Students' Perceptions of E-Learning Systems at the Jordanian Universities Through the Lens of E-Business Booming During the Coronavirus Pandemic

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ABSTRACT

This paper investigates undergraduate students' perceptions and acceptance of e-learning systems at Jordanian universities. The framework of this study is guided by the Unified Theory of Acceptance and Use of Technology (UTAUT) and DeLone and McLean Information System Success Model. The online questionnaire is used to collect data from 411 undergraduate students at Jordanian public and private universities. Partial Least Squares Structural Equation Modeling (PLS-SEM) is used to analyze the data. The findings suggest that (1) performance expectancy, facilitating conditions, and information quality have a significant, positive effect on the actual usage of e-learning systems, whereas system quality did not; (2) the usage of e-learning systems positively influences educational performance and students' satisfaction; (3) the impact of COVID-19 moderates the relationship between the use of e-learning systems and educational performance; and (4) face-to-face is the most favorable educational-learning approach, followed by blended and e-learning.

KEYWORDS

COVID-19, D&M IS Success Model, E-Learning, Information Quality, Students' Satisfaction, System Quality, UTAUT

INTRODUCTION

As a result of the COVID-19 pandemic, educational institutions around the world have been closed as a precautionary measure by governments to halt future expected waves. This closing has affected students and has had a negative impact on institutions (Mukhtar et al., 2020, Sharma & Bumb, 2021), like schools, colleges, and universities have been compelled to transition to complete e-learning (Landrum et al., 2021). This transition was a challenge for the global education system, which worked hard to move to online teaching in a short time. Most educational departments that were previously reluctant to shift their new education approach were forced to turn completely into online educational

institutions (Dhawan, 2020). The consequences of the COVID-19 pandemic provide an incentive to restructure the current traditional classroom system (Rajhans et al., 2020).

The e-learning approach involves education using electronic resources, where students acquire skills and knowledge through the Internet. It has become common at universities as a cutting-learning technology that aids in building student-centered learning paradigms during lockdown situations (Quadir & Zhou, 2021). Moreover, e-learning has proven to be a leading educational method in academic institutions, whereby a teacher can host, for example, a scientist and specialist from any other country as a guest in the lecture. Here, students can acquire new educational skills and knowledge that contribute to their scientific and personal development (Adel & Dayan, 2021). Moreover, e-learning transfers the students from their school or home to any virtual laboratory in the world to acquire new information (Abdullah & Ward, 2016; Mishra et al., 2020), whereas blended learning is a novel education method that combines traditional (face-to-face educational methods) and digital learning models together. Blended learning not only improves the convenience and flexibility of e-learning and traditional learning but also advances innovation in the education process (Adel & Dayan, 2021). The advantages of e-learning thus include remote learning, comfort, and accessibility, while the limitations relate to inefficiencies and difficulty in maintaining academic integrity (Mukhtar et al., 2020).

In terms of information and communication technology (ICT), information technology (IT) applications and ICT methodologies impact educational training programs and environments at various educational levels. The introduction of IT tools improve the quality of e-learning outcomes (Amir et al., 2020; Castro & Tumibay, 2021). Furthermore, through the lenses of e-business, the incorporation of ICT into business and services has revolutionized the interactions between service providers and individuals (Arjunan, 2016). Thus, e-learning takes the form of e-commerce or e-business, where "E-business is defined as doing business electronically, while online learning is defined as the use of computer networks to provide access to learning materials, activities, and support. Online learning is a sub-set of e-learning and flexible learning" (Mitchell & John, 2003, p.6). The consequent advantages of the e-learning process are the ability to upload large amounts of data on educational platforms and the interactivity between users. Therefore, these platforms require an e-business model to enable e-learning to be accessible and effective (Kannan & Jothi, 2018; Stanescu, 2018).

Indeed, to the best of our knowledge, this study is unique in exploring the mediating role of e-learning system usage (e-LSU) and the moderating effect of the COVID-19 pandemic on the usage of an e-learning system, its effectiveness, and students' satisfaction. Therefore, the main objective of this study is to evaluate students' perceptions and actual usage of e-learning systems from the lens of e-business perspectives (system quality (SQ), information quality (IQ), student's satisfaction, and educational performance) during the pandemic.

The Jordanian Accreditation and Quality Assurance Commission for Higher Education Institutions (2020) issued the regulation and accreditations guideline for distance and blended learning to control the digital processes. It believes that distance learning is not an alternative to face-to-face education, but it facilitates the sustainable transition to a student-centered approach. Several debates are related to e-learning pedagogy implementation, such as flexibility, affordability, accessibility, and lifelong learning to improve knowledge, new skills, and competencies (Baticulon et al., 2021; Camargo et al., 2020; Huang, 2021).

The framework of this study is guided by the integration of two models: (i) the unified theory of acceptance and use of technology (UTAUT) model (Venkatesh, Morris, Davis, & Davis, 2003) and (ii) the DeLone and McLean information system (D&M IS) success model (DeLone & McLean, 2003).

LITERATURE REVIEW

E-learning Systems and Technology

Technological innovation has changed the educational environment and aided in the establishment of e-learning as a digital learning model (Wei & Chou, 2020). Indeed, e-learning is the umbrella term for all Internet-based services used in educational settings. Higher education institutes and universities currently depend on IT applications for delivering distance learning programs that are entirely implemented through platforms such as Zoom, Google Meet, and Cisco Webex by using personal computers, laptops, or smartphones (Sharma & Bumb, 2021). In traditional education, most instructors use online resources to clarify and visualize some concepts and ideas, but during the COVID-19 pandemic, e-learning becomes mandatory (Mishra et al., 2020).

Accordingly, the main differences between e-learning and face-to-face learning are considered in terms of primary sources of information, educational materials, assessment producers, and quality of education. In terms of traditional education, students are evaluated by their lecturers, who represent the main source of knowledge, and skills (Baticulon et al., 2021). In contrast, in e-learning, the comprehensive evaluation of the students is complex.

Several digital learning models are implemented, such as distance learning, e-learning, and blended learning. Distance learning has undergone much development in recent years, and Internet-based online learning is currently provided through different means (i.e., seminars, video instructional classrooms, and YouTube) and has become a trend in the field of education (Zhao et al., 2021). Online classes encourage interactive lectures, which motivate students to attend video lectures and incorporate interesting features of audio and visual media. Although online classes are a beneficial alternative to traditional classes, they are associated with some challenges, including (i) a lack of access to infrastructure; (ii) Internet and resource issues; and (iii) increasing educational workloads at home, mental and physical stress, inadequate training, a lack of social interaction, anxiety, and uncertainties due to the COVID-19 pandemic (Sharma & Bumb, 2021).

Marek et al. (2021) recently conducted an international survey to investigate instructors' experiences in higher education institutes that have shifted to distance learning due to the COVID-19 pandemic. Their findings revealed that most respondents experience more stress and higher workloads than traditional classes. Accordingly, institutions must provide suitable theory-based training related to instructional design and e-learning pedagogy, not just concerning the use of software and hardware.
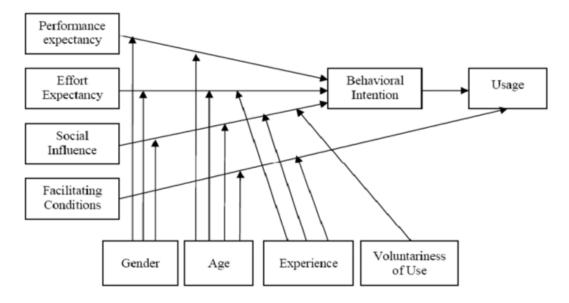
Underpinning Theories

The UTAUT

The UTAUT was expanded by Venkatesh et al. (2003). It has been used as a framework in various studies and different research fields in the educational setting (Liebenberg et al., 2018) to assess students' acceptance of digital learning systems. The UTAUT focuses on system end-users and the actual usage of a technology-based system, as illustrated in Figure 1. Venkatesh et al. (2003) use four central constructs, which can be adopted for the antecedents of e-learning: performance expectancy (PE), which is the perception of the usefulness of a new learning system; effort expectancy (EE), which refers to simplicity; social influence (SI), which consists of subjective norms; and facilitating conditions (FCs), which implies compatibility. In the context of e-learning, these constructs impact users' behavioral intention (BI) towards using a new system and the actual usage of e-learning systems (Ngampornchai & Adams, 2016).

Liebenberg et al. (2018) explored the acceptance of ICT in terms of the UTAUT's applicability to undergraduate students. They found that PE, FCs, and EE showed high practically significant relationships with BI. Moreover, self-efficacy and attitude toward using technology as mediators of the model were confirmed.

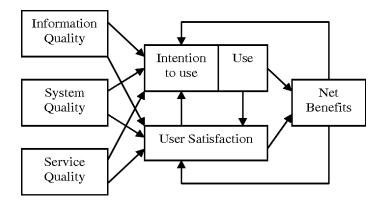**Figure 1. UTAUT (Venkatesh et al., 2102, p.160)**

The D&M IS Success Model

Information system (IS) success research examines the successful development and use of knowledge through technology (DeLone & McLean, 2016). The D&M IS success model provides a useful framework for identifying the multidimensionality of IS success and evaluating the related success-dependent constructions (DeLone & McLean, 1992).

In 2003, the new D&M IS model was introduced to address the usefulness of the updated e-commerce success measurement model presented in Figure 2. It focuses on six performance dimensions: the quality of the information; the quality of the system; the quality of the service, which will affect the intention to use; the quality either high or low which will lead to either better satisfaction or dissatisfaction; and the outcomes (DeLone & McLean, 2003).

It is claimed that the variable "Use" should be removed from the D&M IS model where usage is compulsory. Even when "Use" is required, variability in the quality and intensity of this usage is

Figure 2. Updated (D&M IS) Success Model (DeLone & McLean, 2003, p.24)

likely to have a significant impact on the realization of the system benefits. Thus, "Use" and "Intention to Use" are important success measures (DeLone & McLean, 2016, p.60).

Students' Perception and Actual Usage of e-Learning Systems

Students' IT self-efficacy for e-learning readiness has a mediating influence not only on e-learning perceptions and online discussion scores but also on e-learning perceptions and course satisfaction (Wei & Chou, 2020). Students enjoy being involved in an e-learning system, and faculty members' awareness of the need to incorporate e-learning into the education process is growing. Wong (2020) recently found that e-learning can meet students' needs regarding autonomy and competence, as there is social interaction between tutors and students.

The Impact of COVID-19 on the Effectiveness of Educational Systems

The transition to e-learning due to COVID-19 was unplanned, since some institutions had not previously adopted e-learning, they could not transit smoothly compared to institutions that already had experience with e-learning (Alqahtani & Rajkhan, 2020). According to the International Association of Universities survey, transitioning from face-to-face to distance learning is not easy; difficulties arise in accessing technical resources (Marinoni et al., 2020). During the COVID-19 crisis, online education has involved a pedagogical shift from the traditional paradigm to a modern approach of teaching-learning, from classroom to platform, from personal to virtual, and from seminars to webinars (Mishra et al., 2020).

Effectiveness of e-Learning Systems and Students' Satisfaction

A variety of issues must be considered before implementing an e-learning initiative, including technical, pedagogical, and human considerations. E-learning is easy to use, can reach rural and remote areas, and is less costly than traditional education in terms of accommodation and transportation (Dhawan, 2020). Through the lens of the D&M IS model, a higher SQ and a better IQ of e-learning systems and platforms will lead to higher user (student) satisfaction and usage of e-learning systems (Shahzad et al., 2020). There are several challenges such as rapid transition and the readiness of IT infrastructure that implement the reform mechanism in the education sector that has resulted from the COVID-19 crisis (Mishra et al., 2020). However, during COVID-19, the transition to e-learning was unintentional for all educational institutions. For instance, during regular hours, students can visit the library, attend tutoring sessions, and even go to places with a strong Internet connectivity speed if they do not have one at home, as compared to COVID-19 conditions (Landrum et al., 2021, Schijns, 2021).
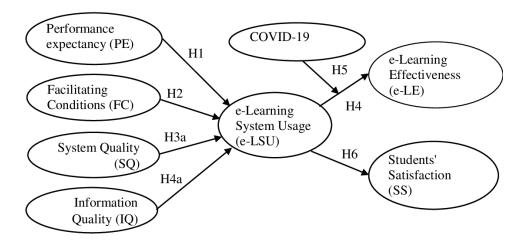
Physical fitness, brain fatigue, anxiety, and isolation are the main negative sides associated with e-learning during COVID-19 in comparison with traditional learning environments. It has been argued that if students can control brain fatigue and the threat of viral infection, they will have better mental health. As a result, this will improve students' satisfaction with e-learning (Zhao et al., 2021). Meanwhile, Garg (2020) identified several factors that influence learning effectiveness, including course content, pedagogy, and assessment approach.

THEORY AND HYPOTHESES

This study's research model depends on the UTAUT and the D&M IS success model. Figure 3 illustrates that PE, FCs, IQ, and SQ are anticipated to influence the e-LSU. In turn, e-LSU and COVID-19 influence students' perceptions of the effectiveness of e-learning systems (e-LE). Additionally, e-LSU has an impact on students' satisfaction (SS). Meanwhile, COVID-19 is assumed to moderate the relationship between e-LSU and its effectiveness.

The UTAUT proposes that PE is one of the main factors that predict users' acceptance and actual use of IT systems. This first determinant in the model of this study refers to the extent to which a user

Figure 3. The Research Model

perceives that the actual usage of ICT will be useful to obtain the expected outcomes based on the UTAUT (Venkatesh et al., 2003; 2016). PE is the central predictor in the context of users' perceptions of technology system usage (Al-Harazneh & Sila, 2021). Ngampornchai and Adams (2016) found that PE has a significant positive relationship with system usage. Therefore,

H1: PE has a direct positive impact on the use of an e-learning system (e-LSU).

UTAUT determinants are regarded as effective criteria for assessing users' adoption of emerging technologies. According to the UTAUT, FCs deal with the availability of the necessary technological resources (i.e., machines or smart devices, Internet access, and technical support) to allow system usage. FCs have an effect on users' behavior and expectations of technology adoption (Venkatesh et al., 2003). Moreover, they will impact students' and tutors' satisfaction regarding the overall e-LE (Camargo et al., 2020). Thus,

H2: FCs have a direct, positive effect on the e-LSU.

DeLone and McLean (2016) argued that the quality and features of an e-learning system can be measured through usability, usefulness, availability, flexibility, and reaction time. The quality of information and content portrays the accuracy of the information that is available in the e-learning structure. Therefore, a high IQ not only enables higher management to issue a quick decision but also provides users with online knowledge and appropriate information at all times (Shahzad et al., 2020).

Students' perceptions of technology enhance their learning performance and competencies (Quadir & Zhou, 2021). Moreover, Dhawan (2020) debates that an ideal e-learning system is the winner of the games. Therefore, the high quality of e-learning systems is critical in these current situations. Pham et al. (2019) reveal that e-learning SQ is the key factor that impacts overall e-learning service quality and usage. Thus, the following hypotheses are formulated:

H3: SQ and IQ in e-learning have a direct positive effect on the e-LSU.
H3a: E-learning SQ has a direct, beneficial effect on the e-LSU.
H3b: The e-learning IQ has a direct, positive effect on the e-LSU.

The technology readiness of higher education institutions to implement an e-learning system during the COVID-19 pandemic is critical to the improvement of the educational process (Alqahtani & Rajkhan, 2020). However, many students and teachers encounter some difficulties in using educational platforms and computers, which influence e-LE and the expected benefits. Moreover, many students are careless and do not pay attention to this type of learning due to their weakness in using smartphones and computers, which in turn has an impact on e-LSU (Mishra et al., 2020).

The COVID-19 pandemic alters not only the applications but also pedagogical methods (Amir et al., 2020). Alqahtani and Rajkhan (2020) propose that the most dominant constructs for e-learning during COVID-19 include technology management, management support, augmented awareness of students regular use of e-learning systems, and the need for a high level of IT knowledge from all partners in the educational process (students, instructors, and universities). In this context, several educational platforms are used to assist teachers and students to interact and ensuring e-LE (Amir et al., 2020). Thus:

H4: e-LSU has a positive influence on students' perceptions of e-LE.
H5: The impact of COVID-19 moderates the association between the e-LSU and the efficiency of e-learning systems.

Through the lens of DeLone and McLean's (2003) model, a strong e-learning system would lead to high student satisfaction, which will generate a high quality of education and qualified students. The main aspects of e-learning SQ that drive students' satisfaction are related to the system content and structure, professors' efforts and lectures, and educational management, which lead to frequent usage of the system (Schijns, 2021). Despite the prominence and reputation of e-learning, educational institutions face difficulties of low levels of e-LSU between students and some academic staff (Ibrahim et al., 2018). Thus:

H6: Frequent and regular e-LSU has a positive influence on students' satisfaction with an e-learning system (SS).

RESEARCH METHODOLOGY

Sampling and Data Collection

Undergraduate students at Jordanian public and private universities are the targeted populations of this study. The sample consists of students who are using an e-learning system. The annual report of the Ministry of Higher Education (2021) states that the approximate number of undergraduate students is more than 280,000. Therefore, according to Sekaran and Bougie (2016), 384 students are considered a suitable sample for this research; 411 valid online responses are received from a total of 650 distributed questionnaires. The required conditions for the proposed theoretical framework and Partial Least Squares Structural Equation Modelling (PLS-SEM) analysis are met by this suitable sample size.

PLS-SEM has become a fundamental multivariate statistical modeling technique that is frequently used in the field of e-learning studies (Huang, 2021). This study also employs PLS-SEM, since it is more suitable for comprehensive analysis than other methods, such as CB-SEM (covariance-based SEM). PLS-SEM enables moderator and mediator effects analysis (Hair, Hult, Ringle & Sarstedt, 2014).

Measurements of Survey Instruments

The multi-item scales of this study are developed and adopted from e-learning and user satisfaction-related literature. The 36 items cover the eight variables in the research framework, and the survey

instruments are refined and tested in a pilot study to ensure the content validity of the items. To obtain proper accuracy, a Likert-type, seven-point scale was adopted (ranging from 1: completely disagree to 7: completely agree). Moreover, the demographic information covers participants' gender, academic year, accumulative average, skills in IT, and preferred educational type (traditional, blended, or online).

DATA ANALYSIS

The preliminary analysis of the demographic factors (Table 1) demonstrates that the majority of the respondents are female (67.6%), and (32.4) are male. Most of the respondents get good to excellent accumulative average, as well as good to excellent skills in using the computer and Internet. Unexpectedly, 46% of the respondents prefer the traditional face-to-face education, meanwhile, 29.9% prefer the blended, and 24.1% prefer the online education-learning.

Table 1. The General Information (Demographic Factors)

Academic Year	1		2	3	4	Total
Number	104		118	116	70	411
Percentage	25.3%		28.7%	28.2%	17%	100%
A. Average	Excellent		V. Good	Good	Acceptable	Total
Number	136		180	91	4	411
Percentage	33.1%		43.8%	22.1%	1%	100%
Computer skill	Exc.	V. Good	Good	Acceptable	weak	Total
Number	87	164	101	41	18	411
Percentage	22.2%	39.9%	26.4%	10%	4.4%	100%
Internet skill	Exc.	V. Good	Good	Acceptable	weak	Total
Number	127	156	87	27	14	411
Percentage	30.9%	38%	21.2%	6.6%	3.4%	100%
Educational Type	Traditional		Blended		Online	Total
Number	189		123		99	411
Percentage	46%		29.9		24.1	100%

This study employs SmartPLS 3.2.9 to evaluate the proposed hypotheses. PLS-SEM fit indices suggested that "Standardized Root Mean square Residual" (SRMR) < 0.08 and Normed Fit Index (NFI) above 0.8. These indices offer rigorous signs of model fitness (Hair et al., 2019). The results indicate a good fit of the proposed model where SRMR= 0.036 and NFI= 0.91.

Measurement Model Assessment

The assessment of the measurement properties includes the evaluating of factors loading, reliability and validity of constructs, and discriminate validity (Hair et al., 2017).

Factors Loading

It is recommended that factor loadings values are above (0.708) since they indicate that these constructs explain above 50% of the variance in the dependent variables, consequently, they present acceptable

reliability of the measured constructs (Hair et al., 2019). All indicator loadings are above 0.70, except FC1 (0.607), FC2 (0.629), FC6 (0.695), e-LE7 (0.631), e-LSU2 (0.436), and US2 (0.066), thus, all these indicators are dropped from the measurement model. See Figure 4.
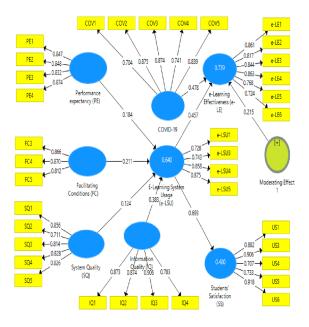
Figure 4. *The measurement model including moderating variable*

PE: Performance Expectancy; **FC**: Facilitating Conditions; **SQ**: System Quality; **IQ**: Information Quality; **e-LSU**: e-Learning System actual Usage; **COV**: impact of **COVID-19** pandemic; e-LE: e-Learning Effectiveness; and **SS**: Students' Satisfaction.

Table 2. Construct reliability and validity

	Cronbach's Alpha	**Rho-A**	**Composite Reliability (CR)**	**Average Variance Extracted (AVE)**
COV 19	0.867	0.884	0.904	0.656
FC	0.898	0.902	0.922	0.663
IQ	0.824	0.876	0.879	0.646
PE	0.808	0.821	0.886	0.722
SQ	0.882	0.892	0.919	0.740
SS	0.872	0.876	0.912	0.723
e-LE	0.889	0.925	0.919	0.696
e-LSU	0.867	0.873	0.904	0.654

Construct Reliability and Validity

The second step is the assessment of the reliability and validity of the constructs. Reliability is assessed through Cronbach's alpha, and composite reliability, which are well-known criteria for this purpose. If the values of Cronbach's alpha are larger than 0.7 then the block of items will be evaluated as homogenous. The same for composite reliability which ought to be also larger than 0.7 which indicates the good internal consistency, where the values range from 0.70 to 0.90 are assessed to be satisfactory to good respectively (Hair et al., 2019). Whereas, the values exceed 0.95 indicate the possibility of disagreeable response patterns. Another recommended measure is used for the assessment of the internal consistency reliability is roh alpha (ρA) that normally lays between Cronbach's alpha and the composite reliability. Henceforth, ρA can be assumed as a good compromise in the case of considering that the model is correctly fitted. Moreover, the Average Variance Extracted (AVE) must be higher than 0.5. Subsequently, the assessment of the internal consistency and reliability is verified via assuring that all values meet the recommended cut-off criteria.

   The results in Table 2 presents that the values of Cronbach's alpha are between 0.808 and 0.898, where the ρA values are between 0.821 and 0.925, all these values exceed the threshold value of 0.7 and less than 0.95 (Hair et al., 2019). The same conclusion for the values of the composite reliability lay between 0.886 and 0.922. Moreover, AVE values are between 0.646 and 0.740, which indicate a good convergent validity of the study's scales and exceed the benchmark. Thus, these obtained results provide a reasonable level of construct reliability and validity to the scales of this study.

Table 3. Discriminant validity (Fronell Lacker Criterion)

	COV 19	FC	IQ	PE	SQ	SS	e-LE	e-LSU
COV 19	**0.810**							
FC	0.657	**0.850**						
IQ	0.625	0.657	**0.860**					
PE	0.673	0.725	0.634	**0.850**				
SQ	0.701	0.741	0.789	0.729	**0.809**			
SS	0.800	0.754	0.653	0.780	0.731	**0.834**		
e-LE	0.754	0.758	0.751	0.734	0.804	0.842	**0.814**	
e-LSU	0.638	0.689	0.736	0.671	0.717	0.693	0.753	**0.804**

Table 4. Collinearity Statistics (VIF)

	VIF		VIF		VIF		VIF		VIF		VIF
PE1	2.045	SQ3	1.995	IQ1	2.538	COV3	2.894	e-LSU5	2.074	e-LE6	1.695
PE2	2.210	SQ4	2.172	IQ2	2.463	COV4	1.633	e-LE1	2.876	US1	3.240
PE3	2.049	SQ5	2.116	IQ3	2.957	COV5	2.244	e-LE2	2.186	US3	3.559
PE4	2.335	FC5	1.667	IQ4	1.801	e-LSU1	1.810	e-LE3	2.740	US4	1.697
FC3	1.735	SQ1	2.421	COV1	1.613	e-LSU3	1.869	e-LE4	2.691	US5	1.767
FC4	2.019	SQ2	1.633	COV2	2.750	e-LSU4	2.056	e-LE5	1.869	US6	3.669

Discriminant validity

The discriminant validity assesses the extent to which a particular construct is uniquely measured by a definite set of related items that do not measure another variable in the proposed model (Hair et al., 2014). Explicitly, the variables must have variances between each other larger than the variance with other variables. As a conclusion, Table 3 shows that discriminant validity is not an issue and it is satisfactory in the study's measurement model.

Structural Model

After the properties of the measurements (outer) model are found to be assessed as adequate and acceptable, then the second stage in PLS-SEM evaluates the structural (inner) model. The standard assessment criterion, which must be taken into account, includes "the coefficient of determination (R-squared (R^2)), and statistical significance and relevance of the path coefficients" as well as the "blindfolding-based cross-validated redundancy measure Q^2". Moreover, the PLS predict process is applied for evaluating the model's out-of-sample predictive power, where "R^2 is referred to as in-sample predictive power". The f-square effect size *(f^2)* may be reported also to explain the "presence of partial or full mediation" effects (Hair et al., 2019, p.11).

The presence of multi-collinearity in the analysis of the structural model will distort the empirical findings. Thus, the estimation of the Variance Inflation Factor (VIF) is evaluated before starting the preliminary data analysis process. The results in Table 4 shows that the values of VIFs are not exceeding the threshold of 5.0 values (Kline, 2011).

The findings in Figure 5 explain that the direct effects of hypotheses (H1- H6) are evaluated through the estimation of the path coefficients. Bootstrapping is a nonparametric process that is employed to assess the significance of the items' outer weight and loadings, outer loadings, as well as the path coefficients between variables through estimating the standard errors and T statistics values. Thus, a consistent PLS (PLSc) bootstrapping method with resampling (5000 resamples) is used to statistically evaluate the significance of the hypothesized framework, and interactions between variables (Hair et al., 2017).
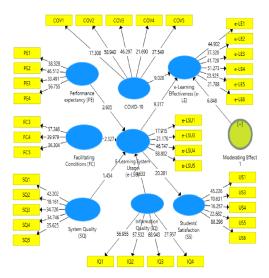
Figure 5. *PLSc bootstrapping of the structural model; T Statistics*

Coefficient of Determination (R^2)

The R^2 measures the variance that is explained in all the dependent variables, evaluating the explanatory power and the predictive validity of the proposed model. The R^2 with high values ranges from 0.0 to 1.0 indicates a higher explanatory power, where the R^2 value of 0.75 is substantial, 0.5 is considered a moderate value, and 0.25 is assessed as weak (Hair, Sarstedt, Pieper, & Ringle, 2012). The results in Table 5 and Figure 4 show the values of R^2, where 64% of the variance in e-LSU is explained by PE, FC, SQ, and IQ. Moreover, e-LSU and COV19 explain 73.9% of the variance in e-LE, and e-LSU explains 48% of the variance in SS.

Table 5. R square (R^2)

Variable	R Square	R Square Adjusted	Assessment
SS	0.480	0.478	» moderate
e-LE	0.739	0.736	» substantial
e-LSU	0.640	0.634	moderate

All results of R^2 range from 48% to 73.9% which (48%) are around 50% are considered moderate and (73.9%) is close to 75% is assessed as substantial. The result shows that the whole model provides

Table 6. F square (f^2)

	SS	e-LE	e-LSU
COV 19		0.517	
FC			0.046
IQ			0.148
Moderating Effect		0.175	
PE			0.037
SQ			0.011
e-LSU	0.925	0.475	

a good model fit and suggests that the collected data fits the structural model.

F-Square Effect Size (f^2)

The f-square effect size (f^2) measure is another name for the R^2 change effect. The f-square expresses how large a proportion of unexplained variance is accounted for by R^2 change. The acceptable level of (f^2) depends on the research context, where 0.02, 0.15, 0.35 are assessed as weak, moderate, and strong effects respectively. The results in Table 6 show that the values of (f^2) are between 0.037 and 0.925 (Hair et al., 2014). These results indicate that the collected data fit the structural model and specify a suitable model fit.

Direct Effect Hypotheses (Path Coefficients)

The next step runs the bootstrapping to examine the significance of the constructs' path coefficients (Hair et al., 2019). The value is considered significant as it closes to 1 regardless of its sign. Table 7 illustrates the path coefficient values that range from 0.124 to 0.693.

Table 7. Path coefficients

	Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	p Values
H1	**PE -> e-LSU**	0.184	0.183	0.071	2.605	**0.005***
H2	**FC -> e-LSU**	0.211	0.212	0.091	2.327	**0.010***
H3a	**SQ -> e-LSU**	0.124	0.135	0.085	1.454	**0.073**
H3b	**IQ -> e-LSU**	0.383	0.374	0.083	4.633	**0.000****
H4	**e-LSU -> e-LE**	0.457	0.459	0.049	9.317	**0.000****
H5	**COV 19 -> e-LE**	0.478	0.477	0.053	9.028	**0.000****
-	**Moderating Effect**	0.215	0.212	0.031	6.848	**0.000****
H6	**e-LSU -> SS**	0.693	0.695	0.034	20.281	**0.000****

Significant at: *** $p < 0.000$, ** $p < 0.01$, and * $p < 0.05$ (Two- tailed test)

The analysis's findings are significantly positive, suggesting empirical support for all proposed hypotheses (H1-H6) except H3a where the p-value is more than 0.5. Moreover, the findings specify that the impact of COVID-19 is partially moderating the relationship between e-LSU and e-LE. Table 7 and Figure 5 show that all the results have a T-value above 1.96 except H3a (0.073). The p-value is less than 0.05 for H1 and H2, and less than 0.001 for H3b- H6. Moreover, all direct paths have a 99.5% confidence interval that does not include zero. Therefore, all hypotheses are supported except H3a.

Table 8. Specific indirect effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
FC -> e-LSU -> SS	0.146	0.147	0.062	2.350	**0.009***
IQ -> e-LSU -> SS	0.265	0.260	0.059	4.496	**0.000****
PE -> e-LSU -> SS	0.128	0.127	0.050	2.539	**0.006***
SQ -> e-LSU -> SS	0.086	0.094	0.060	1.422	**0.078**
FC -> e-LSU -> e-LE	0.097	0.097	0.042	2.325	**0.010***
IQ -> e-LSU -> e-LE	0.175	0.172	0.042	4.127	**0.000****
PE -> e-LSU -> e-LE	0.084	0.084	0.034	2.470	**0.007***
SQ -> e-LSU -> e-LE	0.057	0.063	0.041	1.374	**0.085**

Significant at: *** $p < 0.000$, ** $p < 0.01$, and * $p < 0.05$ (Two- tailed test)

Mediating Analysis

The mediation analysis is performed for the assessment of the mediating role of e-LSU between the constructs (PE, FCs, SQ, and IQ) and (e-LE and SS) by using the bootstrapping technique recommended by Preacher and Hayes (2008). The findings in Table 8 reveal that the specific indirect effects of all relationships are positively significant except for SQ (H3a).

Thus, e-LSU partly mediates the relationships between (PE, FCs, and IQ) and (e-LE and SS) because the direct relationships between all these constructs are significant. Moreover, all indirect paths have significant p values, a 99.5% confidence interval that does not include zero, and T Statistics values are above 1.96 for all constructs except for SQ.

DISCUSSION AND IMPLICATIONS

This empirical study extends the debate regarding e-learning systems and their anticipated effect on learning effectiveness and students' satisfaction. The framework is based on the UTAUT and the D&M IS success model, offering novel insight for this research field, especially at the time of the coronavirus pandemic and for the future of e-learning systems at higher institutes.

The findings of this study reveal that PE, FCs, IQ, and SQ explain 64% of the variance in e-LSU, where a value of 64% is moderate, and IQ is the most powerful variable, followed by FCs and PE. Furthermore, the path coefficients of PE (0.184), FCs (0.211), and IQ (0.383) have a positive significant impact on e-LSU, whereas SQ (0.124) is not significant. These outcomes provide statistical support for H1 to H3b; however, H3a (SQ – e-LSU) is not supported, since the impact of SQ on e-LSU is not significant according to the perception of the undergraduate students, because most of the universities are unwilling to make a large investment in an ad hoc learning system. The students positively perceive the content of their e-learning platform, whereas the features of the system itself are not perceived to be high quality.

Moreover, e-LSU and the coronavirus explain 73.9% of the variance in e-LE, which is close to 75% and can be considered substantial. Meanwhile, e-LSU explains 48% of the variance in SS, which is close to moderate. Additionally, e-LSU (path coefficient = 0.457) and the direct effect of COVID-19 (path coefficient = 0.478) indicate a positive effect on e-LE ($R^2 = 0.739$). Furthermore, the impact of COVID-19 is partly moderated the relationship between e-LSU and e-LE (path coefficient = 0.215), and e-LSU (path coefficient = 0.693) have a positive, significant effect on SS ($R^2 = 0.480$). These findings provide significant support for H4 to H6. A further main finding is that e-LSU is partly mediated the relationships between PE, FCs, and IQ on the one hand and e-LE and SS and on the other hand. Accordingly, e-LSU is considered the hub and the sphere that interconnected the variables that predict the actual and frequent use of an e-learning system with the moderating effect of COVID-19 and e-learning system outcomes.

Finally, the value (f^2) effect sizes are weak for PE–e-LSU (0.037), while for FCs, IQ, and SQ with e-LSU, the effect sizes are moderate (0.046, 0.148, and 0.111, respectively). In contrast, SS – e-LSU is strong and the most influential (0.925), and the effect sizes for COV19, moderating effect, and e-LSU with e-LE are also strong (0.517, 0.175, and 0.475, respectively). Consequently, the f^2 result suggests that the collected data fit the structural model and provide a good model fit. These results indicate that e-learning-related factors can enhance the knowledge regarding e-LE. Thus, the consequent impacts on e-learning are emphasized in the context of e-business success factors.

Managerial Implications

The findings of this study provide clear and new insights for academics and specialists who are concerned with and interested in the development of higher education. The study covers public and private universities in Jordan, examines the implementation of e-learning systems, particularly in literature, humanities, and social sciences courses. The findings demonstrate that the adoption of

ICT application in education will serve as a key tool, which enable universities to manage their educational service quality and information content effectively. Furthermore, students' willingness to use blended learning methods over e-learning has a significant impact on their learning satisfaction, based on the teaching strategies and useful teaching methods implemented by their instructors, where the educational producers and implemented strategies must lead students to achieve learning goals and progress in their learning. Universities and institutes can thus determine the factors that affect the best implementation and desired outcomes of e-learning systems.

Theoretical Implications

Several pieces of research have replicated different technology acceptance models to evaluate the main factors that affect the successful implementation of IT systems. The UTAUT has been adopted in e-learning research (Liebenberg et al., 2018; Ngampornchai & Adams, 2016; Pham et al., 2019), while the D&M IS success model has been adopted in the e-business and IT systems context. Thus, the integration of parts of the UTAUT (PE, FCs, and system usage) and the D&M IS model (IQ, SQ, use, and net benefits) could produce a novel model, where the use of an e-learning system is the hub that connects the variables that predict the actual use of an e-learning system and the anticipated outcomes.

The findings of this study are consistent with previous e-learning studies, which emphasize the importance of an e-learning system for higher education and the challenges associated with its future (Alqahtani & Rajkhan, 2020; Amir et al., 2020; Mishra et al., 2020; Moore et al., 2011; Pham et al., 2019).

Research Limitations

The key limitation of this study relates to cross-sectional data collection, where the population are undergraduate students at social science colleges as the main users of an e-learning system, excluding the science faculties.

CONCLUSIONS

This study offers new and important understandings regarding the perspectives of online educational learning platforms during the COVID-19 pandemic. This research explores undergraduate students' perceptions of e-learning systems at Jordanian universities. The results are useful for other similar higher institutes as well as specialists and decision-makers in higher education authorities. There is a need for additional studies on ICT applications associated with the future of e-learning and distance education in the aftermath of the COVID-19 pandemic. On the one hand, the main advantages of e-learning include, but are not limited to, cost reduction, the ability to study from home or in any place, permanent access to online educational materials, the ability to learn without time restrictions, and relaxed environments. On the other hand, the main disadvantages are the steady increase in courses tuition fees, the lack of social interaction between teachers and students, a missing university environment, and technical problems with the IT apparatus. The respondents' opinions of traditional learning and e-learning do not significantly differ in terms of the abilities of the learning approaches to enhance knowledge acquisition. According to the findings, e-learning is the least preferred option, and blended learning is also considered to be less effective than the face-to-face learning method in terms of improving students' skills and competencies.

This study recommends the adoption of e-business concepts, such as the quality of the system, information, and user satisfaction, in the evaluation of e-learning platforms. Moreover, ethical aspects (self-regulation, attendance of lectures, and self-dependency in exam solving) are the most important factors that affect the success of e-learning systems. Finally, future research can use this study's model and findings to evaluate the effectiveness and acceptance of e-learning systems from different users' perspectives (students, tutors, and IT specialists).

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