R.S. (1999) *Learning in Adulthood*, Jossey-Bass, San Francisco.

Moore, M. (1990) 'Recent contributions to the theory of distance education', *Open Learning: The Journal of Open, Distance and e-Learning*, Vol. 5, No. 3, pp.10–15.

Morrison, G.R., Ross, S.M. and Kemp, J.E. (2007) *Designing Effective Instruction*, 5th ed., Wiley and Sons, Hoboken, New Jersey.

Murphy, E., Rodrıguez-Manzanares, M. and Barbour, M. (2011) 'Asynchronous and synchronous online teaching: perspectives of Canadian high school distance education teachers', *British Journal of Educational Technology*, Vol. 42, No. 4, pp.583–591.

Ng, K.C. (2000) 'Costs and effectiveness of online courses in distance education', *Open Learning: The Journal of Open, Distance and e-Learning*, Vol. 15, No. 3, pp.301–308.

Nikou, S. and Maslov, I. (2021) 'An analysis of students' perspectives on e-learning participation – the case of COVID-19 pandemic', *The International Journal of Information and Learning Technology*, Vol. 38, No. 3, pp.299–315.

Ntshwarang, P., Malinga, T. and Losike-Sedimo, N. (2021) 'eLearning tools at the University of Botswana: relevance and use under COVID-19 crisis', *Higher Education for the Future*, Vol. 8, No. 1, pp.142–154.

Nunnally, J.C. (1994) *Psychometric Theory*, 3rd ed., Tata McGraw-Hill Education, New Delhi.

Ogbodoakum, N., Ayub, A.F.M. and Abiddin, N.Z. (2022) 'The influence of individual and organizational factors on readiness to accept online learning among higher education lecturers in Nigeria', *Knowledge Management & E-Learning*, Vol. 14, No. 3, pp.304–328, https://doi.org/10.34105/j.kmel.2022.14.017.

Olson, P.W. (2005) 'Significant success factors in distance education', *International Journal of Case Method Research & Application*, Vol. 17, No. 2, pp.235–245.

Parker, A. (2003) 'Identifying predictors of academic persistence in distance education', *Journal of the United States Distance Learning Association*, Vol. 17, No. 1, pp.55–62.

Parsad, B., Lewis, L. and Tice, P. (2008) *Distance Education at Degree-Granting Postsecondary Institutions: 2006–2007*, National Center for Education Statistics Institute of Education Sciences, Washington DC.

Peterson, D., Kaakko, T., Smart, E., Jorgenson, M. and Herzog, C. (2007) 'Dental students attitudes regarding online education in pediatric dentistry', *Journal of Dentistry for Children*, Vol. 74, No. 1, pp.10–20.

Poehlein, G.W. (1996) 'Universities and information technologies for instructional programs: issues and potential impacts', *Technology Analysis & Strategic Management*, Vol. 8, No. 3, pp.283–290.

Pokhrel, S. and Chhetri, R. (2021) 'A literature review on impact of COVID-19 pandemic on teaching and learning', *Higher Education for the Future*, Vol. 8, No. 1, pp.133–141.

Prior, D.D., Mazanov, J., Meacheam, D., Heaslip, G. and Hanson, J. (2016) 'Attitude, digital literacy and self efficacy: flow-on effects for online learning behavior', *The Internet and Higher Education*, Vol. 29, No. 2016, pp.91–97.

Prvan, T., Reid, A. and Petocz, P. (2002) 'Statistical laboratories using Minitab, SPSS and Excel: a practical comparison', *Teaching Statistics*, Vol. 24, No. 2, pp.68–75.

Rahman, A. (2021) 'Using students' experience to derive effectiveness of COVID-19-lockdown-induced emergency online learning at undergraduate level: evidence from Assam, India', *Higher Education for the Future*, Vol. 8, No. 1, pp.71–89.

Ruiz, J.G., Mintzer, M.J. and Leipzig, R.M. (2006) 'The impact of e-learning in medical education', *Academic Medicine*, Vol. 81, No. 3, pp.207–212.

Schudde, L., Bradley, D. and Absher, C. (2018) *Ease of Access and Usefulness of Transfer Information on Community College Websites in Texas*, CCRC Working Paper No. 102 [online] https://academiccommons.columbia.edu/doi/10.7916/D8HX2VQH (accessed 18 March 2023).

Selim, H.M. (2007) 'Critical success factors for e-learning acceptance: confirmatory factor models', *Computers & Education*, Vol. 49, No. 2, pp.396–413.

Shephard, K. (2008) 'Higher education for sustainability: seeking affective learning outcomes', *International Journal of Sustainability in Higher Education*, Vol. 9, No. 1, pp.87–98.

Shih, Y.C.D. and Cifuentes, L. (2000) 'Online ESL learning: an authentic contact', *International Conference on Computers in Education/International Conference on Computer-Assisted Instruction*, 21–24 November, Taiwan

Singh, A., Sharma, S. and Paliwal, M. (2021) 'Adoption intention and effectiveness of digital collaboration platforms for online learning: the Indian students' perspective', *Interactive Technology and Smart Education*, Vol. 18, No. 4, pp.493–514.

Singh, M. (2021) 'Inroad of digital technology in education: age of digital classroom', *Higher Education for the Future*, Vol. 8, No. 1, pp.20–30.

Singh, V. and Thurman, A. (2019) 'How many ways can we define online learning? A systematic literature review of definitions of online learning (1988–2018)', *American Journal of Distance Education*, Vol. 33, No. 4, pp.289–306.

Spinelli, M.A. (2001) 'The use of technology in teaching business statistics', *Journal of Education for Business*, Vol. 77, No. 1, pp.41–45.

Thyer, B.A., Artelt, T., Markward, M.K. and Dozier, C.D. (1998) 'Evaluating distance learning in social work education: a replication study', *Journal of Social Work Education*, Vol. 34, No. 2, pp.291–295.

Tobias, S. (1987) 'Learner characteristics', in Gagne, R. (Eds.): *Instructional Technology: Foundations*, pp.207–231, Lawrance Erlbaoum, Hillsdale, NJ.

Tomar, R. and Daruwala, S. (2022) 'Is going online efficient? A comparative study of offline and online mode of working and learning during COVID-19', *International Journal of Higher Education and Sustainability*, Vol. 4, No. 2, pp.81–96.

Truluck, J. (2007) 'Establishing a mentoring plan for improving retention in online graduate degree programs', *Online Journal of Distance Learning Administration*, Vol. 10, No. 1, pp.1–6.

Truong, Y. and McColl, R. (2011) 'Intrinsic motivations, self-esteem, and luxury goods consumption', *Journal of Retailing and Consumer Services*, Vol. 18, No. 6, pp.555–561.

Ullah, O., Khan, W. and Khan, A. (2017) 'Students' attitude towards online learning at tertiary level', *PUTAJ – Humanities and Social Sciences*, Vol. 25, Nos. 1–2, pp.63–82.

Volery, T. (2001) 'Online education: an exploratory study into success factors', *Journal of Educational Computing Research*, Vol. 24, No. 1, pp.77–92.

Volery, T. and Lord, D. (2000) 'Critical success factors in online education', *International Journal of Educational Management*, Vol. 14, No. 5, pp.216–223.

Vonderwell, S. and Turner, S. (2005) 'Active learning and preservice teachers' experience in an online course: a case study', *Journal of Technology and Teacher Education*, Vol. 13, No. 1, pp.65–84.

Worthington Jr., E.L., Welsh, J.A., Archer, C.R., Mindes, E.J. and Forsyth, D.R. (1996) 'Computer-assisted instruction as a supplement to lectures in an introductory psychology class', *Teaching of Psychology*, Vol. 23, pp.175–181.

Yustika, G.P. and Iswati, S. (2020) 'Digital literacy in formal online education: a short review', *Dinamika Pendidikan*, Vol. 15, No. 1, pp.66–76.

Zinn, K.L. (2000) 'Computer-assisted learning and teaching', in *Encyclopedia of Computer Science*, pp.328–336, John Wiley and Sons Ltd., Chichester, UK [online] http://dl.acm.org/citation.cfm?id=1074100.1074248.