

The impact of E-service quality, Facebook usage and Artificial Intelligence on E-learning systems: The mediating role of student satisfaction

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ARTICLE INFO	ABSTRACT
<p><i>Article History:</i> Received: January Revised: February Accepted: March Available Online:</p> <hr/> <p><i>Keywords:</i> Malaysia, student satisfaction, E-service quality, Artificial intelligence.</p> <hr/> <p><i>JEL Classification:</i> L86, C88, B16</p>	<p><i>The adoption of e-learning systems has been increasing and reports indicate that Asia has the highest percentage of the growth towards e-learning systems. Following this backdrop, the main purpose of the present study was to evaluate the role of the E-service quality, Facebook usage, artificial intelligence, and student satisfaction on the usage of the E-learning systems. Sample data was collected from students enrolled in any institute offering e-learning in Malaysia. A total of 500 questionnaires were disseminated to the participants identified via online polling and a total of 412 usable questionnaires were evaluated for SEM. The findings of the study show that the usage of Facebook, Artificial intelligence, the satisfaction of students, and E-service quality affected the use of the E-learning systems. Students' satisfaction was also found to positively mediate with AI, FBU, ESQ, and ELS. E-learning adoption is increasing in Malaysia and the recent outbreak of COVID-19 has also invigorated the need for the development of effective e-learning programs so that the education of students doesn't get interruptions. The present study has important theoretical and practical implications in this regard; the findings can be applied to the development of e-learning systems of the country.</i></p>

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1. Introduction

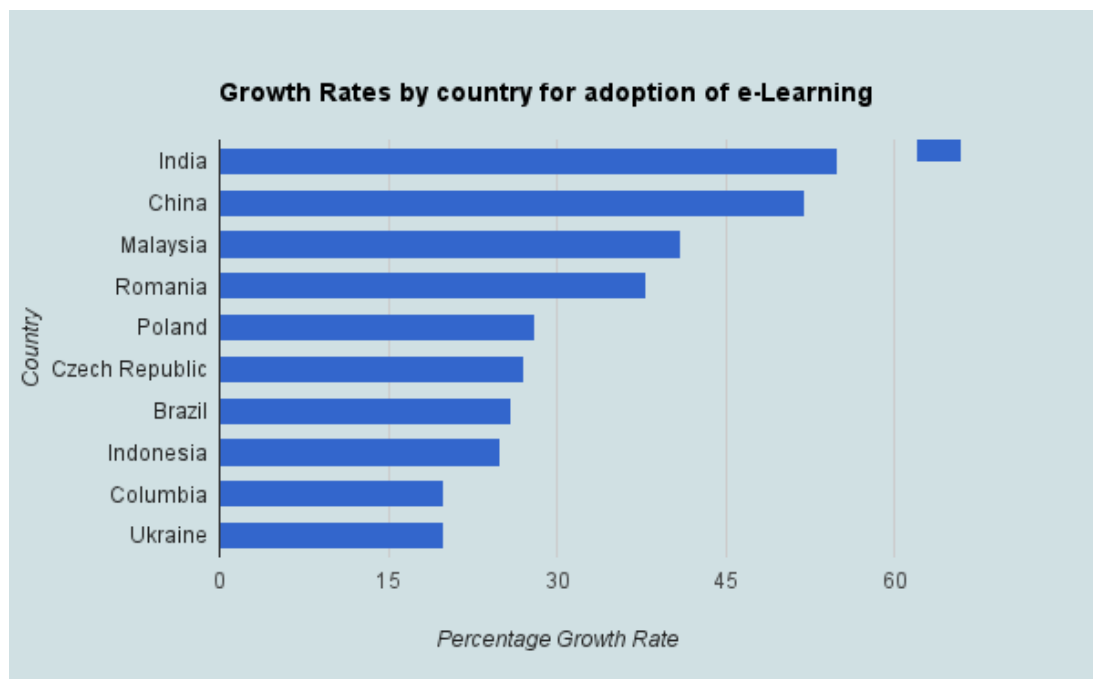
The advancements of the ICT sector in the last decade have contributed towards the development of systems and solutions of varying natures. Electronic learning is also a product of the development in the ICT, information, and communication technologies, and has been evaluated for its uses in the academic literature as well (Ramayah & Lee, 2012). The IT investments have been increasing in different sectors as well. Table 1 shows the growth rate of IT-led sectors. The E-learning systems have been providing new learning environments to the students that involve experiences beyond the boundaries of the classroom curriculum and text-based formats as well. E-learning is defined as the delivery of education or courses through electronic media by the use of some application or server (Chopra, Madan, Jaisingh, Bhaskar, & Education, 2019). The developments and improvements in the internet-based learning curriculum have led towards the development of educational modules i.e. face to face and online education (Padilla-Meléndez, Del Aguila-Obra, & Garrido-Moreno, 2013; Persico, Manca, & Pozzi, 2014). The educational institutions have been actively making investments in e-learning programs, and have also been working on solutions and processes to make these accessible and effective so that the students can draw benefit from them and also to increase student satisfaction and performance (Tarhini, Hone, & Liu, 2013). Malaysia is one of the countries that has positively been initiating the improvement and inculcation of e-learning systems in their educational institutes due to the features like time-saving, accessibility, cost-effectiveness, greater reach and coverage.

Table 1: IT solutions

Segment	Market share of ICT revenue
Mobile	20.2
Education	15.1
Cloud computing	19.1
Data analytics	17.6
Storage	14.3

Source: (Global Data)

The institutes in Malaysia have made effective efforts for the adoption of e-learning systems so that their students can get the maximum benefit from these programs. The innovation in the educational institutes of Malaysia has led the way for the development and usage of e-learning systems. Also, the present environment of COVID-19 has inculcated the importance and need for e-learning systems as well. The following graph indicates the position of Malaysia in the adoption of E-learning systems;

Figure 1: Growth rate by country

Source: Prasoon (2016)

The present literature on e-learning systems has stressed the importance of student engagement and satisfaction, however, there is a lack of studies evaluating the role of social media networks and factors like AI for the interesting development in e-learning systems. Moreover, AI and e-learning have only been studied concerning adaptive or smart study networks. The present study proposes that there is a link between the varying levels of affordance of a student and his/her satisfaction with e-learning systems. Also, the linkage between AI and e-learning systems needs to be evaluated further to develop as well. Thus the objectives of the present study are to evaluate the impact of the e-learning quality, Facebook usage, AI, and student satisfaction, both as a mediator and a direct predictor of e-learning system usability.

The rest of the paper is structured as follows; the second section presents the literature review. Section 3 discusses and presents the methodology used for the collection of data. Section 4

presents the results of structural equation modeling and section 5 presents the discussion, conclusion, limitations, and implications for the study.

2. Literature Review

2.1.E-service quality and E-learning systems

E-service quality is an important indicator of the evaluation of the adoption of e-learning systems (Chopra, Madan, Jaisingh, & Bhaskar, 2019). L. Pham, Limbu, Bui, Nguyen, and Pham (2019) evaluated the role of e-learning quality and student satisfaction as antecedents for the application of e-learning systems in Vietnam and found that e-service quality was one of the most important factors governing the usage and application of e-learning systems in higher education. The service quality governs the adoption of e-learning systems as it is one of the main tenets of customer satisfaction and also is eventful in the formulation of student perceptions regarding the effectiveness of the e-learning systems. Poor or bad quality creates negative perceptions in the minds of the students (Al-Rahmi et al., 2018). Based on these factors the following hypothesis is generated;

H1: There is a significant effect of E-service quality on e-learning systems.

2.2.Facebook usage and E-learning systems

A number of studies have linked the usage of social media intending to use or purchase a product (Dehghani & Tumer, 2015). The usability of social media websites creates a powerful impact on the brand image. As the customers can communicate with one another, the benefits from the usage of a particular item or system are communicated and discussed across networks. Previous studies have shown that there is a positive association between Facebook usage, knowledge sharing, academic distraction, obligations, and social support between college students (Shava & Chinyamurindi, 2018). Facebook has been recognized as an important part of the marketing and promotion mix (Brison, Baker III, & Byon, 2015). In educational settings, the possible affordances are the pedagogical, social, and technological, which are related to the utility and usability of the educational system and can affect the introduction of learning systems (Tang & Hew, 2017).

H2: there is a significant effect of Facebook usage on e-learning systems.

2.3.Artificial intelligence and E-learning systems

ICT is among the fastest-growing sectors worldwide and thus is considered to be vital for the development of several sectors, including the education resource development, and therefore it is necessary for the active improvement in the learning systems by making them more accessible and catering to the needs of different types of students (Farzin & Fattahi, 2018). The advancements in the sector of ICT has created opportunities for universities in their support to improve the quality of services provided to the students in the forms of curriculum, faculty teaching, calendar, admissions, examination, student activities, training, workshops, research information, and the achievements of teachers and students. All this information can be communicated to the recipients with the help of a website or electronic boards and this could be accessed by teachers and students using the intranet, and by the alumni and industrial groups through the extranet as well (Ikpotokin & Imiefoh, 2017, 2018). Another important development in this sector is the advancement in different learning systems which are created for improving the experiences of students. Through the usage of AI-assisted tools and software learning applications and e-learning systems are being developed which aim to increase the usability of the students (Colchester, Hagra, Alghazzawi, & Aldabbagh, 2017). The educational systems are being built as adaptive within the e-learning systems, by understanding the fact that the learning process is varied and different for each learner. Thus, it is important to provide different solutions, enabled by artificial intelligence for e-learners. To provide

effective solutions and resources to the students by way of e-learning services, some of the study materials are being smart to cater to the needs of different students and also to increase the overall experience through smart learning which has been made possible through the inculcation of AI in e-learning resources (Bajaj & Sharma, 2018).

H3: there is a significant effect of artificial intelligence on e-learning systems.

2.4. Student satisfaction and E-learning systems

Student satisfaction in this context refers to the degree of contentment or fulfillment or gratification a student feels from the use of an e-learning system. The dimensions and characteristics of the e-learning systems have a direct impact on the satisfaction levels of the students. The service quality has been found to have an important and significant impact on the satisfaction and engagement levels of the students. Also, the quality and interface of the e-learning systems or websites refer to the medium through which these systems are accessible for the students. The overall dimensions, outlook, user-friendliness, structure, and understandability of the system will have a positive impact on the satisfaction of the students (Chopra, Madan, Jaisingh, & Bhaskar, 2019; C. Pham, Vu, & Tran, 2020). E-learning has been transpiring as a new trend in the modern education systems. A study evaluated the relationship between the student loyalty, engagement, and quality of the e-learning systems and found that quality was one of the strongest indicators to affect the satisfaction of students with technical systems (L. Pham et al., 2019). Another study found E-learning service quality to positively relate with student trust with e-learning, which is a direct antecedent of student loyalty (Hue, Thuy, Thom, & Giang, 2019).

H4: there is a significant effect of student satisfaction on e-learning systems.

2.5. The mediation of student satisfaction

Satisfaction is one of the most important antecedents of the formation of an opinion or the intention to purchase or use some technology or system. The service quality i.e. the transmission quality, the interface of the system, its user-friendliness, and the understandability of students and the final intention to use is affected by the satisfaction levels of the user. Also, the AI interfaces and the perceptions of students formulated through the use of social networking websites and applications affect the engagement, usability, satisfaction, and ultimately the decision to use a system. Therefore, the following hypotheses are generated;

H5: there is a significant mediating impact of student satisfaction on e-service quality and e-learning systems.

H6: there is a significant mediating impact of student satisfaction on artificial intelligence and e-learning systems.

H7: there is a significant mediating impact of student satisfaction on Facebook usage and e-learning systems.

3. Methodology

A questionnaire-based survey design has been implemented in the study. The method of online administration was used due to the current prevailing conditions of COVID-19. The study uses convenience sampling. The present study is based upon the evaluation of the e-learning systems and for this purpose students of schools, colleges and universities were targeted. The researcher uploaded a request for participation in a survey on different social media handles and the willing participants were sent the details of the study along with a google form survey link via email. The focus of the study was upon the ability and adherence of the students with the e-learning systems and for that reason, the students were targeted primarily. The respondents

were sent a cover letter with anonymity and ethical declarations, the respondents were sent reminder emails for completing the survey one week after the initial email. The sample size was selected based on the item response theory and the criteria of 20 respondents per item were used. Based on the method suggested by Campbell, Brislin, Stewart, and Werner (1970) the questionnaire was first developed in English and then translated into Malay, by the usage of the forward and back-translation method. Three translators who are fluent in Malay and English were consulted for the translation. The translated questionnaire was also evaluated by two academicians for ensuring understandability and relevance to the study. The questionnaire was pretested on 50 graduate students and minor changes were made upon recommendations.

The scales for evaluation of the variables were adapted according to the requirements of the present study. The existing scales were used due to their established reliability and validity. The variables were measured based on a 5 point Likert scale and demographical information was also collected. Electronic service quality was evaluated based on the scale developed by Parasuraman, Zeithaml, and Malhotra (2005). The scale was used to evaluate the dimensions of privacy, system availability, privacy, and fulfillment. Facebook usage was measured based on the scale developed by Shava and Chinyamurindi (2018) the scale consists of four items and a sample item is “I do not think I can limit myself on how I utilize Facebook”. Student satisfaction was measured on the three-item scale developed by Bhattacharjee (2001). A sample item is “The Overall, taking this class makes me feel”. E-learning systems were evaluated based on the scale and model developed by Delone and Mclean (2004), the three-item scale for e-learning was used. Artificial intelligence was evaluated based on a five-item scale, the present study followed the directions of the recent study by Basri (2020) for evaluating AI in educational systems.

A total of 500 questionnaires were disseminated, out of which 450 were returned. The questionnaires were scaled for missing values and response bias. There was no difference found in early and late responses, thus the response bias wasn't present. A total of 38 questionnaires were found to have over 15 percent missing values, so they were discarded. The final sample consists of 412 responses.

4. Results

The sample is based on a total of 412 respondents, out of which 55.1 percent are male and 44.9 percent are female. Most of the students are young and 73 percent are aged less than 35, showing that most of these students are in universities. The education level of the respondents is mainly bachelors and graduation, showing that most of the sample is enrolled for or has finished higher education.

Table 2 shows that the mean responses for most of the variables are approaching 4, which shows that majority of the sample is in agreement with the statements of the questionnaire. The skewness values are within the threshold of $-1+1$, showing that data is spread normally (Ghasemi & Zahediasl, 2012). The minimum and maximum statistics of the data are a reflection of the data points of the Likert scale; thus no outliers were detected in the data.

Table 2: Descriptive Statistics

	N	Minimu m	Maximu m	Mean	Std. Deviation	Skewness	Std. Error
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	
ESerQ	412	1.00	5.00	3.2876	1.04220	-.254	.120
FBUse	412	1.00	5.00	3.2482	1.03033	-.361	.120
ArtIntel	412	1.00	5.00	3.5400	1.15496	-.569	.120
StuSat	412	1.00	5.00	3.2120	1.20347	-.281	.120
ELeaS	412	1.00	5.00	3.3778	1.13839	-.478	.120
Valid N (listwise)	412						

The KMO and Bartlett's test was conducted to evaluate the adequacy of the data for factor analysis. The results show that the KMO value is close to one and that Bartlett's sphericity is also significant, thus showing that the factor analysis can be implemented on the sample.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.924
Bartlett's Test of Sphericity	Approx. Chi-Square	6672.778
	df	171
	Sig.	.000

The results for the factor loadings are displayed in table 4. It can be seen that all loading values are greater than 0.7, thus these are significant and contribute effectively to the overall variance of the construct (Hair, Black, Babin, Anderson, & Tatham, 2006). The issue of cross-loading hasn't been observed in the factor matrix as well.

Table 4: Rotated Component Matrix

	Component				
	1	2	3	4	5
SQ1		.825			
SQ2		.876			
SQ3		.839			
SQ4		.793			
FU1			.790		
FU2			.753		
FU3			.799		
FU4			.830		
AI1	.828				
AI2	.826				
AI3	.820				
AI4	.831				
AI5	.874				
SS1				.840	
SS2				.872	
SS3				.854	
EL1					.789
EL2					.792
EL3					.829

The convergent and discriminant validity was evaluated as per the directions of Bagozzi, Yi, and Phillips (1991). The convergent validity is evaluated based on the CR and AVE values. The CR, composite reliability, is supposed to be greater than 0.7 and AVE has a cut-off value of 0.5. The results presented in table 5 show that both of these conditions have been satisfied, thus convergent validity is established. The

MSV values are less than AVE and the self-correlation values are also higher than the inter-correlations, thus showing that discriminant validity is also present (Fornell & Larcker, 1981).

Table 5: Convergent and discriminant validity

	CR	AVE	MSV	SS	SQ	FU	AI	EL
SS	0.919	0.790	0.493	0.889				
SQ	0.919	0.739	0.340	0.342	0.860			
FU	0.881	0.651	0.340	0.361	0.583	0.807		
AI	0.943	0.769	0.303	0.472	0.524	0.509	0.877	
EL	0.931	0.819	0.493	0.702	0.416	0.516	0.550	0.905

The model fitness indices show that the measurement model is fit; CFI>IFI and GFI are significantly greater than their defined thresholds and CMIN and RMSEA are also lesser than their cut-off points. Thus showing that the model is fit (Byrne, 2013).

Table 6: Model Fit Indices

CFA Indicators	CMIN/DF	GFI	IFI	CFI	RMSEA
Threshold Value	≤ 3	≥ 0.80	≥ 0.90	≥ 0.90	≤ 0.08
Observed Value	1.966	0.935	0.979	0.979	0.048

Figure 2: CFA

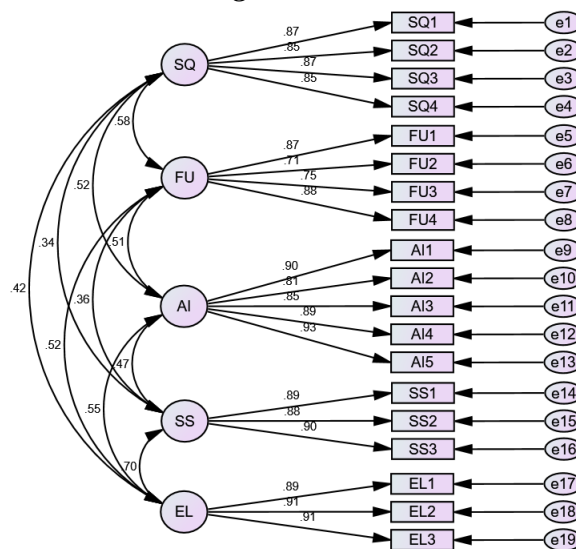


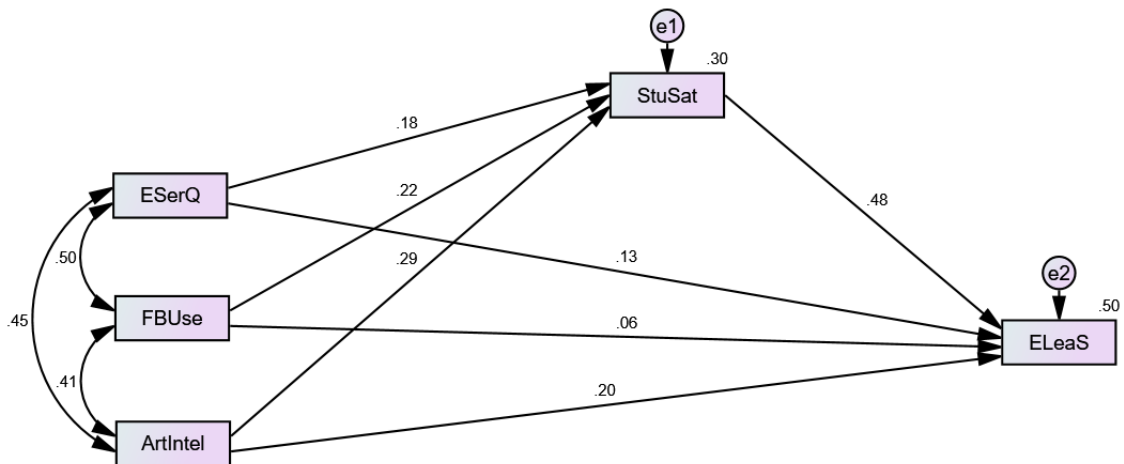
Table 7 presents the results of the SEM. It can be seen that a unit increase in ArtIntel will cause an increase of 0.337 in ELeaS, showing the presence of a significant and positive relationship thus the hypothesis is accepted. It can be seen that a unit increase in FBUse will cause an increase of 0.168 in ELeaS, showing the presence of a significant and positive relationship thus the hypothesis is accepted. Similarly, a unit increase in ESerQ and StuSat will cause an increase of 0.210 and 0.483 in ELeaS, showing the presence of a significant and positive relationship thus the hypotheses are accepted. The bottom portion of Table 7 presents the results of

mediation, it can be seen that the mediation is significant as well. thus all seven hypotheses are accepted.

Table 7: Structural Equation Modeling

Total Effect	ArtIntel	FBUse	ESerQ	StuSat
StuSat	.286**	.219**	.176**	.000
ELeaS	.337**	.168**	.210*	.483**
Direct Effect	ArtIntel	FBUse	ESerQ	StuSat
StuSat	.286**	.219**	.176**	.000
ELeaS	.199**	.062	.125**	.483**
Indirect Effect	ArtIntel	FBUse	ESerQ	StuSat
StuSat	.000	.000	.000	.000
ELeaS	.138**	.106**	.085**	.000

Figure 3: SEM



5. Discussion and conclusion

The present study evaluated the impact of various factors on the e-learning systems of the students enrolled in Malaysian educational institutes. The study by Al-rahmi, Othman, and Yusuf (2015) evaluated the effectiveness of using e-learning technologies and found the technology interface, student satisfaction, self-efficacy, intention to use, and usefulness of the system to correlate with the e-learning experiences of the UTM students. Similarly, Dang, Zhang, Ravindran, and Osmonbekov (2016) studied the gender differences and student satisfaction from the technology supported blended learning systems, the findings showed that the satisfaction of female students was affected by the institutional, self-efforts and instructor efforts made for understanding and driving accomplishment from the systems. Al-Rahmi et al. (2018) found that the factors like the content of e-learning and the self-efficacy of the students seem to have a positive impact on student satisfaction and is related to the usefulness of the e-learning technology and systems imparted by the universities in Malaysia. Cheng (2020) found that the perception of interactivity, design quality of the course, and content quality of the course are factors that contribute to the satisfaction and perceived usefulness of students and also affect their intention to use the e-learning systems in the future.

The present study analyzed data from university students to evaluate their satisfaction with e-learning systems. The study utilized SEM to evaluate the relationships among different factors and the results indicate that there is a presence of a direct, significant, and positive association between Facebook usage, artificial intelligence, student satisfaction, and e-service quality and e-learning system in Malaysia. The results also confirmed the presence of positive mediation of student satisfaction between AI, SQ, FBU, and e-learning systems. The results indicate that

the educational institutes should focus on improving the quality of the systems provided to the students so that their satisfaction with the adoption of e-learning systems can increase. Also, the AI incorporation and Facebook usage relevance show that the students who are comfortable with using social media networks and other technology can adopt the e-learning systems effectively.

5.1.Limitations, recommendations, and implications

The present study is from the perspective of the experiences of the students, to increase the reliability and to develop an understanding of the overall effects of the e-learning systems a diode study for students and teachers is recommended. Moreover, the present study only evaluates the experiences of the Malaysian students, a review and inclusion of the e-learning systems of other countries of the Asian Pacific region will enrich findings, as it is the recipient of the largest e-learning growth regions.

The present study produces several theoretical, social, and practical implications as well. There has been a growth in the learning systems shift to online mediums, as the present study highlights the satisfaction levels of the students, implications regarding policy changes, and improvements in services have been made. Also, in the current environment of the pandemic, the need for e-learning systems and facilitation of students with such networks has been increasing thus the present study makes important theoretical contributions as well.

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