Journal of Social, Humanity, and Education (JSHE)
ISSN2746-623X, Vol 3, No 3, 2023, 197-218 https://doi.org/10.35912/jshe.v3i3.1294

E-learning Portal Success in higher education organizations: A multi-group comparison

Sanjoy Kumar Roy
General Education Department, City University, Dhaka, Bangladesh
mritojonmajoy@gmail.com

Article History
Received on 8 November 2022
1st Revision on 22 November 2022
2nd Revision on 23 November 2022
3rd Revision on 24 November 2022
Accepted on 5 December 2022

Abstract
Purpose: This study provides an analytical framework based on the literature to evaluate the effectiveness of E-learning portals. The study aims to contrast the accessibility of e-learning portals from the perspectives of business and engineering students.
Research methodology: Using convenience and snowball sampling methods with the help of Google polls, the data was acquired from 482 students, including engineering and business students. The study used a seven-point Likert-type questionnaire to gather data. The study employed PLS-SEM to do a multi-group analysis and examine group differences.
Results: The results revealed user satisfaction predicts the system used for both models. Only e-service quality is the significant predictor of user satisfaction and the system used in the business model, but the system and information qualities are also predictors in the engineering model. Finally, the success of an e-learning portal is positively correlated with user satisfaction and system use.
Limitations: This study consists of only a sample of 482 students. Future research may take into account using a bigger sample size. Additionally, this study mostly focused on how students perceived the efficacy of the e-learning portal while ignoring the viewpoints of the instructors and the institution, which may vary.
Contribution: Higher administration in Bangladeshi educational institutions will find the study helpful in building policies and plans for the growth of e-learning portals.
Novelty: This work validates the DeLone and McLean Model in the context of Bangladeshi undergraduate students. The study shows how business and engineering students' access to e-learning portals varies.
Keywords: *E-learning portal success; E-learning in higher education; Group difference; PLS-MGA; Bangladesh*
How to Cite: Roy, S. K. (2023). E-learning Portal Success in higher education organizations: A multi-group comparison. *Journal of Social, Humanity, and Education*, 3(3), 197-218.

1. Introduction

The COVID-19 epidemic has enforced the development of new policies and practices, which have significantly impacted the world (Amiri, Khademi, Khafri, Akbari, & Jangjoo, 2022; Şahin, Doğan, Okur, & Şahin, 2022). Education is one of the crucial areas where these techniques have had an enormous impact. To enable more than 1 billion learners whose schooling was affected by the pandemic to complete their education, teaching that was unable to be offered through conventional methods needs to be changed to online education (Hossain & Yasmin, 2022; Lowenthal, Borup, West, & Archambault, 2020). To guarantee that instruction can go without a hiccup and that it can be provided in a high-quality way, universities and colleges have made considerable expenditures (EDIG, 2022; Şahin et al., 2022). The crucial role that e-learning platforms, whose potency has long been acknowledged, must play has become abundantly apparent. In addition, it is underlined how essential it is for digital learning to use information technology efficiently, such as e-learning portals

(Şahin, Doğan, İlic, & Şahin, 2021; Shahzad, Hassan, Aremu, Hussain, & Lodhi, 2021; Shams, Niazi, Gul, Mei, & Khan, 2022). Various distance learning techniques have been employed throughout the pandemic to lessen the adverse effects on schooling, including television, radio, carrying study materials home, and online learning sites (Shams et al., 2022; Wargadinata, Maimunah, Eva, & Rofiq, 2020). Since the emergence of e-learning, where learning and teaching take part on online platforms, technology has been the essential lifeline for schooling globally.

Most colleges and universities worldwide provide online programs for on-campus and off-campus students throughout the epidemic. Several operational instructions for COVID-19 activities were released by the Ministry of Higher Education in Bangladesh. Following these criteria, various public and private universities began offering online classes in late April 2020. Following this online instruction, the study continued through October 2021. Several universities have provided blended learning to students since the reopening of the academic institutions. The author has emphasized considering the "study subject" while using technology and the online context for e-learning because there are disparities in their learning styles (Nasirun, Ramayah, Khalid, & Shahruddin, 2021). In earlier works, the D&M model was evaluated on the total populace (Al-Nuaimi, Al-Kabi, & Al-Emran, 2021; Şahin et al., 2021), including institutions like banks, colleges, as well as other financial institutions. Numerous studies have been conducted to compare male and female pupils in groups (Shahzad et al., 2021; Shams et al., 2022). Additionally, the majority of research examined the D&M model during the COVID-19 period (Al-Nuaimi et al., 2021; Shahzad et al., 2021; Shams et al., 2022). In the present study, the population is separated into business and engineering student groups to facilitate distinct conceptual contributions by dividing the population throughout the new normal era.

The research concentrated on business and engineering students' e-learning satisfaction and use of the e-learning system with a view to the success of Bangladeshi institutions' e-learning portals. Many researchers have asserted that students' happiness and frequent use of e-learning platforms substantially influence the success of e-learning portals (M. R. Khan & Roy, 2022; Selvaraj, 2019; Shahzad et al., 2021; Shams et al., 2022). This study concentrated on university students registered at Bangladeshi institutions using an e-learning portal to further their education. According to the argument made so far, there is still a deficit in the body of knowledge on the use of e-learning systems by higher education institutions in the wake of the Covid-19 epidemic and the subsequent closure of university education. The target of the current research work is to determine how user satisfaction (US) and e-learning system usage (SU) are affected by e-service quality (ESQ), information quality (IQ), and system quality (SQ), as well as how these factors affect the success of E-learning platforms. As a result, the study compares business and engineering students as a group using an e-learning platform.

2. Literature Review

2.1. A Novel Educational Paradigm: E-learning in Education

E-learning is now widely available across all subject areas because of the rapid development of technology, and students like its ease, adaptability, and personalized learning environment (Shahzad et al., 2021; Shams et al., 2022). Several concepts are used to exemplify the word "e-learning.". Using technology and the internet to offer education is known as e-learning (Aljawarneh, 2020). The majority of these words, including computer-mediated, web-based, blended, online, or open learning, relate to a technical tool associated with a system or network that makes teaching and learning possible at any time and any place (Shahzad et al., 2021; Shams et al., 2022). Online education has increased teaching-learning's inventiveness, adaptability, and independence (Shahzad et al., 2021; Shams et al., 2022). E-learning may be possible in synchronous or asynchronous settings utilizing a range of tools and technology, including computer networks, text, email, and global chat (Al-Maroof & Al-Emran, 2021; Shahzad et al., 2021). Synchronous online learning, which incorporates direct communication between lecturers and students during live lectures, makes an instantaneous response feasible. Educational resources are available on numerous platforms and discussion boards in asynchronous learning, which is flexible and student-centered. Asynchronous learning environments cannot accommodate real-time feedback or discussions (Hrastinski, 2008). The advantages and

restrictions of these two strategies rely on media affordances. In contrast to asynchronous learning, which allows for individual study, synchronous learning gives social connection (McBrien, Cheng, & Jones, 2009).

Planning carefully and investing much in assets are necessary for online learning. Additionally, students who study online require more help than those who learn in person (Shams et al., 2022). Online learning platforms allow teachers to provide students with little computer experience and additional instruction in developing their abilities (Shahzad et al., 2021; Sharma & Dogra, 2012). Even though it has been available for more than ten years, e-learning is still a novel technique for teaching and learning in literary works (Cojocariu, Lazar, Nedeff, & Lazar, 2014). The digitization of educational content was uncommon prior to the current pandemic. Only 20% of all nations had access to online learning tools in classrooms, while only 10% of all governments had online technologies outside classrooms (Dar & Jan, 2022; Portal, 2020). No global virtual learning curriculum was uniform and standardized (Shams et al., 2022).

However, institutions everywhere have made great efforts to switch to learning environments to guarantee that education continues in this challenging time (Al-Nuaimi et al., 2021; Shams et al., 2022). It's crucial to comprehend learners' viewpoints while establishing online learning platforms and integrating gateway and technology in accordance (Shams et al., 2022; Williams, Consalvo, Caplan, & Yee, 2009). Many students can participate in video conferencing on the perfect digital learning platforms, and there is room for immediate conversations with the learners. Any digital device may support materials, including recording lectures, enabling rapid feedback, and submitting assignments.

2.2. Online Education: An Essential Part of the Pandemic

The devastating COVID-19 outbreak led to a pandemic over the planet at the end of January 2020. When the illness spread widely, the entire world was placed under quarantine. Within a few days, more than 120 other countries stopped their educational institutions (Shahzad et al., 2021). Institutions were compelled to implement cutting-edge tools like Google Classroom, Zoom, Microsoft Teams, Facebook Live, and Webex Blackboard of this sudden transformation (Al-Nuaimi et al., 2021; Dignan, 2020; Roy, Chowdhury, Islam, & Siddique, 2021; Shahzad et al., 2021). The organizations in charge of online education, instructors, and students all had difficulties due to COVID-19. How schooling might continue under challenging conditions was one worry. The only good move was to convert to an online platform. Even though there are platforms for delivering education online, institutions must drastically change their teaching and learning practices for the online setting (Carey, 2020; Shahzad et al., 2021). There are three prerequisites for offering online courses: 1) Internet accessibility, 2) the knowledge and skills to utilize technology, and 3) the appropriate technological devices (Shams et al., 2022).

Unfortunately, although online learning has been the most fantastic and only option for conventional learning during the COVID-19 crisis, numerous countries still cannot modernize their educational institutions (Shahzad et al., 2021; Shams et al., 2022). According to statistics, 706 million students worldwide do not have internet connectivity, and more than 56 million do not have broadband connectivity. This learning leaves 826 million students without access to technology (UNESCO, 2020). Numerous higher education institutions in Bangladesh have realized the usefulness of online learning environments as a crucial teaching tool to ensure the continuation of learning during the COVID-19 shutdown. Numerous students were able to complete their education thanks to the shift to online instruction, although Bangladesh still faces many obstacles (Humida, Al Mamun, & Keikhosrokiani, 2022). The inaccessibility to dependable internet connections, power outages, a shortage of digital devices, a lack of educated lecturers, system use, the layout of learning management system designs, and pupil acceptance of technology are a few of the problems (Humida et al., 2022).

It is necessary to monitor information systems (IS) performance effectively and practically in order to fully appreciate the value of expenditures made in course development and delivery as well as its impacts. IS success is multidimensional, evaluated by multiple levels, and influenced by several

circumstances. According to (Hellstén & Markova, 2006), measuring IS success is crucial. One of these factors is the "topic or subject matter," which significantly influences the success of IS (Ashari, Abbas, Abdul-Talib, & Mohd Zamani, 2021; S. H. Chowdhury, Roy, Arafin, & Siddiquee, 2019; Nasirun et al., 2021). Business and non-business students were shown to have different levels of satisfaction concerning IS success in terms of the trust, engagement, information processing, interaction, and utilization (Nasirun et al., 2021). Given these contrasts, the present study employed the IS success model of DeLone and McLean (2003) to examine how business and engineering students used the system and how satisfied they were with it, as well as how these factors affected their performance in the ELP. The academic will study the success of ELP in the meanwhile to understand how Bangladeshi students see it from the viewpoints of business and engineering.

2.3. An important Model for assessing IS success: DeLone and McLean Model

In order to gauge many aspects of IS performance, DeLone and McLean developed IS success model. In 1992, the D&M model was established. Initial research on information systems, communications, and output categorization served as the foundation for the concept. Then, based on the findings of several scholars, as stated by Hellstén and Markova (2006), it was determined that the six vital interdependent characteristics of IS effectiveness were individual impact, information quality, organizational impact, system quality, system usage, and user satisfaction. The primitive researchers improved their work ten years later in response to the backlash from academics in this field. In order to account for service quality factors, as a result, DeLone and McLean revised their model. To expand the implications of IS to sectors, communities, and nations, they substituted net benefits for the personal and collective impact (DeLone & McLean, 2003). According to Cornelius (2002) communication construct, the technological level of communication generally relates to the effectiveness and precision of the communication network, the semantic phase is concerned with communicating the message's intended meaning, and the potency level deals with the consequence of the information on the receiver (Mohammadi, 2015). Figure 1 below shows the six-dimensional D&M model.

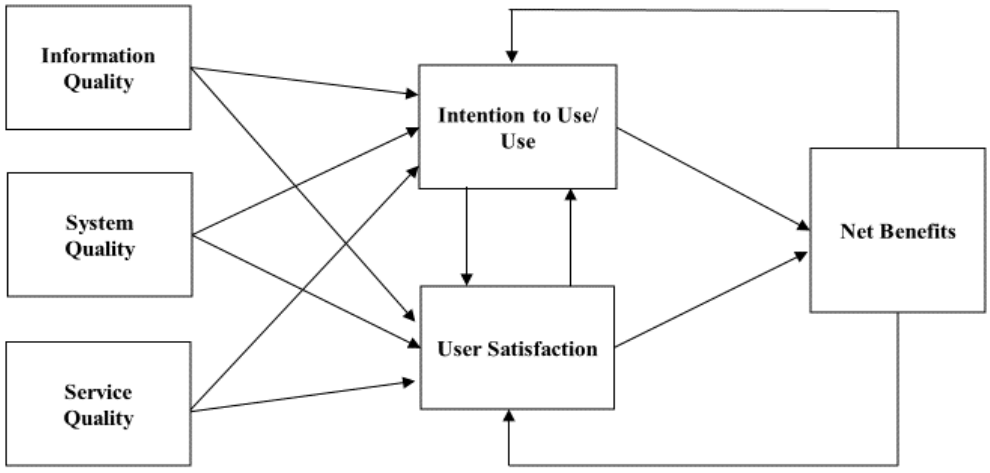

Figure 1. Updated DeLone and McLean Model (D&MISSM)
Source: Delone and McLean (2003)

In this paradigm, the "system quality" component stands for technological accomplishment. As opposed to this, the "Information quality" indicator exhibits "semantic success." The four remaining factors, "use," "user satisfaction," "individual impact," and "organizational impact," however, demonstrate "effectiveness success."

The D&M model was revised to take into account the feedback and suggestions from several academics. This framework is one of the most effective and significant studies in the current IS research, as mentioned in many scholarly journals (Al-Kofahi, Hassan, Mohamad, Intan, & Com,

2020). The organizational environment affects how the six critical aspects in Figure 1 may be used in practice (DeLone & McLean, 2016). Al-Kofahi et al. (2020) suggested in their meta-analytic evaluation that the D&M model would be helpful in examining the effects of organizational or individual systems, particularly with regard to performance. To date, the D&M approach has been used in many domains, notably higher education, to evaluate IS (Al-Nuaimi & Al-Emran, 2021; DeLone & McLean, 2016; Shahzad et al., 2021; Shams et al., 2022; Sulistio & Hutagalung, 2022).

Looking at the acceptance or effective application of the D&M concept among students, multiple authors have used it in the educational sector of various nations, according to a scholarly article (Humida et al., 2022; Khaneghahi, Sefatgol, & Siyasar, 2022; Nguyen, Nguyen, & Cao, 2015; Safsouf, Mansouri, & Poirier, 2020; Shahzad et al., 2021; Shams et al., 2022). The fact that so little study has looked at the model from the "subject matter" perspective, which is crucial to its effectiveness, implies that there is a gap in the corpus of knowledge. Furthermore, academics like Al-Kofahi et al. (2020) advocated for more investigation into the validity of the model in low-income nations like Bangladesh that lack advanced technology infrastructure. As a result, the current research work explores the success of D&M from the "subject matter" viewpoint in the institutions of higher education, filling the knowledge gap and answering the research need.

2.3.1. E-Service Quality (ESQ)

The construction of the ESQ is assisted by the IS or IT sectors. However, the service quality component includes many aspects of quality. It is generally agreed that dependability, assurance, tangibility, responsibility, and empathy are crucial (Petter, DeLone, & McLean, 2008). Similar to earlier research, it is hypothesized that ESQ will affect user satisfaction (US) (Fernando, 2020; Shahzad et al., 2021; Shams et al., 2022) and intentions to use the system (SU) (Çelik & Ayaz, 2022; Hadoussa, 2020; Shahzad et al., 2021; Shams et al., 2022). Therefore, the researcher proposes:

H1: The impact of ESQ on the US differs significantly for students studying business and engineering.

H2: The impact of ESQ on the SU differs significantly for students studying business and engineering.

2.3.2. Information Quality (IQ)

The outcome features of an e-learning platform, for example, reports and web pages, are included in the IQ construct. The online learning platform should provide users with timely access to accurate, pertinent, useable, comprehensive, and intelligible information. Depending on the information's caliber, people's level of satisfaction with it will vary (Fernando, 2020; Ifinedo, 2014; M. R. Khan, Roy, & Pervin, 2022; Khand & Kalhoro, 2020; Mohammadi, 2015). Again, the quality of the information affected users' behavioral intentions to use systems (SU) such as E-learning sites. (Çelik & Ayaz, 2022; Mohammadi, 2015). Therefore, the researcher proposes:

H3: The impact of IQ on the US differs significantly for students studying business and engineering.

H4: The impact of IQ on the SU differs significantly for students studying business and engineering.

2.3.3. System Quality (SQ)

Flexible, dependable, user-friendly, intuitive, and sophisticated are depicted in the SQ aspect as desired qualities of information systems. According to numerous previous studies, SQ criteria are essential for better performance for any digital learning platform. SQ raises the participant's interest and satisfaction with the e-learning portal (Hadoussa, 2020; Shahzad et al., 2021) and increases the intention to system use (Çelik & Ayaz, 2022; Fernando, 2020; Roy, 2022; Shahzad et al., 2021; Shams et al., 2022; Yakubu & Dasuki, 2018) for the e-learning portal. Therefore, the researcher proposes:

H5: The impact of SQ on the US differs significantly for students studying business and engineering.

H6: The impact of SQ on the SU differs significantly for students studying business and engineering.

2.3.4. User Satisfaction (US)

The US factor, which assesses total e-learning process satisfaction, is crucial to the success of IS (Hadoussa, 2020). Reliability, relevance, usefulness, and efficacy are the US attributes this survey

captured (Pillay & Maharaj, 2014). Usage of the IS and users' perceptions of its effectiveness in meeting their informational demands during the learning process can be used to measure the US (Harandi, 2015). System Usage (SU) or net advantages of e-learning systems have been proven to be influenced by their US (Khand & Kalhoro, 2020). Therefore, the researcher proposes:
H7: The impact of the US on the SU differs significantly for students studying business and engineering.
H8: The impact of the US on the E-learning portal success differs significantly for students studying business and engineering.

2.3.5. System Use (SU)
The system use dimension is concerned with evaluating how the IS is used. Several studies have assessed this dimension's degree of use or actual usage to determine how it is quantified (Velasquez, Durcikova, & Sabherwal, 2009). A collaborative site is set up in institutions in Bangladesh, mirroring procedures in other places around the world. The institution's administration demands that students and faculty use online learning platforms. This work scrutinizes the SU dimension regarding finishing and performing tasks (Wang & Wang, 2009). In the revised D&M-IS study model, the SU component was believed to be impacted by all of the quality components (ESQ, IQ, SQ, and US). The association between SU and the effectiveness of the E-Learning portal (ELP) has been supported by several kinds of research in the context of this topic (i.e., net benefits or actual usage of ELP) (Mohammadi, 2015; Shams et al., 2022). Therefore, the researcher proposes:
H9: The impact of SU on the E-learning portal success differs significantly for students studying business and engineering.

To summarize, the revised D&M theory has been crucial in establishing the efficacy of numerous technical deployments (Shahzad et al., 2021; Shams et al., 2022). This methodology has been used to assess the efficacy of numerous online applications, including e-banking, e-government services, and e-procurement (Hsu, Yen, & Chung, 2015). By comparing the level of satisfaction and e-learning system usage among business and engineering students, this study, which is based on the D&M model, evaluates the effectiveness of e-learning portals (ELP). This study uses ESQ, IQ, SQ, US, and SU to determine how well ELPs perform, as illustrated in Figure 2. The diagram illustrates the connections between ESQ, IQ, and SQ and US and SU, as well as the relationships between SU, US, and the success of an e-learning portal (ELPS).

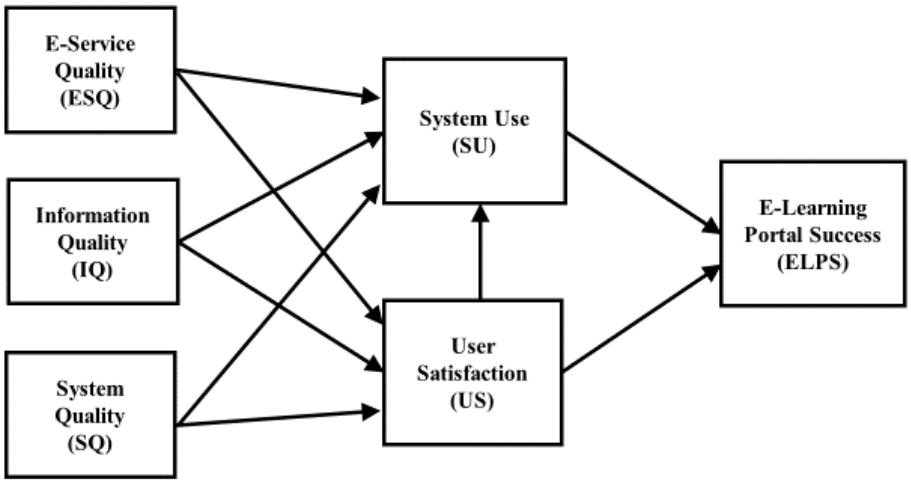

Figure 2. The proposed research model for the current study

3. Research Methodology

3.1. Procedure and instrumentation

A literature study of numerous research works aids the researcher in defining and assessing essential ideas and concepts for this work (Prasojo et al., 2020). The research instrument was designed and

reworded to meet the study's objectives (Habibi, Yusop, & Razak, 2020). To evaluate the constructs of information quality (IQ), e-service quality (ESQ), system quality (SQ), system usage (SU), user satisfaction (US), and e-learning platform success (ELPS), this study employed a total of 27 questions. The ESQ, IQ, SQ, US, and SU constructs were assessed using 7, 6, 5, 5, and 5 items, respectively. The Likert scale, which has a maximum score of 7, was used for all items. Its response options are "strongly disagree" to "strongly agree." The ESQ, IQ, SQ, US, and SU constructs questions were taken from the measures created by Rai, Lang, and Welker (2002), McGill, Hobbs, and Klobas (2003), and Freeze, Alshare, Lane, and Wen (2010). On a four-item scale, the ELPS construct was examined. The scale created by Freeze et al. (2010) served as the source of the items for this construction. A 7-point Likert scale was utilized for all of the ELP success questions, with 1 denoting "Very poor," 2 "Poor," 3 "Fair," 4 "Not sure," 5 "Satisfactory," 6 "Very Good," and 7 denoting "Excellent."

3.2. Collection of the data

Undergraduate students (business and engineering) from several private universities in Bangladesh participated in this study. The information was gathered by a web-based structured questionnaire survey administered by Google Form, a Google Inc. service, using convenience and snowball sampling approaches (Roy & Ahmed, 2016). Students were asked to complete the questionnaire and distribute it to other business and engineering students. Only students with at least two semesters (eight months) of online learning experience were invited to participate in the survey.

The survey questionnaire includes demographic questions and several items for each variable in the study model. Students' responses were taken anonymously so that they may respond to the questions honestly. Because all participants were learning internationally, the questionnaire was distributed in English. An online poll was used to conduct this research from February 2022 to April 2022. There were 517 answers in all. After that, 482 were utilized for analysis. The researcher used MS Excel 2019, SPSS 22.0, and SmartPLS 3.3.5 (Ringle, Wende, & Becker, 2015) to analyze the data set.

3.3. Demographic data analysis of the respondents

Table 1 represents the demographic analysis of the respondents. The "student group" component revealed that 64.5 percent of engineering students responded, compared to 35.5 percent of business students. Most students were male (82.6%), and the rest were female (17.4%). Most respondents were 21-25 years (77.2%). Only 2.1% of the students were age group of more than 30 years. Additionally, statistics on the "e-learning portal's experience" revealed that the majority of the students who took part in the survey had used the portal for one to two years (48.3 percent).

Table 1. Description of the sample respondents

Variables	Categories	Frequency	%
Department	Business Administration	171	35.5
	Mechanical Engineering	104	21.6
	Civil Engineering	54	11.2
	Electrical and Electronic Engineering	48	10.0
	Computer Science and Engineering	63	13.1
	Textile Engineering	42	8.7
Student Group	Business Students	171	35.5
	Engineering Students	311	64.5
Gender:	Female	84	17.4
	Male	398	82.6
Age (in years):	Less than 20	30	6.2
	21 – 25	372	77.2
	26 – 30	70	14.5
	More than 30	10	2.1
E-learning Portal's Experience (years)	< 0.5	78	16.2
	0.5 - 1	92	19.1
	1 -2	233	48.3

> 2	79	16.4

Source: Author's calculation

4. Results and Discussions

For the data analysis in this study, SmartPLS software was used to run PLS-SEM (Ringle et al., 2015). PLS is a better method for analyzing a sequence of dependent connections concurrently when doing research for predicting anything (Baber, 2021; Hair Jr, Hult, Ringle, & Sarstedt, 2021). Again, the PLS-SEM technique is preferable for theory testing, validation (Shmueli, Ray, Estrada, & Chatla, 2016), and modeling (Lowry & Gaskin, 2014). It is employed as a research tool in the social sciences and the field of management information systems (Hair Jr et al., 2021). In this respect, academics have recently presented novel assessment methodologies (Shmueli et al., 2016) that are specially built for PLS-prediction-oriented SEM's character and employed in higher education and e-learning research (Cattaneo, Antonietti, & Rauseo, 2022). Researchers used a two-step strategy to examine outcomes, following PLS-SEM principles (Hair Jr et al., 2021). The test's inter-item reliability, convergent validity, and discriminant validity were assessed in the first phase of the PLS-SEM approach. The second stage examined the structural model to check hypotheses and determine predictive capabilities (Henseler, Ringle, & Sarstedt, 2016).

4.1. Measurement results

4.1.1. Convergent Validity

In the first step of the assessment, inter-item reliability was determined using a 0.70 threshold for factor loadings (Hair Jr et al., 2021). In the second step, convergent validity was determined using the average variance extracted (AVE) value, with 0.50 serving as the cutoff value (Bagozzi, Yi, & Phillips, 1991; Gefen, Straub, & Boudreau, 2000). And at the third stage, the composite reliability (CR) and Cronbach's Alpha (α) of the scores were examined, and the results were found to be over the threshold of 0.70, indicating internal consistency reliability (Hair Jr et al., 2021). The findings are in Table 2. Thus, this study evidenced convergent validity. Furthermore, the results of the whole measurement model, the BS model, and the ES model are represented in Figures 3-5, respectively.

Table 2. Factor loadings, α, CR, and AVE scores

Constructs	Factor loadings			α			CR			AVE		
	FM	BSM	ESM	FM	BSM	ESM	FM	BSM	ESM	FM	BSM	ESM
E-Service Quality				0.905	0.912	0.903	0.925	0.930	0.923	0.638	0.655	0.632
ESQ1	0.833	0.791	0.855									
ESQ2	0.811	0.876	0.776									
ESQ3	0.776	0.770	0.779									
ESQ4	0.800	0.815	0.794									
ESQ5	0.786	0.821	0.773									
ESQ6	0.770	0.784	0.763									
ESQ7	0.812	0.804	0.822									
Information Quality				0.877	0.902	0.860	0.907	0.925	0.895	0.619	0.671	0.588
IQ1	0.816	0.820	0.812									
IQ2	0.751	0.820	0.705									
IQ3	0.811	0.839	0.794									
IQ4	0.786	0.848	0.750									
IQ5	0.809	0.792	0.822									
IQ6	0.745	0.796	0.711									
System Quality				0.905	0.923	0.892	0.929	0.942	0.920	0.724	0.764	0.698
SQ1	0.855	0.890	0.834									
SQ2	0.852	0.881	0.831									
SQ3	0.854	0.874	0.841									
SQ4	0.844	0.879	0.820									
SQ5	0.848	0.846	0.851									
User Satisfaction				0.888	0.919	0.868	0.918	0.939	0.904	0.690	0.755	0.653
US1	0.831	0.876	0.802									
US2	0.821	0.855	0.802									
US3	0.854	0.869	0.845									
US4	0.808	0.863	0.779									
US5	0.840	0.881	0.812									
System Use				0.899	0.918	0.886	0.925	0.938	0.917	0.712	0.753	0.687
SU1	0.852	0.865	0.844									
SU2	0.858	0.867	0.851									
SU3	0.865	0.895	0.846									

SU4	0.806	0.844	0.781									
SU5	0.839	0.867	0.820									
E-Learning Portal Success				0.896	0.896	0.895	0.927	0.903	0.927	0.761	0.701	0.761
ELPS1	0.873	0.933	0.898									
ELPS2	0.881	0.789	0.872									
ELPS5	0.849	0.811	0.833									
ELPS6	0.886	0.808	0.884									

Note: FM = Full Model, BSM = Business Students' Model, ESM = Engineering Students' Model.
Source: Author's calculation

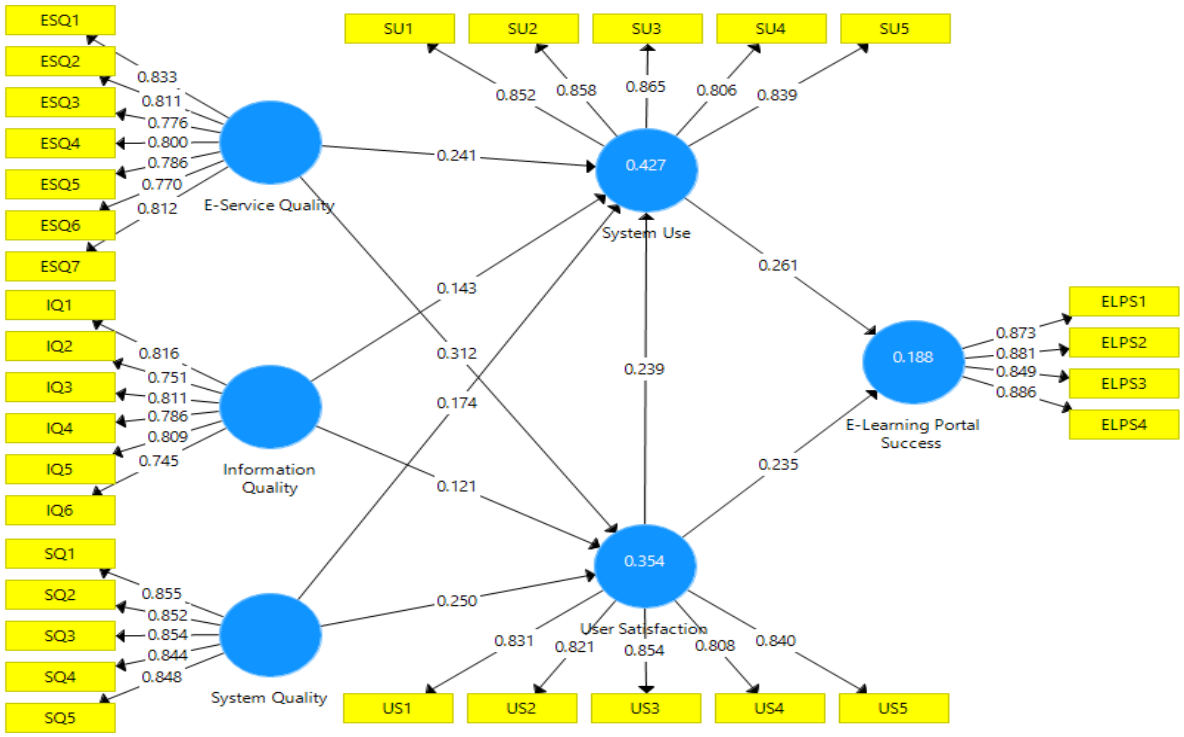

Figure 3. represents the measurement model for complete data.
Source: Author's calculation

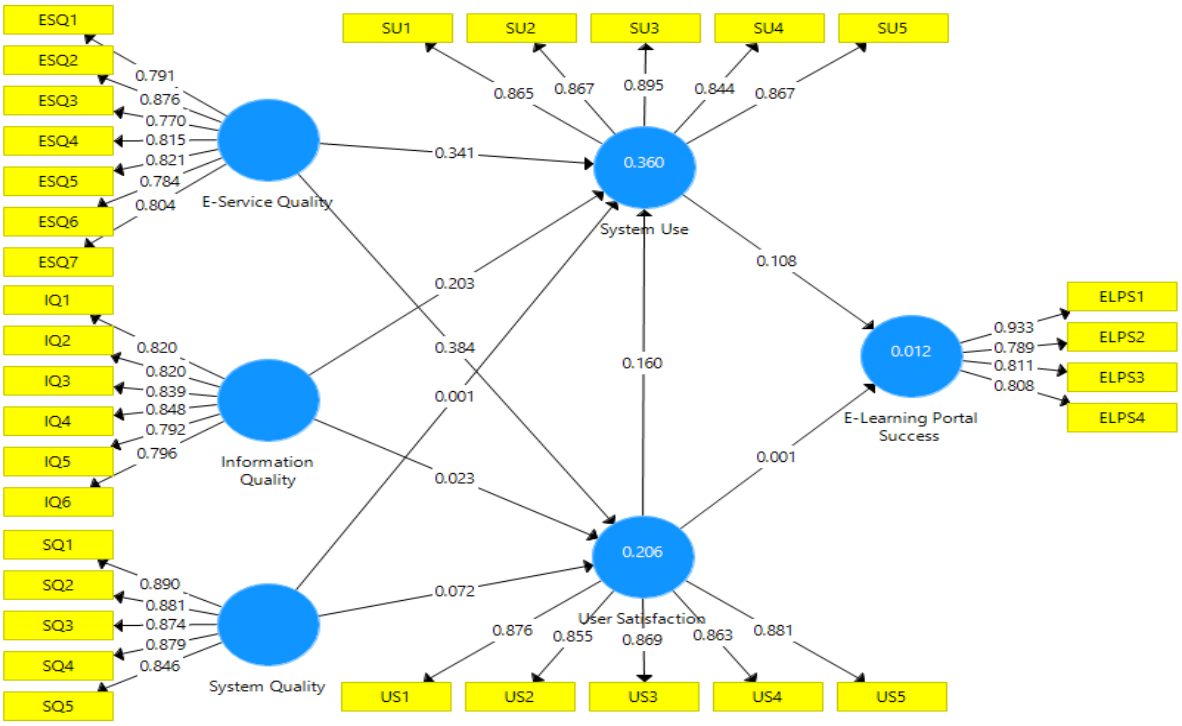

Figure 4. represents the measurement model for business students
Source: Author's calculation

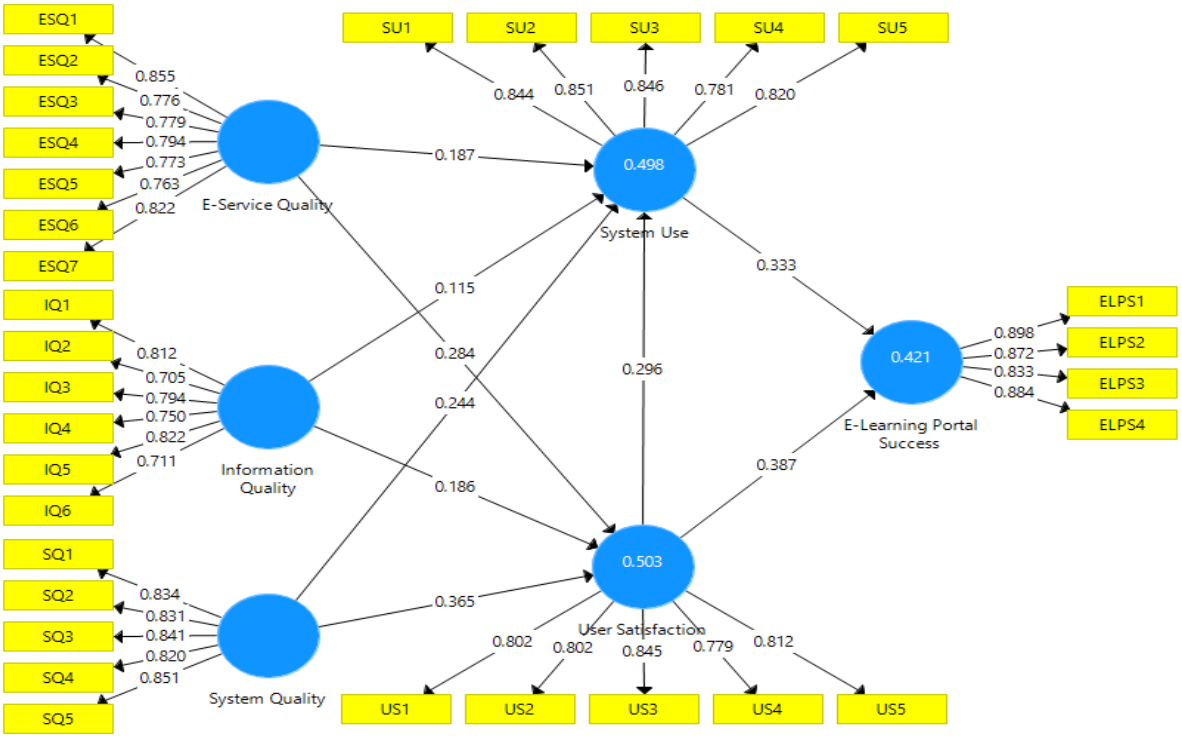

Figure 5 represents the measurement model for engineering students
Source: Author's calculation

4.1.2. Discriminant validity

As stated by Henseler et al. (2016), the Heterotrait-Monotrait correlations ratio (HTMT) approach was employed to determine the discriminant validity of the factors. Due to recent criticism of the (Fornell

& Larcker, 1981) criteria, researchers utilized the HTMT technique. If the HTMT value surpasses 0.85 (Kline, 2005) or 0.90 (Gold, Malhotra, & Segars, 2001), discriminant validity is a concern. Table 3 shows that all HTMT readings matched the proposed criterion of 0.85 (Kline, 2005).

Table 3. Discriminant validity results (HTMT ratios).

	Full Model					
	ESQ	IQ	SQ	US	SU	ELPS
E-Service Quality (ESQ)	***0.799***					
Information Quality (IQ)	0.706	***0.787***				
System Quality (SQ)	0.678	0.652	***0.851***			
User Satisfaction (US)	0.602	0.516	0.569	***0.831***		
System Use (SU)	0.627	0.567	0.584	0.585	***0.844***	
E-Learning Portal Success (ELPS)	0.568	0.508	0.555	0.409	0.423	***0.872***
	Business Students' Model					
	ESQ	IQ	SQ	US	SU	ELPS
E-Service Quality (ESQ)	***0.809***					
Information Quality (IQ)	0.825	***0.819***				
System Quality (SQ)	0.729	0.719	***0.874***			
User Satisfaction (US)	0.487	0.383	0.368	***0.869***		
System Use (SU)	0.613	0.560	0.451	0.418	***0.868***	
E-Learning Portal Success (ELPS)	0.493	0.429	0.453	0.055	0.089	***0.837***
	Engineering Students' Model					
	ESQ	IQ	SQ	US	SU	ELPS
E-Service Quality (ESQ)	***0.795***					
Information Quality (IQ)	0.635	***0.767***				
System Quality (SQ)	0.652	0.609	***0.835***			
User Satisfaction (US)	0.678	0.615	0.714	***0.808***		
System Use (SU)	0.637	0.577	0.675	0.706	***0.829***	
E-Learning Portal Success (ELPS)	0.611	0.568	0.613	0.666	0.640	***0.872***

Note. Diagonal bold & italic elements represent the square root of the AVE.
Source: Author's calculation

4.2. Measurement invariance assessment

In order to examine two groups of university students, this study performed an invariance analysis (business and engineering). Before doing a multi-group investigation, the invariance test must be carried out. An invariance test is utilized to assess "whether measurement models produce estimates of the same property under diverse conditions of viewing and analyzing events" (Henseler et al., 2016). There are three phases for testing the invariance test. The 1st and 2nd steps are configural invariance and compositional invariance, respectively. In order to assess the measurement invariance, the final step is to ensure that the composite mean values and variances are equivalent (Henseler et al., 2016).

Given that the measurement models for both groups contain the same number of constructs, data handling, items, and algorithm settings, configural invariance is established in the first phase. Table 2 and 3 represents the results. In the second step, a permutation test was used to evaluate compositional invariance. The permutation test ensures that the groups' composite values are equal. Lastly, the research also estimates the equivalence of composite variances and group mean values. The variance ratio and mean differences between the composites must be within the 95 percent confidence range. According to Table 4, the findings indicate that neither the composite means nor the variance ratios of any of the composite constructs differ statistically significantly from one another. Additionally, for business and engineering students, full measurement invariance is shown in Table 5. In light of the differing model estimations made by the business and engineering student groups, neither the content nor the utilization of the E-learning system varied.

Table 4. Results of MICOM.

Composite	Original Correlation (c)	5% quantile value	Compositional invariance
E-Service Quality	1.000	0.999	Supported
Information Quality	0.999	0.997	Supported
System Quality	1.000	0.999	Supported
User Satisfaction	1.000	0.999	Supported
System Use	0.999	0.999	Supported
E-Learning Portal Success	0.999	0.998	Supported
Composite	Difference of Mean (Value = 0)	95% CI	Equal Mean Values
E-Service Quality	-0.006	[-0.176, 0.172]	Supported
Information Quality	0.051	[-0.177, 0.185]	Supported
System Quality	-0.155	[-0.192, 0.181]	Supported
User Satisfaction	-0.038	[-0.183, 0.173]	Supported
System Use	-0.120	[-0.184, 0.191]	Supported
E-Learning Portal Success	-0.160	[-0.194, 0.172]	Supported
Composite	Difference of Mean (Value = 0)	95% CI	Equal Mean Values
E-Service Quality	-0.009	[-0.393, 0.366]	Supported
Information Quality	0.260	[-0.415, 0.357]	Supported
System Quality	0.210	[-0.350, 0.341]	Supported
User Satisfaction	0.249	[-0.315, 0.281]	Supported
System Use	0.261	[-0.393, 0.362]	Supported
E-Learning Portal Success	-0.006	[-0.430, 0.398]	Supported

Note: CI = Confidence Interval
Source: Author's calculation

4.3. Evaluation of group differences

The researcher in the current study used PLS-MGA to calculate the differences using the Welch-Satterthwaite evaluation on the Business and Engineering student groups (Sarstedt, Henseler, & Ringle, 2011). The differences between the composite's means and path coefficients are also represented in Table 5. Several paths, however, are discovered to be significantly different across business and engineering data sets. The current research found that business and engineering students' system quality toward user satisfaction differs. Once more, the business and engineering groups have different levels of user satisfaction with the success of the e-learning platform.

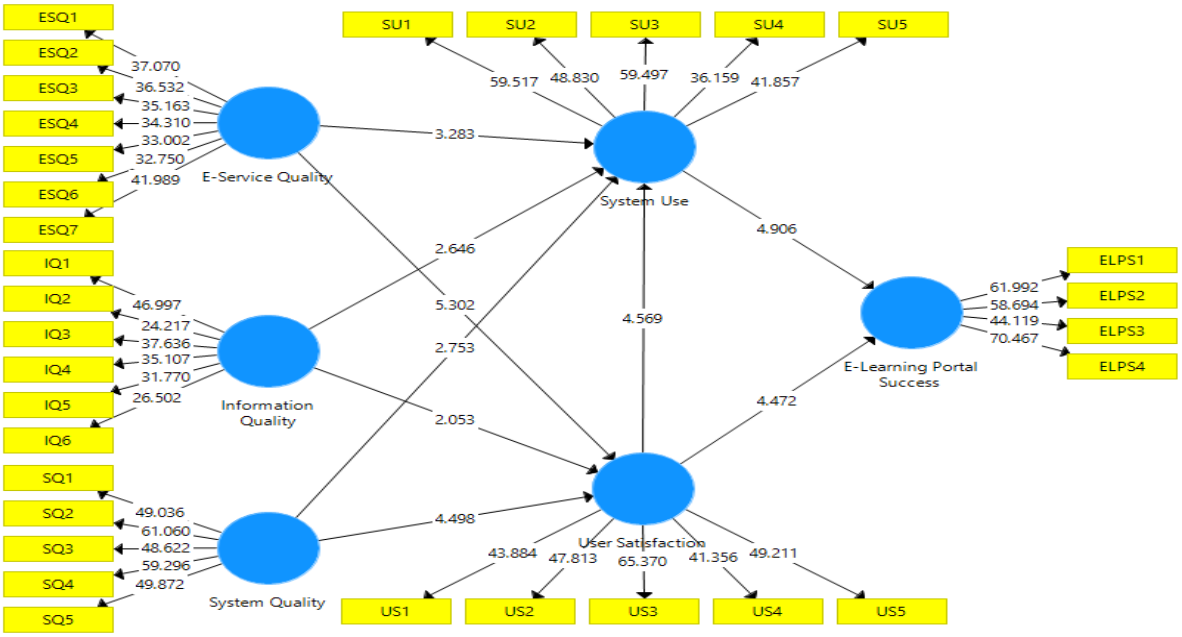

Figure 6. Full structure model
Source: Author's calculation

Table 5. Assessment results of group differences.

Path	PCO (BS)	PCO (ES)	t-Value (BS)	t-Value (ES)	PCD	p-Value Henseler's MGA	p-value Permutation test	p-Value Welch Satterthwaite test	Supported
ESQ->US	0.385***	0.284***	3.686	4.409	0.101	0.406	0.437	0.411	No/No
ESQ->SU	0.342**	0.187*	3.060	2.118	0.155	0.277	0.353	0.276	No/No
IQ->US	0.022	0.186**	0.175	3.254	-0.163	0.241	0.170	0.241	No/No
IQ->SU	0.204	0.114*	1.640	2.057	0.090	0.509	0.435	0.509	No/No
SQ->US	0.070	0.366***	0.663	5.858	-0.296	0.019	0.015	0.017	Yes/Yes
SQ->SU	-0.001	0.245**	0.009	3.214	-0.246	0.064	0.079	0.067	No/No
US->SU	0.161*	0.297***	1.998	4.736	-0.135	0.183	0.239	0.186	No/No
US->ELPS	-0.010	0.386***	0.091	6.132	-0.396	0.001	0.002	0.002	Yes/Yes
SU->ELPS	0.107	0.334***	0.836	4.862	-0.227	0.066	0.056	0.117	No/No

Note: p*** < 0.001, P** < 0.01, p* < 0.05.
PCO = Path Coefficient Original, PCD = Path Coefficients Differences, BS = Business Students, ES = Engineering Students,
Source: Author's calculation

4.3.1. Assessment of business students' group

According to the group evaluation of business students included in Tables 5 and 6, with a path coefficient of (0.385***), hypothesis 1 indicated that ESQ is substantially positively correlated with the US, and (p<0.001) validated this prediction. Once more, hypothesis 2 is confirmed by the evidence and exhibits a meaningful positive correlation between ESQ and SU (β=0.342, p<.01). Hypothesis 3 asserted a significant positive correlation between IQ and US, but the data did not support this claim (β=0.022, p>0.05). Once more, hypothesis 4 shows a substantial positive connection between IQ and SU (β=0.204, p>0.05); however, the outcome does not support the argument. Hypothesis 5 was not supported by the prediction that SQ is not substantially related to US (β=0.070, p>0.05). The hypothesis is not supported by the results of hypothesis 6, which show a negligible negative correlation between SQ and SU (β=-0.001, p>0.05). Once more, hypothesis 7 asserted that US and SU are positively correlated (β =0.161, p<0.001), hence validating hypothesis 7. Like hypothesis 7, hypothesis 8 said that US is significantly and favorably linked with ELPS (β=-

0.010, p>0.05), which does not support hypothesis 8. Last but not least, hypothesis 9 shows a significant positive correlation between SU and ELPS (β=0.107, p>0.05), although the outcome does not support hypothesis 9. As a result, it is clear from the information shown above that business students have a limited understanding of the value of using e-learning portals to succeed in university coursework. The results suggest that business students are less proficient users of the e-learning platform.

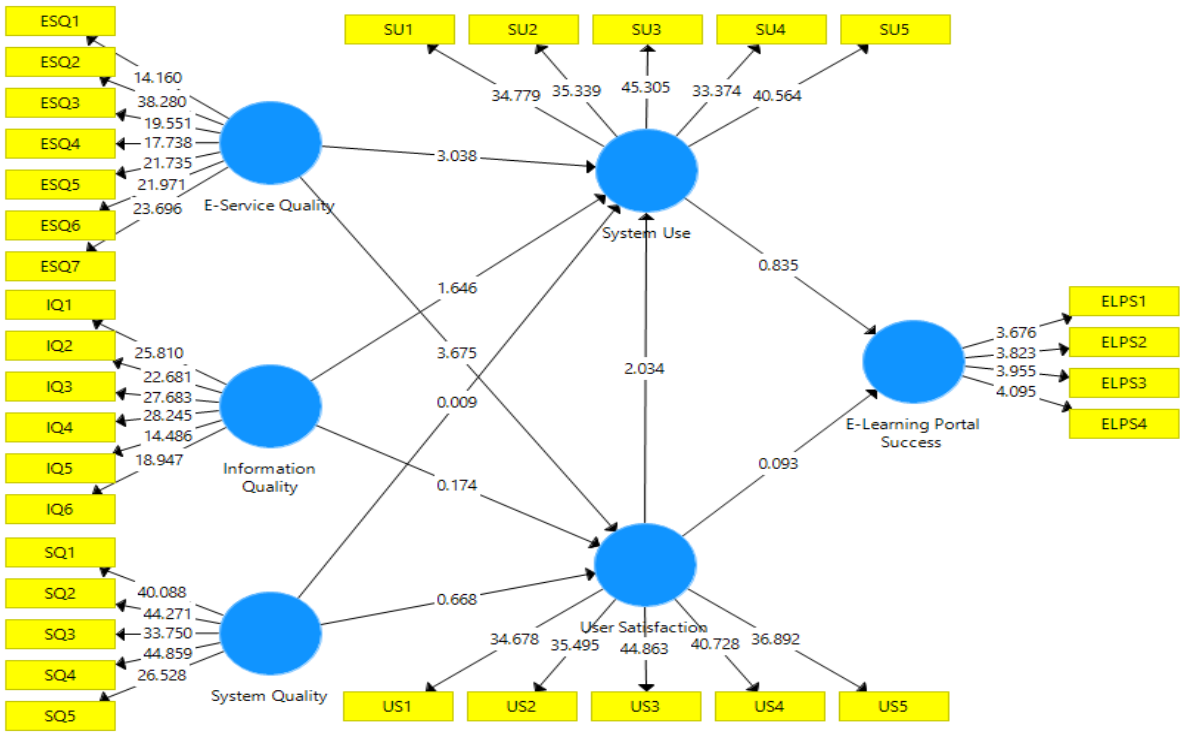

Figure 7. Structure model for Business students' group
Source: Author's calculation

4.3.2. Assessment of engineering students' group

The premise that ESQ is positively and significantly connected to US was supported by Tables 5 and 6, according to the group evaluation of engineering students (β=0.284, p<0.001). The result (β=0. 187, p<0.05) confirms hypothesis 2, which shows a strong positive correlation between ESQ and SU. Reiterating that IQ and US had a significant positive correlation (β =0.186, p<0.01), hypothesis 3 was supported. Similar to hypothesis 3, hypothesis 4 also demonstrates a strong positive connection between IQ and SU (β=0.114, p<0.05), which supports hypothesis 4. As a result, hypothesis 5 showed that SQ positively links with US (p<0.001, β=0.366). A substantial positive correlation between SQ and SU is shown by hypothesis 6's findings (β=0.245, p 0.01), proving that this hypothesis is correct. Again, the results support hypothesis 7 because US was significantly associated with SU (β=0.297, p<0.001). Additionally, Hypothesis 8 confirmed that the US and ELPS are strongly positively correlated (β=0.386, p 0.001). Finally, hypothesis 9 was supported by a significant positive connection between SU and ELPS (β=0.334, p<0.001). Meanwhile, this suggests that engineering students dominate in assessing the effectiveness of using an e-learning portal based on the findings of the Path Coefficient (Tables 5 and 6) and (Figures 6-8).

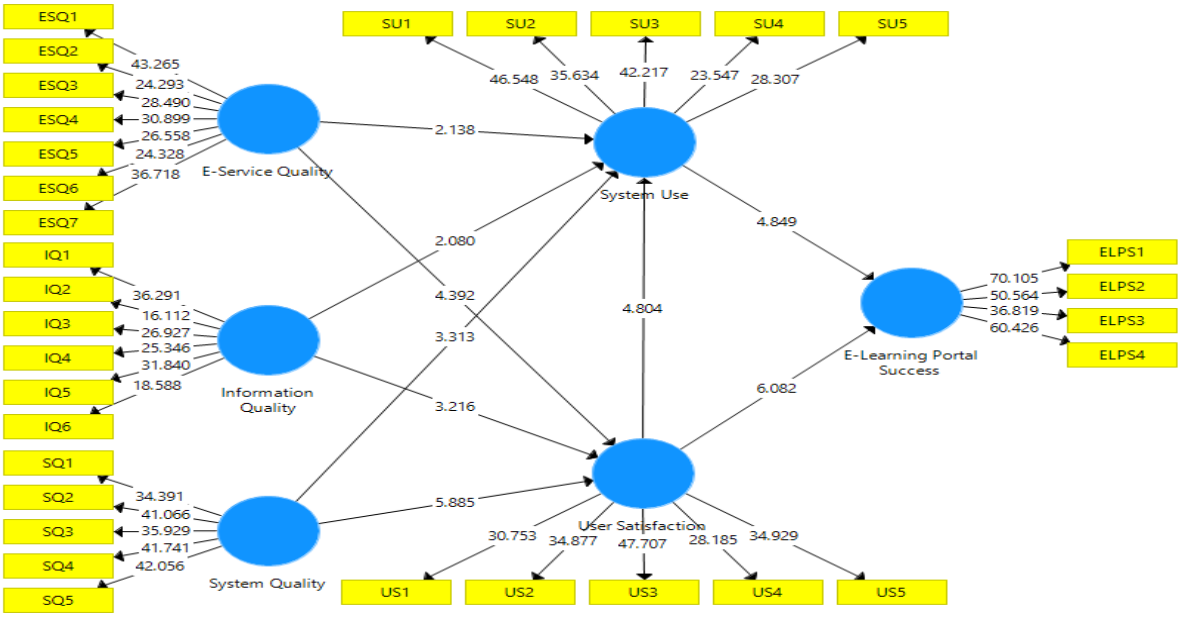

Figure 8. Structure model for Engineering students' group
Source: Author's calculation

Table 6. Results of model comparison.

	Full model		Business students' model		Engineering students' model	
Relationships	Coefficients	Decisions	Coefficients	Decisions	Coefficients	Decisions
ESQ->US	0.312***	S	0.385***	S	0.284***	S
ESQ->SU	0.241**	S	0.342**	S	0.187*	S
IQ->US	0.121*	S	0.022	NS	0.186**	S
IQ->SU	0.142**	S	0.204	NS	0.114*	S
SQ->US	0.250***	S	0.070	NS	0.366***	S
SQ->SU	0.173**	S	-0.001	NS	0.245**	S
US->SU	0.240***	S	0.161*	S	0.297***	S
US->ELPS	0.234***	S	-0.010	NS	0.386***	S
SU->ELPS	0.262***	S	0.107	NS	0.334***	S

Note: p*** < 0.001, P** < 0.01, p* < 0.05. S = Singificant, NS = Not Significant
Source: Author's calculation

4.4. Discussion and comparison of the results

Only three (3) factors supported the success of the e-learning portal when the hypothesis testing was conducted on business students. In the business students' model, ESQ directly influences US and SU. Similarly, US has a significant positive association with SU. In contrast, all the variables are significant in the engineering students' group. ESQ, IQ, and SQ directly relate to US and SU. While this is going on, US and SU have a productive relationship. And likewise, US and SU significantly predict the ELPS. The association is the same as the engineering model in the entire model. Al the variables, directly and indirectly, predict ELPS. Thus, engineering students at Bangladeshi universities use e-learning portals more frequently than business students.

This study demonstrated a considerable favorable effect of ESQ on the SU, which is consistent with findings from other investigations (Fernando, 2020; Mohammadi, 2015; Shahzad et al., 2021; Shams et al., 2022) and US (Fernando, 2020; Mohammadi, 2015; Shahzad et al., 2021; Shams et al., 2022) for both business and engineering group students. Accordingly, the finding suggests that HEIs should try to promote information systems by implementing them in a way that will enable the achievement of desired results, such as information management and storage (Shahzad et al., 2021; Shams et al., 2022). Along with being flexible, the IS should also be usable and simple. Users won't see the benefits

of IS when it is not safe, accurate, and dependable, and they may quit depending on it to get the desired outcomes.

Again, the study results revealed that IQ is significantly and positively associated with US (Islam, Hossain, & Roy, 2021; Khand & Kalhoro, 2020; Mehrolia, Alagarsamy, & Sabari, 2021; Shahzad et al., 2021) and SU (Khand & Kalhoro, 2020; Mehrolia et al., 2021; Shahzad et al., 2021) only for the engineering students. These findings mention that information quality is very important for getting more US as well as SU, which in turn lead to the success of e-learning portals for engineering students. Similar to other research, this one discovered that SQ had a major impact on the US (Fearnley & Amora, 2020; Hadoussa, 2020; Shams et al., 2022) and SU (Ifinedo, 2014; Shahzad et al., 2021) only for engineering students. This result suggests that the desired qualities of information systems, such as reliability, adaptability, intuition, usability, and sophistication, lead to user satisfaction, which is also essential for any e-learning system's success.

Again, the study further revealed that US significantly and positively influences SU (Mehrolia et al., 2021) for both student groups. So, when the students perceive e-learning as a good learning instrument, they will further use it for effective learning e-learning, which will lead to the success of the e-learning portal. This study's other conclusion was that the SU and US were shown to have an impact on ELP success, which is consistent with further research (S. Chowdhury & Roy, 2015; Hadoussa, 2020; Mohammadi, 2015; Shahzad et al., 2021; Shams et al., 2022) only for the engineering students. This conclusion suggests that users of the existing information system (ELP)—students, teachers, and staff—perceive it to be efficient in consumption, beneficial in the learning process, and meet their informational demands. As a result, engineering students in higher education institutions affiliated with Bangladeshi universities place greater emphasis on using and succeeding with the E-learning site than business students.

5.1. Theoretical implication of this research

According to the available research on the phenomenon of technology adoption, most prior studies largely focused on either the organizational level (for example, management or institution), the personal level (for example, customers), or both. (Shahzad et al., 2021; Shams et al., 2022). However, research on the adoption of technology, such as those on the effectiveness of ELP among business and engineering student groups, is rarely carried out, particularly in Bangladesh. This ground-breaking study examines the empirical and theoretical linkages between business and engineering student groups in educational contexts regarding e-portals. The D&M approach was considered since it may assist Bangladeshi institutions in improving their services in the new normal by providing them with concrete information components.

The study mainly focused on how factors like ESQ, IQ, SQ, and US relate to and how their connection affects SU. Therefore, these factors are a crucial component that promotes the regularity of system usage. It is clear from this that the study provides important information that might serve as the basis for assessing an IS performance and its use in higher education, such as the effectiveness of an e-learning environment. Researchers might undertake more studies based on the data reported here to ascertain the favorable and important links between the various components of the DeLone and McLean model (Shahzad et al., 2021; Shams et al., 2022; Tilahun & Fritz, 2015).

Additionally, studies may be conducted to determine how the nature of the system and the implementation regions may influence the project's performance. These research findings might predict how users would react to the introduction of an IS and how much they will rely on it in their daily lives. The significant addition of this work is how the model behaves when evaluated on two sets of samples (i.e., business students and engineering students). When evaluated concurrently on two data sets, the D&M model produces distinct findings. In other words, the hypothesized connection between the variables changed when the model was tested for two subgroups. So business and engineering students in Bangladeshi universities have diverse experiences with the success and efficacy of e-learning portals.

5.2. Practical implications of this research

The findings of this study have various ramifications for HEIs worldwide, not only in Bangladesh, regarding the practice of e-learning doorway innovation. In reality, many scholars have drawn attention to the IS success model being validated in high-income nations, whereas low-income countries have had little access to research (Al-Kofahi et al., 2020; Shams et al., 2022). Consequently, creating room for academics from low-income countries (Al-Kofahi et al., 2020; M. R. Khan, Roy, & Hossain, 2019; S. K. R. M. R. Khan & Hossain, 2016; Khatuna & Roy, 2022) like Bangladesh. The Bangladeshi educational system is suitable for this study to ascertain if the IS success model applies to a country with a low or medium range of IS implementation and a modest level of technological growth. The study's findings demonstrate the installed information system's (ELP) limited performance in providing users with a means of engaging in instructional activities inside the organization.

To create policies and programs that will contribute to the success of the ELP in Bangladesh, the Government of Bangladesh and the higher authorities, for example, the University Grant Commission (UGC) of Bangladesh and the managing directors in the HEIs, will find this study to be helpful. The preceding stakeholder groups will be better able to provide adequate resources to enhance the ESQ, IQ, and SQ if they are aware of the characteristics of the IS (such as ELP) and how users assess them (DeLone & McLean, 2016). Additionally, by doing this, the stakeholders will be better able to analyze the internal and external elements that affect how consumers react to IS initiatives. Using various methods, such as the D&M framework, the director of the faculty department in academic institutions should be encouraged to assess and carefully consider the validity of IS and foresee their perspective effects (Burton-Jones & Straub Jr, 2006; Shams et al., 2022). They may be able to create plans necessary for carrying out the IS initiatives with the aid of the aspects of IS success. Additionally, they will be aware of and comprehend the adjustments that must be made to guarantee the initiatives' success.

In general, and particularly in the higher education context, the COVID-19 pandemic has altered the operating practices of organizations worldwide. Higher education institutions are expected to start providing their learners with online classes. In the new normal Bangladeshi higher education setting, this study presents a positive perspective on the efficacy of ELP in increasing student access and enhancing teaching and learning standards. Additionally, the IS can help HEIs be creative and adaptable to students' changing needs and educational contexts. If the epidemic persists, there may be a lifelong switch from a face-to-face conventional schooling system to technology-based learning one. Depending on that, the success of the E-learning website will be determined by the quality of the e-learning service, the quality of the content, and the system, which will affect user satisfaction and system usage (Shams et al., 2022). So, the present research work offers recommendations to the HEIs, including the provision of error-free information, offering the e-learning portal reachable 24/7, updated information, quality in contents, the server's robustness, quality of information, well-organized data, students' approachable designs of the learning platform, periodic user feedback, and training module invented with e-learning platform use for newcomers will strengthen the appropriateness and reliability of the e-learning portal.

5. Conclusion

The objective of the current study was to compare the ELP likelihood of success in HEIs for the business and engineering student populations. It brings to light the opinions of engineering and business students on how adaptable ELP services are. The present study discovered that ESQ, IQ, and SQ impact US and SU. Again, US has a positive impact on SU, which will eventually result in the success of the ELP. In addition to lowering education costs, e-learning systems allow for the spread of education across international boundaries. Education may cross international borders in the ensuing five to ten years.

Consequently, the study offers higher authorities of the higher education institutions recommendations for gaining knowledge of ESQ, IQ, SQ, US, and SU connected to the effectiveness and performance of ELP. The successful application of ELP in Bangladesh is highlighted by several

distinctions between business and engineering students, some of which are considerable and others not. The small sample size overall, especially for the students in the business group, may be one of the key reasons for the underwhelming results regarding the disparities between students in the engineering and business groups on ELP accomplishment.

5.2. Limitations

There are several limitations to this work, and it needs more research. For example, the researcher used a small sample of 482 students. Future research, however, may consider using a bigger sample size to look at the effect of the subject on the effectiveness of the ELP. Additionally, this study mostly focused on how students perceived the efficacy of the ELP while ignoring the viewpoints of the instructors and the institution, which may be fascinating to learn about for comparison purposes. Future studies may be done by contrasting the views of the academic and administrative personnel and the student's thoughts, both collectively and individually. Analyzing and comprehending potential problems from using ELP in public and private universities would be helpful.

5.3. Suggestions

Only the six revised D&M model dimensions emphasized in earlier research were employed in this study (DeLone & McLean, 2003). Future studies, however, could take into account additional factors such as user characteristics, motivation, and attitude toward ELP, in addition to technical proficiency and infrastructural support. Additionally, the cross-sectional research approach utilized in this study limits the generalizability of the findings. Therefore, for increased generalizability of HEIs, future studies might use a longitudinal study design to explore the link between theoretical components experimentally.

Acknowledgments

The researcher thanked all participants.

Disclosure statement

The author reported no potential conflict of interest.

References

Al-Kofahi, M., Hassan, H., Mohamad, R., Intan, T., & Com, M. (2020). Information systems success model: A review of literature. *International Journal of Innovation, Creativity and Change*, 12.

Al-Maroof, R. A., & Al-Emran, M. (2021). Research trends in flipped classroom: a systematic review. *Recent advances in intelligent systems and smart applications*, 253-275.

Al-Nuaimi, M. N., & Al-Emran, M. (2021). Learning management systems and technology acceptance models: A systematic review. *Education and Information Technologies*, 26(5), 5499-5533.

Al-Nuaimi, M. N., Al-Kabi, M. N., & Al-Emran, M. (2021). Digitizing Learning During the Outbreak of COVID-19 Pandemic: Lessons Learned from the Most Infected Countries *Emerging Technologies During the Era of COVID-19 Pandemic* (pp. 291-303): Springer.

Aljawarneh, S. A. (2020). Reviewing and exploring innovative ubiquitous learning tools in higher education. *Journal of Computing in Higher Education*, 32(1), 57-73.

Amiri, Y., Khademi, N., Khafri, F. Z., Akbari, Z., & Jangjoo, R. (2022). The Impact of Corona Outbreak on Virtual Education Policy in Iranian Universities. *Journal of Social, Humanity, and Education*, 3(1), 1-15.

Ashari, H., Abbas, I., Abdul-Talib, A.-N., & Mohd Zamani, S. N. (2021). Entrepreneurship and Sustainable Development Goals: A Multigroup Analysis of the Moderating Effects of Entrepreneurship Education on Entrepreneurial Intention. *Sustainability*, 14(1), 431.

Baber, H. (2021). Modelling the acceptance of e-learning during the pandemic of COVID-19-A study of South Korea. *The International Journal of Management Education*, 19(2), 100503.

Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative science quarterly*, 421-458.

Burton-Jones, A., & Straub Jr, D. W. (2006). Reconceptualizing system usage: An approach and empirical test. *Information systems research*, 17(3), 228-246.

Carey, K. (2020). Everybody ready for the big migration to online college? Actually, no. *The New York Times*, 13.

Cattaneo, A. A., Antonietti, C., & Rauseo, M. (2022). How digitalised are vocational teachers? Assessing digital competence in vocational education and looking at its underlying factors. *Computers & education*, 176, 104358.

Çelik, K., & Ayaz, A. (2022). Validation of the Delone and McLean information systems success model: a study on student information system. *Education and Information Technologies*, 27(4), 4709-4727.

Chowdhury, S., & Roy, S. (2015). Evaluating the Impact of Insurance Companies in the Development of Insurance Practices in Bangladesh. *Scholar Journal of Business and Social Science*, 1(1), 37-42.

Chowdhury, S. H., Roy, S. K., Arafin, M., & Siddiquee, S. (2019). Green HR Practices and Its Impact on Employee Work Satisfaction-A Case Study on IBBL, Bangladesh. *International Journal of Research and Innovation in Social Science, Delhi*, 3(3), 129-138.

Cojocariu, V.-M., Lazar, I., Nedeff, V., & Lazar, G. (2014). SWOT analysis of e-learning educational services from the perspective of their beneficiaries. *Procedia-Social and Behavioral Sciences*, 116, 1999-2003.

Cornelius, I. (2002). Theorizing information for information science. *Annual review of information science and technology*, 36(1), 392-425.

Dar, W. A., & Jan, K. (2022). Student alienation at University level: Psychometric properties and relationship with student's ICT motives. *Education and Information Technologies*, 27(4), 4637-4656.

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of management information systems*, 19(4), 9-30.

DeLone, W. H., & McLean, E. R. (2016). Information systems success measurement. *Foundations and Trends® in Information Systems*, 2(1), 1-116.

Dignan, L. (2020). Online learning gets its moment due to COVID-19 pandemic: Here's how education will change. *Assessed on 24th April*.

EDIG, M. M. (2022). Time Management And Self-Directed Learning As Predictors Of Academic Performance Of Students In Mathematics. *Journal of Social, Humanity, and Education*, 3(1), 57-75.

Fearnley, M. R., & Amora, J. T. (2020). Learning Management System Adoption in Higher Education Using the Extended Technology Acceptance Model. *IAFOR Journal of Education*, 8(2), 89-106.

Fernando, E. (2020). *Factors influence the success of E-learning systems for distance learning at the university.* Paper presented at the 2020 International Conference on Information Management and Technology (ICIMTech).

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, 18(1), 39-50.

Freeze, R. D., Alshare, K. A., Lane, P. L., & Wen, H. J. (2010). IS success model in e-learning context based on students' perceptions. *Journal of Information systems education*, 21(2), 173-184.

Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information systems*, 4(1), 7.

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of management information systems*, 18(1), 185-214.

Habibi, A., Yusop, F. D., & Razak, R. A. (2020). The role of TPACK in affecting pre-service language teachers' ICT integration during teaching practices: Indonesian context. *Education and Information Technologies*, 25(3), 1929-1949.

Hadoussa, S. (2020). Evaluation of e-learning system on higher education institutions in KSA: a survey at Saudi Electronic University. *International Journal of Technology Enhanced Learning*, 12(2), 180-199.

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). *A primer on partial least squares structural equation modeling (PLS-SEM)*: Sage publications.

Harandi, S. R. (2015). Effects of e-learning on Students' Motivation. *Procedia-Social and Behavioral Sciences*, 181, 423-430.
Hellstén, S.-M., & Markova, M. (2006). *The DeLone and McLean model of information systems success-original and updated models.* Paper presented at the SIGCHI Conference.
Henseler, J., Ringle, C. M., & Sarstedt, M. (2016). Testing measurement invariance of composites using partial least squares. *International Marketing Review*.
Hossain, M. A., & Yasmin, F. (2022). Emergency Online Teaching-Learning Model in the Context of Higher-Level Education due to the COVID-19 Pandemic. *Journal of Social, Humanity, and Education*, 2(4), 327-341.
Hrastinski, S. (2008). Asynchronous and synchronous e-learning. *Educause quarterly*, 31(4), 51-55.
Hsu, P.-F., Yen, H. R., & Chung, J.-C. (2015). Assessing ERP post-implementation success at the individual level: Revisiting the role of service quality. *Information & Management*, 52(8), 925-942.
Humida, T., Al Mamun, M. H., & Keikhosrokiani, P. (2022). Predicting behavioral intention to use e-learning system: A case-study in Begum Rokeya University, Rangpur, Bangladesh. *Education and Information Technologies*, 27(2), 2241-2265.
Ifinedo, P. (2014). Information systems security policy compliance: An empirical study of the effects of socialisation, influence, and cognition. *Information & Management*, 51(1), 69-79.
Islam, S., Hossain, M. S., & Roy, S. K. (2021). Performance Evaluation using CAMELS Model: A Comparative Study on Private Commercial Banks in Bangladesh.
Khan, M. R., & Roy, S. K. (2022). Do primary HR functions model work in emerging economies? Sustainable compact perspective for Bangladeshi RMG industry. *Review of International Business and Strategy*(ahead-of-print).
Khan, M. R., Roy, S. K., & Hossain, S. K. (2019). Factors Affecting Garments Employees Perception on Job Performance: Evidence from Bangladesh. *International Journal of Management and Sustainability*, 8(1), 32-47.
Khan, M. R., Roy, S. K., & Pervin, M. T. (2022). Retail-based Women Entrepreneurship Entry Model through Small Business Orientation (SBO). *JWEE*(1-2), 117-136.
Khan, S. K. R. M. R., & Hossain, S. K. (2016). Determinants of users' satisfaction regarding mobile operators in Bangladesh: An exploratory factor analysis approach on university students. *European Journal of Business and Management*, 8(26), 31-39.
Khand, Z. H., & Kalhoro, M. R. (2020). Testing and validating Delone and Maclean is model: ERP system success in higher education institutions of Pakistan. *Engineering, Technology & Applied Science Research*, 10(5), 6242-6248.
Khaneghahi, S., Sefatgol, S., & Siyasar, M. (2022). Investigating the Relationship between School Culture and Academic Enthusiasm with Academic Hope and Motivation in High School Students. *Journal of Social, Humanity, and Education*, 3(1), 29-41.
Khatuna, A., & Roy, S. K. (2022). Do Green Marketing Strategies Influence Green Buying Intentions? Evidence from Developing Economy. *International Journal of Innovative Science and Research Technology*, 7(10), 766-777.
Kline, R. B. (2005). Principles and practice of structural equation modeling 2nd ed. *New York: Guilford*, 3.
Lowenthal, P., Borup, J., West, R., & Archambault, L. (2020). Thinking beyond Zoom: Using asynchronous video to maintain connection and engagement during the COVID-19 pandemic. *Journal of Technology and Teacher Education*, 28(2), 383-391.
Lowry, P. B., & Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE transactions on professional communication*, 57(2), 123-146.
McBrien, J. L., Cheng, R., & Jones, P. (2009). Virtual spaces: Employing a synchronous online classroom to facilitate student engagement in online learning. *International review of research in open and distributed learning*, 10(3).
McGill, T., Hobbs, V., & Klobas, J. (2003). User developed applications and information systems success: A test of DeLone and McLean's model. *Information Resources Management Journal (IRMJ)*, 16(1), 24-45.

Mehrolia, S., Alagarsamy, S., & Sabari, M. I. (2021). Moderating effects of academic involvement in web-based learning management system success: A multigroup analysis. *Heliyon*, 7(5), e07000.

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

Nasirun, N., Ramayah, T., Khalid, S. A., & Shahruddin, S. (2021). Modeling Business vs Non-Business Students Blended Learning Experience: Invariance Assessment and Multigroup Analysis. *Asian Journal of Business Research Volume*, 11(3).

Nguyen, T. D., Nguyen, T. M., & Cao, T. H. (2015). *Information systems success: a literature review.* Paper presented at the International Conference on Future Data and Security Engineering.

Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: models, dimensions, measures, and interrelationships. *European Journal of Information Systems*, 17(3), 236-263.

Pillay, K., & Maharaj, M. S. (2014). Social media and mobile communications adoption patterns of South African civil society organisations. *South African Journal of Information Management*, 16(1), 1-8.

Portal, E. D. (2020). Education during COVID-19; Moving towards E-Learning. Retrieved from https://data.europa.eu/en/publications/datastories/covid-19/education-during-covid-19-moving-towards-e-learning

Prasojo, L. D., Habibi, A., Yaakob, M. F. M., Pratama, R., Yusof, M. R., Mukminin, A., & Hanum, F. (2020). Teachers' burnout: A SEM analysis in an Asian context. *Heliyon*, 6(1), e03144.

Rai, A., Lang, S. S., & Welker, R. B. (2002). Assessing the validity of IS success models: An empirical test and theoretical analysis. *Information systems research*, 13(1), 50-69.

Ringle, C. M., Wende, S., & Becker, J.-M. (2015). SmartPLS 3. SmartPLS GmbH. *Bönningstedt, Germany*.

Roy, S. K. (2022). The Impact Of Age, Gender, And Ethnic Diversity On Organizational Performance: An Empirical Study Of Bangladesh's Banking Sector. *International Journal of Financial, Accounting, and Management*, 4(2), 145-161.

Roy, S. K., & Ahmed, J. (2016). A Relational Study of Communication, Reputation and Cooperation on Relationship Satisfaction in the Context of Apparel Sector in Bangladesh. *British Open Journal of Business Administration*, 1, 1-10.

Roy, S. K., Chowdhury, S. H., Islam, S., & Siddique, S. (2021). SOCIO-ECONOMIC STATUS OF THE STREET GARMENT VENDORS: A DESCRIPTIVE STUDY IN THE CONTEXT OF DHAKA CITY, BANGLADESH.

Safsouf, Y., Mansouri, K., & Poirier, F. (2020). An analysis to understand the online learners' success in public higher education in Morocco. *Journal of Information Technology Education. Research*, 19, 87.

Şahin, F., Doğan, E., İlic, U., & Şahin, Y. L. (2021). Factors influencing instructors' intentions to use information technologies in higher education amid the pandemic. *Education and Information Technologies*, 26(4), 4795-4820.

Şahin, F., Doğan, E., Okur, M. R., & Şahin, Y. L. (2022). Emotional outcomes of e-learning adoption during compulsory online education. *Education and Information Technologies*, 1-23.

Sarstedt, M., Henseler, J., & Ringle, C. M. (2011). Multigroup analysis in partial least squares (PLS) path modeling: Alternative methods and empirical results *Measurement and research methods in international marketing*: Emerald Group Publishing Limited.

Selvaraj, C. (2019). Success of e-learning systems in management education in chennai city-using user's satisfaction approach. *The Online Journal of Distance Education and E-learning*, 7(2), 124.

Shahzad, A., Hassan, R., Aremu, A. Y., Hussain, A., & Lodhi, R. N. (2021). Effects of COVID-19 in E-learning on higher education institution students: the group comparison between male and female. *Quality & quantity*, 55(3), 805-826.

Shams, M. S., Niazi, M. M., Gul, H., Mei, T. S., & Khan, K. U. (2022). E-Learning Adoption in Higher Education Institutions During the COVID-19 Pandemic: A Multigroup Analysis. *Front. Educ.* 6: 783087. *doi: 10.3389/feduc*.

Sharma, V., & Dogra, J. (2012). Study of new paradigm shift towards online learning and analysis of E-management education. *International Journal of Marketing and Management Research*, 3(1), 99-108.

Shmueli, G., Ray, S., Estrada, J. M. V., & Chatla, S. B. (2016). The elephant in the room: Predictive performance of PLS models. *Journal of Business Research*, 69(10), 4552-4564.

Sulistio, E. B., & Hutagalung, S. (2022). Higher Education Policy Model During The Pandemic: Lesson Learned From University Students. *Journal of Social, Humanity, and Education (JSHE)*, 3(1), 77-87.

Tilahun, B., & Fritz, F. (2015). Modeling antecedents of electronic medical record system implementation success in low-resource setting hospitals. *BMC medical informatics and decision making*, 15(1), 1-9.

UNESCO. (2020). Startling Digital Divides in Distance Learning Emerge. Retrieved from https://www.unesco.org/en/articles/startling-digital-divides-distance-learning-emerge

Velasquez, N. F., Durcikova, A., & Sabherwal, R. (2009). *Studying knowledge management system success in system administration.* Paper presented at the 2009 42nd Hawaii International Conference on System Sciences.

Wang, W.-T., & Wang, C.-C. (2009). An empirical study of instructor adoption of web-based learning systems. *Computers & education*, 53(3), 761-774.

Wargadinata, W., Maimunah, I., Eva, D., & Rofiq, Z. (2020). Student's responses on learning in the early COVID-19 pandemic. *Tadris: Journal of Education and Teacher Training*, 5(1), 141-153.

Williams, D., Consalvo, M., Caplan, S., & Yee, N. (2009). Looking for gender: Gender roles and behaviors among online gamers. *Journal of communication*, 59(4), 700-725.

Yakubu, M. N., & Dasuki, S. (2018). Assessing eLearning systems success in Nigeria: An application of the DeLone and McLean information systems success model. *Journal of Information Technology Education: Research*, 17, 183-203.