

The Effect of Determinants of the E-Learning Effectiveness on Students' Academic Achievement during the COVID-19 Pandemic: Application in the Saudi Context

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Abstract

Based on its importance in continuing education during the COVID-19 pandemic, this study aims to identify, at first, the E-learning effectiveness determinants in order to verify, later, their effect on the students' academic achievements. Determinants were selected on the basis of the studies carried out on this subject. These are administrative support, course content, course design, technical support, the role of a faculty member, and the role of the student. To study students' perceptions of E-learning effectiveness and its relationship to academic achievement, an inferential statistics cross-sectional survey of students from higher education institutions in the Kingdom of Saudi Arabia was carried out using a self-administered questionnaire. With a sample size of 422, all levels of bachelor students participated in the study. Utilizing the SmartPLS program, this study applied a structural equation modeling (SEM) technique. The findings revealed that there is a positive relationship between the set of determinants of E-learning effectiveness and students' academic achievements during the COVID-19 pandemic. Additionally, a significant difference was discovered in the perception of the students between gender, level of the course, and quality of E-learning in the higher education sector during the COVID-19 pandemic.

KeywordsE-learning effectiveness; academic achievement; students' perspective; styling; higher education; COVID-19 pandemic; Saudi Arabia(keywords).

Introduction

Due to the novel coronavirus pandemic, numerous universities all over the world chose E-learning as the strategy to be adopted. The adoption of E-learning, especially in higher education, provides many chances to students to continue their studies during COVID-19. In this regard, a lot of research tried to define E-learning. Rossi (2009) presents it as a set of appliances and learning technique. Thus, it is considered as an approach based on technologies in order to provide students with a comfortable space to continue their studies (Garisson & Anderson, 2003). For many researchers, E-learning represents a major solution to overcome the difficulties and problems caused by this pandemic and encountered by universities in completing courses; many countries have used this strategy in order to provide students with an opportunity to continue their studies.

Similarly, Saudi Arabia also used E-learning as a tool to facilitate its educational system. In 2005, a new establishment was created to make this new strategy a reality; it was named the

National Center of E-learning and Distance (NCEDL). Additionally, in 2011, the Saudi Electronic University was established in order to improve the concept of E-learning in the country and to present various programs related to undergraduate and graduate studies (Alqahtani et al., 2020). Thus, this study aims to verify the role of the determinants of E-learning effectiveness on students' academic achievements during the COVID-19 pandemic. In this regard, several hypotheses are retained as a response to our central question "is there any relationship that combines determinants of E-learning effectiveness and students' academic achievement during the COVID-19 pandemic?"

To provide answers to this question, this study is organized as follows. The first part constitutes a literature review which is used to identify the different hypotheses of the study, in order to clarify the relation between the determinants of E-learning effectiveness and students' academic achievements. Then, a methodology that describes the study's sample, the different measures used in the study, and the method incorporated to analyze these measures is presented. Finally, the obtained results, a discussion, and a conclusion take place at the end of this study.

LITERATURE REVIEW AND HYPOTHESIS

In literature, there exist different terminologies of E-learning. According to Alqahtani et al., (2020), E-learning means E-education, distance learning, and online learning. In our study, we will use the concept of E-learning as a new tool that facilitates teaching and learning during the current pandemic. The adoption of E-learning, especially in higher education, provides many chances to students to continue their studies. This new situation caused by COVID-19 has forced the entire world to choose E-learning as a strategy to realize their learning objectives. In this context and due to its importance, the Kingdom of Saudi Arabia founded the NCEDL in 2005. This center has a central objective to enhance the strategy of E-learning in educational institutions. Recently, in 2011, the Kingdom of Saudi Arabia established the Saudi Electronic University that presents various programs related to undergraduate and graduate studies (Alqahtani et al., 2020). In addition, some authors (Alqhatani, 2011; Elfaki et al., 2019) tried to evaluate the role of E-learning on academic achievement and performance in a Saudi context. They proved the positive effect E-learning has on developing the academic achievement of students.

Regarding its impact and role in improving interaction between students and their teachers, as it is highlighted by some researches (Arkorful et al., 2014; Judahil et al., 2007; Singh et al., 2001; Smedley, 2010; Zhang et al., 2006), E-learning has been chosen by universities in order to provide instructional programs to students during the COVID-19 pandemic. Rossi (2009) defined E-learning as a concept that "covers a range of applications, learning methods, and process." For Garisson and Anderson (2003), as cited in Eddy et al., (2014), E-learning constitutes "a network or online learning that takes place in a formal context and uses a range of multimedia technologies. It is a learning system that is supported by electronic hardware and software either online (synchronous) or offline (asynchronous)." According to Oblinger (2005), "a fully-online course to using technology to deliver part or all of a course independent of permanent time and place." In the same line of ideas, the Organization for Economic Co-operation and Development (OECD) (2005) describes E-learning as "the use of information and communication technologies in diverse processes of education to support

and enhance learning in institutions of higher and includes the usage of information and communication technology as a complement to traditional classrooms, online learning or mixing the two modes.” It is “the wide set of applications and processes which use available electronic media and tools to deliver vocational education and training” (Abbas et al., 2005).

Tao et al. (2006) proved that this new tool of learning based on the usage of electronic networks has a several advantages. According to Goyal (2012), E-learning is a “popular medium of learning as the number of internet users are increasing day by day.” It facilitates the interaction between students and their teachers in universities, and helps them join their courses. It has a positive impact on students’ academic achievements (Abdel Jawad et al., 2020). This new strategy of learning, according to Liaw et al., (2007), makes learning and teaching more “active, interesting and enjoyable.”

The effectiveness and the role of the E-learning is determined, in the literature, through an administrative support matrix developed by Meyer and Barefield (2009), where they tried to identify the essential elements and factors related to effective online educational programs. It is about three essential supportive infrastructure stages: foundation stage, development stage and maintenance stage. According to the Meyer and Barefield (2009), each stage contains elements that should be considered to achieve learning outcomes. Meyer and Barefield (2010, 2013) proved that a sufficient infrastructure and support functions are necessary in order to maintain the implementation of online learning. Hence, it is noted that a relationship exists between administrative support and the effectiveness of E-learning. Therefore, the first hypothesis is formulated as follows:

H1: There is a positive and significant relationship between administrative support and E-learning during the COVID-19 pandemic.

On the other hand, some studies highlighted that E-learning gained popularity because of its flexible content and resources. The importance of the course design and content for the achievement of the E-learning objectives is proved by certain researches; for example, Biggs (2005) found that the design elements constitutes a major tool in intending learning outcomes. The E-learning process is characterized by its ability to improve and to adapt the course content to the needs of the students (Babu et al., 2018). Gamage et al. (2014) based their study on ten factors in order to demonstrate E-learning effectiveness; the most important are interactivity, collaboration, motivation, network of opportunities, and pedagogy. In addition, the study presented by Zhang et al. (2006) showed that the effectiveness of E-learning is based on the process of interactivity and collaboration. These results are proved by another study that found that E-learning effectiveness is highly interlinked with interactive learning activities, multimedia instruction, and the quality of E-learning (Liaw, 2008). As for Wang (2003), four factors have an effect on the effectiveness of E-learning: learner interface, learning community, content, and personalization. Mohamed et al. (2018) affirmed that “contents of learning issues, usability of the information, faster learning, quick responsiveness, learning quality, time and cost friendly, usability outside of the class and appropriateness for working independently” constitute determinants of the E-learning effectiveness. In addition, Liao et al. (2019) found that “appropriate course design of E-learning supports teamwork, and learners find a fun environment during their learning.” Therefore, based on this literature, it is clear that a relationship exists between course content

and E-learning effectiveness, and design of the course and E-learning effectiveness. In this way, the following hypothesis are retained:

H2: There is a positive and significant relationship between course content and E-learning during the COVID-19 pandemic.

H3: There is a positive and significant relationship between course design and E-learning during the COVID-19 pandemic.

In higher education, the effectiveness of the online learning process is related, also, to the availability of some elements. It is done with the help of technological and developed platforms. In this way, internet is required to facilitate communication with students, as Obeidat et al. (2020) noted. Authors proved that designed sites and portals are an appropriate mechanism to achieve the E-learning objective, especially to give students an opportunity to finish their studies during the COVID-19 pandemic (Obeidat et al., 2020). Moore et al. (2010), when defining the E-learning, combined the success of the online learning to the existence of web-based technology tools such as internet, video, audiotapes, and TV broadcasts, which are necessary to provide a learning environment for students. Costa et al. (2012) indicated that the online platforms based on internet constitute a major tool that facilitates the collaboration between students, their colleagues, and their teachers. It helps, also, to deliver information and courses to the students. Cacheiro-Gonzalez et al. (2019), who stipulate that the online learning platforms facilitate to get an immediate response by sending message, prove this idea. In the same line of idea, Ouadoud et al. (2018) emphasized that a learning management system based on the technology represents a vital source; it helps teachers in achieving their learning objectives by easily sharing information with their students. Accordingly, the following hypothesis is retained:

H4: there is a positive and significant relationship between technical support and E-learning during the COVID-19 pandemic.

To be a successful process of learning, the E-learning involves many factors including the instructor and the student. An instructor represents the central actor of the E-learning success. They constitute the agent who must manage the situation well in order to increase the students' satisfaction about the E-learning process. In this context, previous research highlighted that students' perceptions of instructor constitute the starting point of the success of the E-learning process. As the instructor is an essential factor that affects students' satisfaction (Bolliger, 2004; Walker & Fraser, 2005; Özkök et al., 2009), observing their role on improving and achieving the E-learning process objectives is essential. According to Nortvig et al. (2018) and Chigeza and Halbert (2014), interpersonal dialogue with instructor has a positive impact on student engagement and satisfaction. Sun et al. (2020) emphasized in their study that to guarantee the success of the lectures in the situation of online learning, teachers should know how to manage their lectures and how to adapt these sessions to the online environment. Teachers, according to Giray (2021), "can be a medium to interact with student and improving their satisfaction." In addition, according to Moore (1989), interaction and collaboration among students play a major role in their satisfaction and learning. Communication between students can increase and improve the quality of the online learning (Goh et al., 2017, Özkök et al. 2009). Thus, the following hypotheses are formulated:

H5: there is a positive and significant relationship between role of faculty member and E-learning during the COVID-19 pandemic.

H6: there is a positive and significant relationship between role of student and E-learning during the COVID-19 pandemic.

Based on the literature reviewed in this part, the use of new technology tools and the internet, the collaboration, the interaction, and the communication constitute means of the E-learning process. These means help E-learning to be a major tool in realizing academic achievement in the situation of the COVID-19 pandemic. It aims to develop an educational system that helps to guarantee to follow-up the lectures during this situation. The use of online leaning by universities seeks to improve the efficiency and the quality of learning and the satisfaction of students during the pandemic situation. It has a positive impact on the realizing of academic achievement of students (Mothibi, 2015; Abdel Jawad et al., 2020). In this way, it is hypothesized that:

H7: there is a positive and significant relationship between E-learning during the COVID-19 pandemic and academic achievement.

Regarding gender, another research contribution concerns the existence of significant difference between male and female in relation to the perception of E-learning. In this way, according to Gašević et al. (2016), gender has an impact on E-learning outcomes. Alghamdi et al. (2020) prove this idea; they indicate that females are more interested and perform better in an online course, which results in more meaningful learning for women than men. In addition, Moghavvemi et al. (2017) underline the significant effect of gender in the acceptance of the use of E-learning-related means. Park et al. (2019) prove the same idea by indicating a significant difference between males and females in using the E-learning system. Moreover, according to Ellis et al. (2009) and Binaymin et al. (2018), there is a relationship between the course level and the perception of E-learning. Thus, the following hypothesis are retained:

H8. Statistically, significant differences exist in the sample's views concerning the effectiveness of E-learning during the COVID-19 due to variables: (a) gender, (b) level of the course.

H9. Statistically, significant differences exist in the sample's views concerning academic achievement due to variables: (a) gender, (b) level of the course.

Table 1 summarizes critical factors that control the effectiveness of E-learning in higher educational institutions based on the literature on E-learning and academic achievement.

Table 1: Determinants of the effectiveness of E-learning

Items	Authors
Administrative Support	Meyer & Barefield (2009, 2010, 2013)
Course Content	Mohamed et al. (2018)
Course Design	Liao et al. (2019)
Technical Support	Obeidat et al., (2020), Moore et al. (2010), Costa et al. (2012), Cacheiro-Gonzalez et al. (2019), Ouadoud et al.

	(2018)
The role of the faculty member	Bolliger (2004), Walker & Fraser (2005), Özkök et al. (2009), Nortviaget al. (2018), Chigeza& Halbert (2014)
The Role of the student	Giray (2021), Goh et al. (2017)
Academic achievement	Mothibi (2015), Abdel Jawad et al. (2020)

Figure 1 depicts the research model, which includes six independent variables (administrative support, course content, course design, technical support, the role of the faculty member, and the role of the student) and their relationship to the dependent variable (academic achievement) with a moderating variable (the effectiveness of E-learning during the COVID-19 pandemic). The framework was created using multiple studies from high-indexed journals, published and unpublished data, practical experience, and different E-learning concepts.

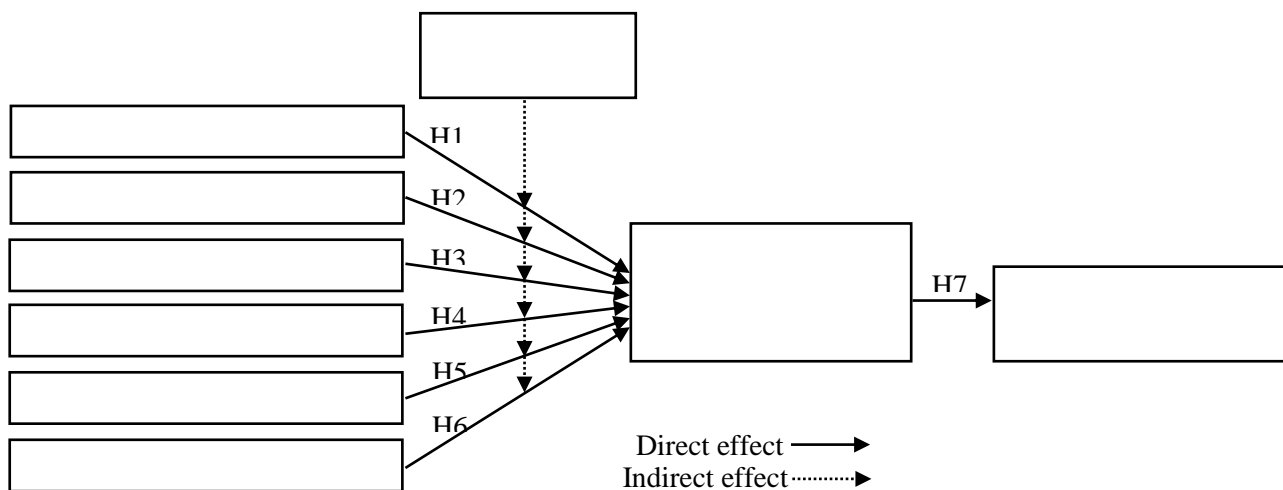


Figure 1: Research Model

METHODOLOGY

The study population consists of students attending online classes during the COVID-19 period in the higher education sector in the Kingdom of Saudi Arabia; it includes bachelors (1st, 2nd, 3rd, and 4th year). A self-made questionnaire was used for this four-part study. A 5-point Likert scale was used in the questionnaire (5-strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree). Part 1, of course, with demographic details such as gender and level to evaluate the moderating effect. Part 2 consists of six variables representing the determinants of E-learning effectiveness [administrative support (Aung & Khaing, 2016), course content (Makokha&Mutisya, 2016), course design (Makokha&Mutisya, 2016),

technical support (Queiros& de Villiers, 2016), faculty member characteristics (Makokha&Mutisya, 2016), the role of the student (Makokha&Mutisya, 2016)] with five questions for each variable. However, some items were omitted because some questions did not achieve the desired level of satisfaction. Part 3 is a representation of E-learning during the COVID-19 pandemic; it contains six questions (Elumalai et al., 2020). Part 4 represents the variable of academic achievement, which consists of six questions (Elumalai et al., 2020). The required information includes 0.5 expected effect sizes (Cohen's d), 95% desired statistical power level, and 0.05 probability level.

RESULTS

GOODNESS OF MODEL FIT

The evaluation using the goodness of model fit must be performed at the initial stage of model assessment, before the measurement and structure model review (Henseler et al., 2016). It is required to report the model fit using inference statistics or fit indices. The model fit should be recorded by the researcher using a model fit test or an estimate of the approximate model fit (Dijkstra &Henseler, 2015).

According to the goodness-of-fit indicators shown in Table 2, the proposed model has a high standard. The goodness-of-fit indicator also recorded a value of 0.4741, which is greater than 0.36 and is the minimum (Wetzels et al., 2009).

Table 2:Results of Goodness-of-Fit

Fit criteria	Value	Goodness-of-Fit
SRMR	0.061	
d_ ULS	1.705	
d_ G	0.994	0.4741
Chi-Square	2000.842	
NFI	0.965	

According to the data in Table 2, the appropriate measure of model fit is the standardized root mean square residual (SRMR) (Dijkstra &Henseler, 2015). Other model fit criteria use the PLS algorithm bootstrap to calculate unweighted least squares (dULS) and geodesic discrepancy (dG) (Hair, Hollingsworth, et al., 2017). A conservative approximation is less than 0.1 of the SRMR value; the estimated result of 0.061 is a perfect fit for SRMR. As a conventional view, dG and dULS are 95% of the bootstrap quantile; the computed results of 0.994 and 1.705 represent the met criteria. Thus, the model achieves a good fit.

Table 3: Results of Measurements Model—Convergent Validity

Items	Constructs	Loadin g	Cronbach's Alpha	rho_ A	Composit e Reliability	Average Variance Extracted (AVE)
ACA 1	Academic achievement	0.790	0.912	0.916	0.931	0.694
ACA 2		0.850				

ACA 3		0.824				
ACA 4		0.799				
ACA 5		0.883				
ACA 6		0.849				
AS2	Administrative support	0.714				
AS3		0.759	0.796	0.800	0.868	0.623
AS4		0.851				
AS5		0.827				
CC1	0.784					
CC2	Course content	0.791				
CC3		0.834	0.867	0.871	0.904	0.653
CC4		0.792				
CC5		0.838				
CD1	0.704					
CD2	Course design	0.843	0.872	0.973	0.901	0.696
CD3		0.862				
CD4		0.913				
COV 1		0.825				
COV 2		0.881				
COV 3	E-learning during the COVID-19 pandemic	0.817				
COV 4		0.854	0.917	0.918	0.935	0.707
COV 5		0.846				
COV 6		0.822				
RL2	The role of the faculty member	0.753				
RL4		0.880	0.896	0.900	0.923	0.706
RL5		0.794				
RS1	0.867					
RS2	The role of the student	0.863				
RS3		0.895	0.922	0.922	0.941	0.762
RS4		0.873				
RS5		0.867				
TS1	Technical	0.853				

TS2	support	0.866
TS3		0.859
TS4		0.836
TS5		0.785

Internal quality reliability, composite reliability value, and Cronbach's alpha should all be greater than 0.70. (Hair, Hult, et al., 2017). The research considers composite reliability, average variance derived (AVE = convergent validity), outer loadings, Cronbach's alpha, and discriminant validity in the measurement evaluation. Table 3 shows that the average variance extracted AVE values were greater than the minimum required amount of 0.50, suggesting that the questionnaire correctly reflects the model (Hair et al., 2010). The square root comparison is performed using latent variable correlations and AVE values (Hair, Hult, et al., 2017). Since the measured values are less than 0.9, the discriminant validity was acknowledged. The results demonstrate that the measurement scales are reliable and valid.

Table 4: Fornell-Larcker Test of Discriminant Validity

	ACA	AS	CC	CD	COV	TS	RS	RL
ACA	0.833							
AS	0.586	0.789						
CC	0.724	0.715	0.808					
CD	0.712	0.453	0.345	0.834				
COV	0.807	0.565	0.694	0.654	0.841			
TS	0.617	0.741	0.699	0.564	0.606	0.840		
RS	0.762	0.526	0.676	0.564	0.775	0.586	0.873	
RL	0.612	0.543	0.652	0.736	0.654	0.543	0.653	0.811

Fornell-Larcker criterion is widely used to measure the degree of mutual variance between latent variables of the model (Fornell&Larcker, 1981). Quadratic root comparison is rendered using latent variable correlations with AVE values (Hair, Hult, et al., 2017). The estimated values are less than 0.9, which implies that the discriminant validity has been recognized. The findings have shown that the measurement scales are reliable and valid.

Therefore, it can be said that the model is more valid for differentiation than other possible constructions. Additionally, cross-load coefficients are analyzed with external load factors for each latent variable in the Table 5.

Through table 5, all the items of the study have a high level of saturation on the underlying variables, and the linkage of the items with the latent variables exceeded the minimum value of 0.7.

Table 5: Results of Discriminant Validity—Cross Loadings

	ACA	AS	CC	CD	COV	RL	RS	TS
ACA1	0.790	0.514	0.568	0.050	0.619	0.040	0.578	0.546
ACA2	0.850	0.578	0.629	0.024	0.667	0.045	0.634	0.577
ACA3	0.824	0.468	0.546	0.048	0.646	0.019	0.635	0.464
ACA4	0.799	0.479	0.594	0.035	0.594	0.004	0.549	0.503
ACA5	0.883	0.428	0.630	0.046	0.752	0.022	0.663	0.501
ACA6	0.849	0.478	0.645	0.083	0.737	0.063	0.730	0.504
AS2	0.459	0.714	0.516	0.001	0.433	0.016	0.383	0.532
AS3	0.443	0.759	0.507	0.049	0.424	0.049	0.356	0.524
AS4	0.505	0.851	0.631	0.026	0.482	0.003	0.459	0.659
AS5	0.440	0.827	0.594	0.023	0.442	0.001	0.456	0.616
CC1	0.571	0.655	0.784	0.013	0.525	0.021	0.484	0.641
CC2	0.568	0.598	0.791	0.016	0.483	0.009	0.505	0.567
CC3	0.612	0.530	0.834	0.016	0.608	0.012	0.591	0.583
CC4	0.576	0.523	0.792	0.011	0.609	0.038	0.615	0.483
CC5	0.596	0.600	0.838	0.007	0.559	0.013	0.519	0.565
CD1	0.028	0.010	0.018	0.704	0.009	0.602	0.063	0.046
CD2	0.010	0.036	0.024	0.843	0.050	0.651	0.094	0.046
CD3	0.052	0.025	0.001	0.862	0.065	0.638	0.141	0.084
CD4	0.074	0.006	0.006	0.913	0.093	0.645	0.109	0.072
COV1	0.649	0.492	0.594	0.150	0.825	0.129	0.660	0.469
COV2	0.729	0.483	0.612	0.105	0.881	0.038	0.679	0.523
COV3	0.641	0.428	0.545	0.033	0.817	0.014	0.637	0.483
COV4	0.701	0.459	0.588	0.061	0.854	0.029	0.646	0.518
COV5	0.657	0.476	0.576	0.000	0.846	0.002	0.664	0.491
COV6	0.693	0.514	0.586	0.061	0.822	0.008	0.624	0.573
RL2	0.037	0.051	0.016	0.511	0.027	0.753	0.080	0.037
RL4	0.019	0.011	0.009	0.701	0.042	0.880	0.116	0.070
RL5	0.045	0.011	0.010	0.552	0.032	0.794	0.117	0.073
RS1	0.629	0.414	0.553	0.115	0.661	0.125	0.867	0.521
RS2	0.659	0.470	0.593	0.118	0.662	0.112	0.863	0.521
RS3	0.681	0.492	0.603	0.093	0.671	0.109	0.895	0.522
RS4	0.670	0.432	0.613	0.089	0.678	0.089	0.873	0.500
RS5	0.684	0.485	0.587	0.149	0.708	0.134	0.867	0.494
TS1	0.522	0.647	0.618	0.085	0.484	0.091	0.473	0.853
TS2	0.552	0.637	0.646	0.025	0.550	0.040	0.540	0.866
TS3	0.542	0.620	0.600	0.100	0.558	0.078	0.532	0.859
TS4	0.519	0.647	0.592	0.077	0.481	0.070	0.494	0.836
TS5	0.450	0.564	0.472	0.041	0.462	0.041	0.408	0.785

If the HTMT criterion is less than 0.90, it reflects that the two reflective structures are just identical and are not very much related (Henseler et al., 2014). Table 6 shows the value less than 0.90, so the scales are reliable and valid.

Table 6: Heterotrait-Monotrait Ratio (HTMT)

	ACA	AS	CC	CD	COV	TS	RS	RL
ACA								
AS	0.692							
CC	0.812	0.864						
CD	0.863	0.849	0.833					
COV	0.878	0.662	0.872	0.880				
TS	0.683	0.876	0.894	0.882	0.866			
RS	0.827	0.812	0.851	0.833	0.842	0.842		
RL	0.053	0.849	0.844	0.815	0.857	0.896	0.855	

STRUCTURAL EQUATION MODELING (SEM)

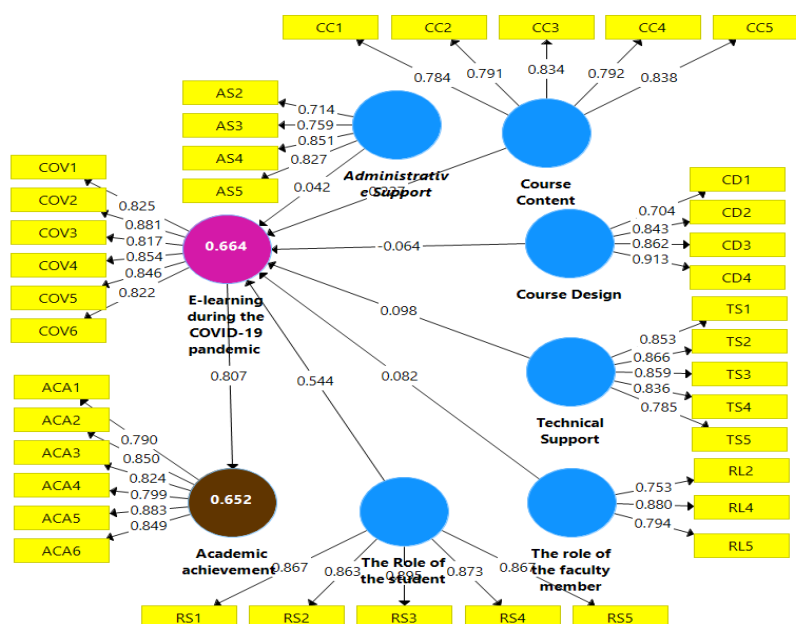


Figure 2: Research Framework

Figure 2 shows that the estimated equation's R2 value is 0.652. It reveals that administrative support, course content, course design, technical support, the role of the student, and the role of the faculty member present 65.2% of the effectiveness of E-learning on students' academic achievement during the COVID-19 pandemic.

Table 7: Structural Hypothesis

Hypo	Relationship	St. Beta	Std. Error	T Values	P Values	Decision
H1	Administrative support -> The effectiveness of E-learning during the	0.042	0.055	0.765	0.445	Unsupported

COVID-19 pandemic						
H2	Course content -> E-learning during the COVID-19 pandemic	0.227	0.065	3.479	0.001	<u>Supported**</u>
H3	Course design -> The effectiveness of E-learning during the COVID-19 pandemic	0.064	0.048	1.337	0.002	<u>Supported**</u>
H4	Technical support -> The effectiveness of E-learning during the COVID-19 pandemic	0.098	0.058	1.683	0.033	<u>Supported*</u>
H5	The role of the faculty member -> The effectiveness of E-learning during the COVID-19 pandemic	0.082	0.044	1.842	0.046	<u>Supported*</u>
H6	The role of the Student-> The effectiveness of E-learning during the COVID-19 pandemic	0.544	0.055	9.861	0.000	<u>Supported**</u>
H7	The effectiveness of E-learning during the COVID-19 pandemic -> Academic achievement	0.807	0.025	32.323	0.000	<u>Supported**</u>

Significant at P** =< 0.01, p*<0.05

The evidence presented in Table 7 demonstrates the results of hypothesizes testing using bootstrapping. To test the hypothesizes, 5,000 re-sampling methods of the bootstrapping procedure were used, while SmartPLS calculated the level of significance of the path between the variables using the analytical bootstrapping technique. The results indicate that administrative support does not have a positive relationship with the effectiveness of E-learning during the COVID-19 pandemic ($\beta=0.042$, $p>0.05$). Therefore, H1 is refused. The findings revealed that course content has a positive relationship with the effectiveness of E-learning during the COVID-19 pandemic ($\beta=0.227$, $p<0.05$). Therefore, H2 is accepted. According to the research results, course design has a positive relationship with the effectiveness of E-learning during the COVID-19 pandemic ($\beta=0.064$, $p<0.05$). Thus, H3 is accepted. The findings revealed that technical support has a positive relationship with the effectiveness of E-learning during the COVID-19 pandemic ($\beta=0.098$, $p<0.05$). Therefore, H4 is accepted. The values indicate that the role of the faculty member have a positive relationship with the effectiveness of E-learning during the COVID-19 pandemic ($\beta=0.082$,

$p < 0.05$) Therefore, H5 is accepted. The findings revealed that the role of the student has a positive relationship with the effectiveness of E-learning during the COVID-19 pandemic ($\beta = 0.544$, $p < 0.01$). Therefore, H6 is accepted. Finally, the findings indicated that the effectiveness of E-learning during the COVID-19 pandemic has a positive relationship with academic achievement ($\beta = 0.807$, $p < 0.01$). So, H7 is accepted.

The bootstrap results in Table 8 can be indicated to confirm the previous results:

Table 8: Results of Confidence Intervals: Bootstrap

Hypo	Relationship	Original Sample (O)	Mean. Boot	2.5%	97.5%
H1	Administrative support - >The effectiveness of E- learning during the COVID- 19 pandemic	0.042	0.042	0.000	-0.065
H2	Course content -> E-learning during the COVID-19 pandemic	0.227	0.230	0.110	0.354
H3	Course design -> The effectiveness of E-learning during the COVID-19 pandemic	0.414	0.454	11.329	0.414
H4	Technical support -> The effectiveness of E-learning during the COVID-19 pandemic	0.307	0.308	0.001	0.353
H5	The role of the faculty member -> The effectiveness of E-learning during the COVID-19 pandemic	0.167	0.065	2.586	0.167
H6	The role of the student -> The effectiveness of E- learning during the COVID- 19 pandemic	0.544	0.541	0.432	0.544
H7	The effectiveness of E- learning during the COVID- 19 pandemic -> Academic achievement	0.807	0.808	0.754	0.854

Table 8 shows that the lower bound and upper bound are positive for the bootstrap value for all favorable hypotheses. Thus, these six research hypotheses are accepted, indicating that there is a positive effect of determinants of the effectiveness of E-learning on students' academic achievements during the COVID-19 pandemic.

Partial Least Squares—Multiple Group Analysis (PLS-MGA)

According to Henseler et al.'s (2009) guidelines, a percentage greater than 0.95 and less than 0.05 indicates a significant difference between groups in the specific PLS path coefficient. If the p-value is greater than 0.95 or less than 0.05, the results are significant at the 5% error level.

Table 9 reveals that there are statistically significant differences between males and females, with regard to the effectiveness of E-learning during the COVID-19 pandemic, which is due to the variable the role of the student ($p < 0.05$). There are, also, statistically significant differences between male and female students with regard to academic achievement, which relates to the effectiveness of E-learning during the COVID-19 pandemic ($p < 0.05$).

Table 9: Significant Difference Between Genders

Relationship	P-value (male vs. female)
Administrative support -> The effectiveness of E-learning during the COVID-19 pandemic	0.641
Course content -> E-learning during the COVID-19 pandemic	0.423
Course design -> The effectiveness of E-learning during the COVID-19 pandemic	0.412
Technical support -> The effectiveness of E-learning during the COVID-19 pandemic	0.654
The role of the faculty member -> The effectiveness of E-learning during the COVID-19 pandemic	0.213
The role of the student -> The effectiveness of E-learning during the COVID-19 pandemic	0.002
The effectiveness of E-learning during the COVID-19 pandemic -> Academic achievement	0.001

Table 10: Significant Difference Between Levels of Course

Relationship	P-value					
	(G1 vs. G2)	(G1 vs. G3)	(G1 vs. G4)	(G2 vs. G3)	(G2 vs. G4)	(G3 vs. G4)
Administrative support -> The effectiveness of E-learning during the COVID-19 pandemic	0.123	0.002	0.001	0.412	0.002	0.31
Course content -> E-learning during the COVID-19 pandemic	0.321	0.003	0.001	0.221	0.151	0.112
Course design -> The effectiveness of E-learning during the	0.110	0.140	0.041	0.191	0.112	0.0341

COVID-19 pandemic							
Technical support ->	0.210	0.201	0.142	0.221	0.113	0.412	
The effectiveness of E-learning during the COVID-19 pandemic							
The role of the faculty member ->	0.035	0.024	0.012	0.121	0.041	0.171	
The effectiveness of E-learning during the COVID-19 pandemic							
The role of the student ->	0.086	0.061	0.041	0.121	0.031	0.223	
The effectiveness of E-learning during the COVID-19 pandemic							
The effectiveness of E-learning during the COVID-19 pandemic ->	0.23	0.171	0.038	0.112	0.043	0.065	
Academic achievement							

According to Henseler et al. (2009), a percentage greater than 0.95 and less than 0.05 indicates a significant difference between groups in the specific PLS path coefficient. If the p-value is greater than 0.95 or less than 0.05, the results are significant at the 5% error level. Table 10 indicates that there are significant differences between the effectiveness of E-learning during the COVID-19 pandemic and the level of courses variable. The p-value of (G1–G2), 0.035 of the role of the faculty member is less than 0.05, reflecting that there is a significant difference between year 1 and year 2 courses. The p-values of (G1–G3), 0.002 of administrative support; 0.003 of course content; and 0.024 of the role of the faculty member, are less than 0.05, reflecting that there is a significant difference between year 1 and year 3 courses. The p-values of (G1–G4), 0.001 of administrative support; 0.001 of course content; 0.041 of course design; 0.012 of the role of the faculty member; and 0.041 the role of the student are less than 0.05, reflecting that there is a significant difference between year 1 and year 4 courses. The p-values of (G2–G4), 0.002 of administrative support and 0.041 of the role of the faculty member, are less than 0.05, reflecting that there is a significant difference between year 2 and year 4 courses. The p-value of (G3–G4), 0.0341 of course design is less than 0.05, reflecting that there is a significant difference between year 3 and year 4 courses. The p-value of (G1–G4) 0.038 of academic achievement is less than 0.05, reflecting that there is a significant difference between year 1 and year 4 courses. The p-value of (G1–G4) 0.043 of academic achievement is less than 0.05, reflecting that there is a significant difference between year 2 and year 4 courses.

DISCUSSION AND CONCLUSION

Based on the retained literature, there is a positive and significant relationship between administrative support and E-learning effectiveness (Meyer & Barefield, 2010, 2013).

However, hypothesis H1 is unsupported; the obtained result demonstrates that this relation is not verified, which means there is no effect of administrative support on the E-learning effectiveness. This negative relationship may be related to several causes and reasons. For example, problems related to managing the interaction between instructors and students or between and among students are the main obstacles to E-learning that are encountered by students. Regarding this, the non-significant relationship is explained by the role played by the teacher in setting up a favorable online teaching situation for students. In this line, the lack of necessary skills to manage the online session, to improve communication with students and the implementation of motivational activities, constitute major reasons related to this non-significance. Thus, to overcome this negative relationship, it is important to improve these gaps to better ensure good online education.

H2 is supported. It means that the course content has a positive relationship with E-learning quality at the 1% (2.58) level of significance. Course content is a primary consideration in E-learning; the pattern of online courses is similar (Babu et al., 2018; Gamage et al., 2014). H3 is supported. The course design has a positive relationship with E-learning quality at the 1% (2.58) level of significance. The course design facilitates students' understanding and participation in the course. The course design is an important factor to consider when developing E-learning (Liao et al., 2019).

H4 is supported. The technical support has a 5% (1.96) significant positive relationship with the effectiveness of E-learning during the COVID-19 pandemic. In order to provide technical support, the necessary infrastructure of computers, networks, and technical teams with expert professionals is required. The availability of long-term technical support is critical to the quality of E-learning (Cacheiro-Gonzalez et al., 2019; Ouadoud et al., 2018). In accordance with the 5% (1.96) level of significance, H5 is supported, which means that the role of the faculty member is associated with higher levels of quality in E-learning. The role of the faculty members is regarded as a critical strategy in the implementation of E-learning. The effectiveness of E-learning is determined by the level of satisfaction with it. Faculty members can reflect on the course quality and students' academic achievements from the students' point of view, based on their perception of the effectiveness of E-learning (Bolliger, 2004; Goh et al., 2017; Özkök et al., 2009; Walker & Fraser, 2005). H6 is supported. The role of the student has a positive relationship with the quality of E-learning by the 1% (2.58) level of significance. It is the student's role and the extent of his interest in E-learning, as demonstrated by his discipline and attendance at courses as well as his participation and asking questions, that determines the effectiveness of E-learning during the COVID-19 period (Giray, 2002; Nortvig et al., 2018; Sun et al., 2020).

As a parallel result with the retained literature (Mothibi, 2015; Abdel Jawad et al., 2020), H7 is supported. There is a statistically positive relationship between the effectiveness of E-learning during the COVID-19 and the academic achievement by the 1% (2.58) level of significance.

According to the findings, there is a statistically significant difference in the effectiveness of E-learning during the COVID-19 between males and females. Therefore, H8a is supported. In E-learning activities, there is a statistically significant difference between male and female students in the quality of E-learning, satisfaction, and motivation of the activities (Alghamdi et al., 2020). Furthermore, there is a statistically significant difference in the effectiveness of

E-learning during the COVID-19 between the levels of courses. As a result, H8b is supported. As with any course, there is a difference in the level of instruction as well as the effectiveness of E-learning during the COVID-19 and other learning strategies (Binaymin et al., 2018).

According to the findings, there is a statistically significant difference in the level of academic achievement between males and females. Therefore, H9a is supported. In level of academic achievement, there is a statistically significant difference between male and female students, so we found that the academic achievement of female students is better than male students. (Gašević et al., 2016). Furthermore, there is a statistically significant difference in the level of academic achievement between the levels of courses. As a result, H9b is supported. As with any course, there is a difference in the level of instruction as well as the level of academic achievement (Ellis et al., 2009).

Male and female students' perspectives on the effectiveness of E-learning during the COVID-19 are taken into consideration in this study, which provides recommendations to decision makers. Because of the external environment, male and female students have different perceptions of each other. Males and females have equal opportunities in E-learning, but female students are more adept at using E-learning platforms than their male counterparts. Young generations are well versed in digital competition. Therefore, it is the responsibility of educational institutions to integrate digital competency into the teaching and learning processes (Park et al., 2019). Designing the E-learning system to be more user-friendly for male students is critical to improve the experience of both male and female students, in providing effective learning activities. Additionally, the perception of E-learning by students varies depending on the level of the course being studied. Students in their third and fourth years of bachelor's degrees may be given fewer contact or lecture classes and more directed and independent learning. It is possible to provide more contact or lecture classes to first-year undergraduates and less directed independent learning to second-year undergraduates. E-learning will be more effective if different support systems are used for different levels of courses, which will be accomplished through the use of information technology.

To synthesize, this study has an objective to identify the relationship between the determinants of the effectiveness of E-learning and students' academic achievements. The obtained results shown a positive, direct, and meaningful effect, which affirms the existence of a relationship between the different determinants of the E-learning effectiveness and the students' academic achievement, except the relationship between the administrative support and the students' academic achievement, which is not verified. In addition, the presented results demonstrate a difference between female and male students in the regard of their academic achievement. These results prove the quality of the study and the hypotheses retained, however in an acceptable proportion in its overall form.

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