

Factors Influencing Online Learning Outcomes in UAE: An Extension of Delon and Mclean with Actual Usage and Cognitive Absorption as Intervening Variables

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Abstract

This is an exceptional time and will have a significant impact on how institutions operate in the coming years. The Covid19 pandemic has devastated the world not only in terms of health, but also in the way we live, work and learn. Companies face the big challenge of keeping ups and downs and are trying to find innovative solutions to survive. Among the many areas that have been hit hardest is the education industry. In the education industry, educational institutions rely on online learning to continue the educational process during blockages and other rigorous measures being implemented by governments around the world. A major concern in this regard is the increasing impact of these technologies on performance. The role of mediating actual use was also considered. This study uses PLS-mediated structural equation modeling to analyze 412 valid questionnaires and evaluate the proposed model. The results showed that all hypotheses were supported. The proposed model described 76.5% of the variation in performance impact.

Keywords: Public universities; Cognitive absorption; Online learning; UAE.

I. INTRODUCTION

The coronavirus pandemic (COVID-19) had a severe effect on lives across the world in 2020. Due to its high infection rates because it transmits through contact routes, such as mouth, hands, and nose (Liu et al., 2020). As the pandemic have brought the world to stand still, education sector is no exception, and therefore, governments around the world decided to take stringent measures of social distancing and avoiding physical interaction which is the case in education (UAE Government Portal, 2020). These decisions have led all classed in higher education institutions to be conducted virtually by making use of many technological applications.

In the United Arab Emirates, the Ministry of Education (MOE) have instructed public and

private universities to follow new guidelines by minimizing the frequency of going to campus and cease face to face classes. Initially, these measures were planned for two weeks during March 2020 but eventually were extended until the end of 2019-2020 academic year (UAE Government Portal, 2020).

Online learning, the main emphasis of this study, is a very hot topic especially since the start of the new millennia, as it is seen the destiny of education powered by the evolution of technology and internet (Bakia et al., 2012). Many governments, international organizations, and universities have shifted their attention towards investing in online learning due to its promised benefits in terms of education reach and coverage, cost, and effectiveness (A. Aldholay et al., 2018; Arghode et al., 2017;

Aspillera, 2010; Bowen, 2013; World Economic Forum, 2016). It is described as the procedure where no less than 80 percent of the program syllabus is delivered through the Internet (Allen & Seaman, 2007). Since its initiation, Web-based learning has been interchangeably linked with several other similar names, such as distance learning, e-learning and blended learning. As per Clark & Mayer (2016), Web-based learning is described as delivery of instructions through the Internet by utilising digital gadgets, such as laptops, tablets, smartphones, and desktop computers. This offers the conventional institutions with modes to expand their programs (Lapovsky, 2015). Deliberations regarding Web-based learning should be positioned exactly within a framework driven by the outlook for higher education (Bowen, 2013). Further, Isaac et al. (2019) have argued about the vital role of online learning during wars with major disruption to the educational process and its infrastructure. It is obvious to mention that the common element between wars and pandemics is that they both cause a significant disruption to the educational process. The framework related to this study is public universities in the United Arab Emirates (UAE).

Today, we are living in the times of COVID-19, which has exceptionally changed the educational practices worldwide. In June 2020, the Government of the UAE decided to deploy Web-based learning for all higher education institutions in the nation. Following several months of observation, the government has pointed out certain elements of concern, such as performance and behaviour of pupils (UAE Government Portal, 2020). It is considered that such elements are vital for academic research as Web-based learning is set to continue beyond the COVID-19 era, as noted by a recent global study by Pearson Education Group (Pearson, 2020). Almuraqab (2020) conducted research on pupils' preference to Web-based learning in the UAE and noted that 55% of respondents held a positive opinion about it while 45% had negative views. Furthermore, in another study, 49% of the respondents were in favour of a mixed mode of learning post-COVID-19.

This research will deploy the DeLone & McLean information success model (William H. DeLone & McLean, 2016) as it studies not only the acceptance but also goes beyond to scrutinise the

effect on performance following the deployment of particular technology – in this case, Web-based learning in the UAE. Moreover, on the basis of the arguments made above regarding the behavioural issues, compatibility, which is a constituent of the Diffusion of Innovation (DOI) theory, will be supplemented to the model for studying its impact on the usage of Web-based learning and its effect on performance of pupils. In addition, the research will lead the way by scrutinising cognitive absorption as a moderating variable as it was observed to be significant in such kinds of technologies – for example, in (Agarwal & Karahanna, 2000). Lastly, the mediation role of actual usage between each of compatibility and user satisfaction in one side and performance impact on the other will be examined.

2. Literature Review

2.1 Compatibility (COMP)

Within the domain of information systems (IS), compatibility is termed as a basic precursor to user espousal of a new application or technology (Moore & Benbasat, 1991). According to Premkumar (2003), compatibility was noted to be a key indicator of espousal of IS innovation. Compatibility is described as the extent to which an innovation is seen as being in line with the prevailing ideals, needs, and previous experiences of prospective adopters (E. M. Rogers, 1995). Moreover, as per Chen et al. (2002), it signifies the extent to which new technology is in line with prevailing values, dogmas, previously presented notions, and needs of prospective adopters. Koenig-Lewis et al. (2010) described it as the degree to which a new offering goes well with the ethics, principles, experiences, and customs of prospective users. Many research works have been carried out to analyse the impact of compatibility on the intent to use and contentment with various technology applications. As the respondents of this research are those who are actually using Web-based learning, it is prudent to term it as usage. In Taiwan, Wu & Wang (2005) studied mobile commerce application and found a significant positive effect of compatibility on usage. Similarly, in a study by Isaac et al. (2017) it was found that there is an effect between technology fit and user satisfaction in the public sector.

Furthermore, Ainin et al. (2015) have studied Facebook usage among SMEs in Malaysia and the result revealed a significance positive relationship between compatibility and usage. Thus, the following hypotheses are presented:

H1.a Compatibility has a substantial impact on performance impact.

H1.b Compatibility has a substantial impact on actual usage.

2.2 User Satisfaction (SATIS)

One of the main success elements behind deploying a new IS mechanism is the contentment of its users (William H. DeLone & McLean, 2016). As pointed out by Xinli (2015), the contentment of users alludes to what extent users of the IS mechanism perceive it to be helpful and intend to utilise it repeatedly. (W. S. Lin & Wang, 2012) described the contentment of users as their reaction to the quality, rapidity, outline, and number of functions of the mechanism. Moreover, user contentment is defined as the extent to which pupils using a Web-based learning setup are contented with its espousal and how well it matches their expectations (Roca, Chiu, & Martínez, 2006; Wang & Liao, 2008). Many published studies have emphasised on the substantialness of the effect of user contentment on the actual use and performance. As per Xinli (2015), the greater the contentment with utilising the electronic monitoring system, the better was the usage and performance of users in China's supervision agencies. Shim & Sug (2020) established the significance of user contentment in improving the actual use and net advantages of using Web-based health information portals. Ashfaq et al. (2020) substantiated the importance of user contentment when utilising chatbot to improve the usage and output of users.

However, research by Daud et al. (2011) noted that there exists an insignificant relationship between user contentment and impact on performance. These conflicting observations give an indication to carry out the research and substantiates the significance/insignificance of user contentment in enhancing the use and performance effect of IS systems from the perspective of Web-based learning in the UAE. On the basis of the aforesaid discussion, the following hypotheses are proposed:

H2.a: User satisfaction has a substantial effect on performance impact.

H2.b: User satisfaction has a substantial effect on actual usage.

2.3 Actual Usage (USE)

Within the domain of technology and IS, where applications are scrutinised with regards to approval, espousal, and effect, several strong concepts and models have evolved with multiple aspects which have been widely employed for studying diverse technological applications in various settings (Jeyaraj, 2020). Actual use is an essential aspect in several theories as it signifies the logical requirement to analyse the effect of any specific technology (Kolasa et al., 2020). As a key element in the Delone & Mclean success model, it is described as the extent to which a user consumes the services of an information system with regards to occurrences and time of usage (DeLone & Mclean, 2003). Aldholay et al. (2018) studied the role of actual use from the perspective of Web-based learning and confirmed its importance in affecting performance. Culibrk et al. (2016) studied the e-government setup in Serbia and substantiated the noteworthy effect which usage has on the clear benefits. Aparicio et al. (2017) collected data from 383 users and deployed SEM-PLS for dissecting it. They noted that usage considerably affected individual impact. In this work, actual usage is described as the rate at which pupils utilise Web-based learning and the volume of time they spend in utilising it. Thus, on the basis of the above, the following is presumed:

H3. Actual usage has a significant impact on performance impact.

H4.a Actual usage has a substantial mediating impact between compatibility and performance impact.

H4.b Actual usage has a substantial mediating impact between user satisfaction and performance impact.

2.4 Cognitive Absorption (CA)

Cognitive absorption is described as a condition of condition involvement or a complete experience which a person has with technology (Agarwal & Karahanna, 2000). It intends to capture the individual's experience with IS (Weniger & Loebbecke, 2011), which is Web-based learning in this research. As per Saadé &

Bahli (2005), cognitive absorption is a manifestation of the degree of user engagement with the Internet and video games. Weniger & Loebbecke (2011) stated that cognitive absorption encompasses two aspects, namely cognitive and affective, wherein curiosity, control, temporal dissociation, and focused immersion signify a cognitive dimension, and heightened enjoyment signifies an affective element. In this research, cognitive absorption signifies a condition of profound involvement and enjoyment with Web-based learning (Agarwal & Karahanna, 2000).

Empirically, many noteworthy research works have studied the function of cognitive absorption from the IS perspective and reported its importance (C. Chen, 2017; C.-P. Lin et al., 2016; Masrek & Gaskin, 2016; Ozkara et al., 2017; Pallud, 2017; Zheng et al., 2019). Furthermore, cognitive absorption has been examined as a moderating variable (Busari et al., 2017) and as a direct precursor to the system aftermath like individual learning (Magni et al., 2013) or application of technology (Rouis, 2012). This work intends to study the moderation impact of cognitive absorption on the association between user contentment, actual use and performance based on the established direct impact of user contentment and actual use on performance (Isaac, Abdullah, Ramayah, & Mutahar, 2017a; Stefanovic et al., 2016). Thus, it can be proposed that:

H5: Cognitive absorption moderates the relationship between actual usage and performance impact.

H6: Cognitive absorption moderates the relationship between user contentment and performance impact.

2.5 Performance Impact (PI)

Technology applications are created for rendering a value to users and their efficacy is gauged by the outcomes of its usage (Tam et al., 2019). Within the IS domain, theories have dealt with the various phases of technology, beginning from its initiation to the actual usage and intention to reuse. The newer Delone & Mclean success model emphasises on assessing the outcomes of usage of technology. It is outlined in several terminologies that are utilised interchangeably, such as clear benefits, organizational effect, individual effect, and performance effect (DeLone & McLean, 2016).

Performance impact is described as the extent to which the usage of a technology application improves the work quality in accomplishing tasks swiftly, secures control over it, reduces errors, and enhances job efficacy (A. Aldholay et al., 2019). As for this research, performance impact is seen as the degree to which the usage of Web-based learning impacts the performance of pupils with regards to knowledge procurement, productivity, proficiency, and resource savings (Isaac et al., 2019). As the decisive goal of this research, user contentment and actual use are presumed to affect performance impact with a moderating outcome by cognitive absorption.

3. Research Method

3.1 Overview of the Proposed Research Model

The model employed is based on the Delone & Mclean information success model (William H. DeLone & McLean, 2016) that encompasses user contentment, actual use, and performance impact. Furthermore, compatibility was drawn from the diffusion of innovation theory (E. Rogers, 1995) and cognitive absorption (Agarwal & Karahanna, 2000). The recommended model has six key hypotheses to be put to test.

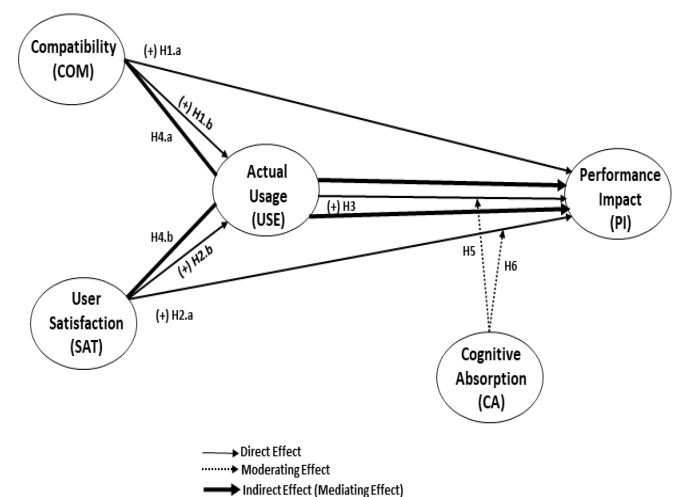


Figure 1: The proposed model

3.2. Development of Instrument and Data Collection

In this work, the researchers formulated a Web-based questionnaire tool that comprises 32 questions. All parameters were evaluated using

the five-point Likert scale as depicted in previous studies (Isaac et al., 2017a; Isaac et al., 2017b). This info was gathered by despatching the questionnaire through email to pupils at 3 public universities in the UAE, namely United Arab Emirates University, Zayed University, and Higher Colleges of Technology, during the period March to July 2021. Of the 500 questionnaires distributed, 412 responses were considered apt for analysis. This sample size was adequate as mentioned by Krejcie and Morgan (1970) and Tabachnick and Fidell (2012).

4. Data Analysis and Results

This research employed SEM-VB (Structural Equation Modelling-Variance Based) through PLS (Partial Least Squares) method to assess the research framework using the software SMARTPLS 3.0 (Ringle et al., 2015). After the descriptive assessment, this research follows the two-phase analytical method suggested by (Anderson & Gerbing, 1988; Hair, Hult, Ringle, & Sarstedt, 2017), and begins with the assessment of measurement model (reliability and validity), after which the structural model evaluation is performed (testing the theoretical relationships). Schumacker & Lomax (2004) as well as Hair et al. (2010) suggest that the 2-step assessment process which incorporates structural and measurement models has an advantage over the 1-phase assessment process. As per Hair et al. (2017), the measurement model denotes how each parameter is measured, whereas structural model denotes how the parameters relate to each other with respect to the structural model. The primary reasons for selecting PLS as a statistical technique for this

research is that for both structural and measurement model, PLS provides simultaneous assessment which leads to more perfect estimates (Barclay et al., 1995).

4.1 Descriptive analysis

Table 1 shows the percentage and frequency for demographic profile of candidates in the research sample. It demonstrates that 313 (75.97%) candidates are female whereas the rest 99 (24.03%) are male candidates. Regarding age groupings of the candidate sample, 15.3 percent of them are below 20 years. The majority of candidates (302; 73.3%) fall into the age group 20-29 years. 7.0% of total candidates are of age group 30-39 that includes 29 candidates from the sample. 4.4% of total candidates are of age group 40-49 with only 18 candidates from that sample. Furthermore, education profile of the respondents, 69.2% of respondents have a diploma. Also, 19.4% or 80 of respondents hold an undergraduate degree certificate, 0.2% of respondents have a postgraduate degree, while 11.2% or 46 of respondents have a high school degree. A huge majority of candidates are single, comprising 83.3 per cent, whereas 16.3 percent of candidates are married and 0.4% of the candidates are widowed and divorced. For the experience of using the computer of the sample, vast majority of the respondents have more than 6 years in using the computer 90.8%. further 9.2% have experience between 1- 6 years in using the computer. Finally, respondents of the survey were from the 3 public universities in the UAE. 48.3 per cent are from the Higher Colleges of Technology, while 30.6 per cent are from UAE university, and the rest of respondents 21.1 per cent are from Zayed University. (See table 1 for details)

Table 1: *Summary of Demographic Profile of Respondents*

Demographic Item	Categories	Frequency	Percentage
Gender	1. Male	99	24.03
	2. Female	313	75.97
Age	1. Less than 20 Years old	63	15.3
	2. 20-29 Years old	302	73.3
	3. 30-39 Years old	29	7.0
	4. 40-49 Years old	18	4.4
	5 More than 50 Years old	0	0

Demographic Item	Categories	Frequency	Percentage
Marital Status	1. Single	343	83.3
	2. Married	67	16.3
	3. Divorced	1	0.2
	4. Widowed	1	0.2
Education Background	1. High School	46	11.2
	2. Diploma	285	69.2
	3. Undergraduate Degree	80	19.4
	4. Postgraduate Degree	1	0.2
Which University are you in?	1. Zayed University	87	21.1
	2. UAE University	126	30.6
	3. Higher Colleges of Technology	199	48.3
		87	21.1
How long you've been using the computer?	1. Less than a year	5	1.2
	2. 1-3 Years	7	1.7
	3. 4-6 Years	26	6.3
	4. More than 6 Years	374	90.8
Total		412	100

4.2 Measurement Model Assessment

The measurement model assessment was conducted through construct reliability and validity (including discriminant and convergent validity). For Construct reliability, this research confirmed the individual Cronbach's alpha coefficients to assess the reliability of every core variable in the model of measurement. The outcomes show that each of the individual Cronbach's alpha coefficients varying between 0.822 and 0.957 were greater than the recommended value of 0.7 (Kannana & Tan, 2005; Nunnally & Bernstein, 1994). Furthermore, for determining construct reliability, all the CR (composite reliability) values varying between 0.894 and 0.963 were greater than 0.7 (Jöreskog, Linn, and Werts, 1974; Kline, 2010; Boudreau, Gefen, and Straub, 2000), which adequately shows that construct reliability is satisfied as displayed in Table 2. Thus, the attained CR and Cronbach's Alpha for all parameters were considered to be adequately error-free.

Factor loading was employed to measure indicator reliability. High loadings on a construct show that the related indicators have much in common apparently, which is illustrated by the construct (Hair et al., 2017). Factor loadings above 0.50 were regarded as very significant (Hair et al., 2010). All items' loadings exceeded the suggested value of 0.5 as illustrated in Table 1. Remaining item loadings in the model have thus fulfilled all the requirements.

For determining convergent validity (which is the extent to which a measure positively correlates with other measures of the same parameter), this research used the AVE (average variance extracted), and it showed that all values of AVE were greater than the recommended value of 0.50 (Hair et al., 2010) varying between 0.723 and 0.833. All constructs' convergent validity has been satisfactorily fulfilled and sufficient convergent validity is attained as shown in Table 2.

Table 2: Mean, standard deviation, loading, Cronbach's Alpha, CR and AVE

Constructs	Item	Loading (> 0.5)	M	SD	α (> 0.7)	CR (> 0.7)	AVE (> 0.5)
Compatibility (COMP)	CMP1	0.869	3.30	1.16	0.827	0.896	0.743
	CMP2	0.852					
	CMP3	0.864					
Actual Usage (USE)	USG1	0.822	3.24	1.02	0.822	0.894	0.738
	USG2	0.875					
	USG3	0.878					
Satisfaction (SATIS)	SAT1	0.913	3.33	1.03	0.899	0.937	0.832
	SAT2	0.914					
	SAT3	0.909					
Cognitive Absorption (CA)	CA1	0.933	3.73	1.13	0.899	0.937	0.833
	CA2	0.887					
	CA3	0.916					
Performance Impact (PI)	PI1	0.856	3.53	1.06	0.957	0.963	0.723
	PI2	0.839					
	PI3	0.868					
	PI4	0.810					
	PI5	0.869					
	PI6	0.872					
	PI7	0.836					
	PI8	0.840					
	PI9	0.851					
	PI10	0.862					

Note: M=Mean; SD=Standard Deviation, α = Cronbach's alpha; CR = Composite Reliability, AVE = Average Variance Extracted.

- The measurement used is a seven-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).
- All the factor loadings of the individual items are statistically significant ($p < 0.01$).

Key: CA: Cognitive Absorption, PI: Performance Impact, COMP: Compatibility, SATIS: User Satisfaction, USE: Actual Usage

There has been some amount of criticism of the criterion of Fornell-Larcker. Henseler, Ringle, & Sarstedt, (2015) which stated that it does not correctly reveal the deficiency of discriminant validity in general research scenarios. They have suggested an alternative method which is known as the HTMT (heterotrait-monotrait) ratio of correlations which is based on the multitrait-multimethod matrix. This research evaluates discriminant validity using HTMT method. It is known that the discriminant validity has an issue when the value of HTMT is higher than HTMT0.90 value of 0.90 (Gold et al., 2001), or the 0.85 HTMT0.85 value (Kline, 2010). All values as shown in Table 4 were below the suggested value of 0.85, signifying that discriminant validity has been determined.

Table 4: Results of discriminant validity by Fornell-Larcker criterion

Factors	1	2	3	4	5
	CA	COMP	PI	SATIS	USE
1 CA	0.85				
2 Comp	0.65	0.85			
3 PI	0.80	0.699	0.85		
4 SATIS	0.78	0.747	0.82	0.85	
5 USE	0.59	0.706	0.68	0.735	0.85

Note: Diagonals represent the square root of the average variance extracted while the other entries represent the correlations.

Key: CA: Cognitive Absorption, PI: Performance Impact, COMP: Compatibility, SATIS: User Satisfaction, USE: Actual Usage

4.3 Structural Model Assessment

Hair, Hult, Ringle, & Sarstedt (2017) recommended structural model assessment by

considering the beta (β), R^2 and the resultant t -values through a bootstrapping process with a resample of 5,000. Additionally, they suggested reporting the predictive relevance (Q^2).

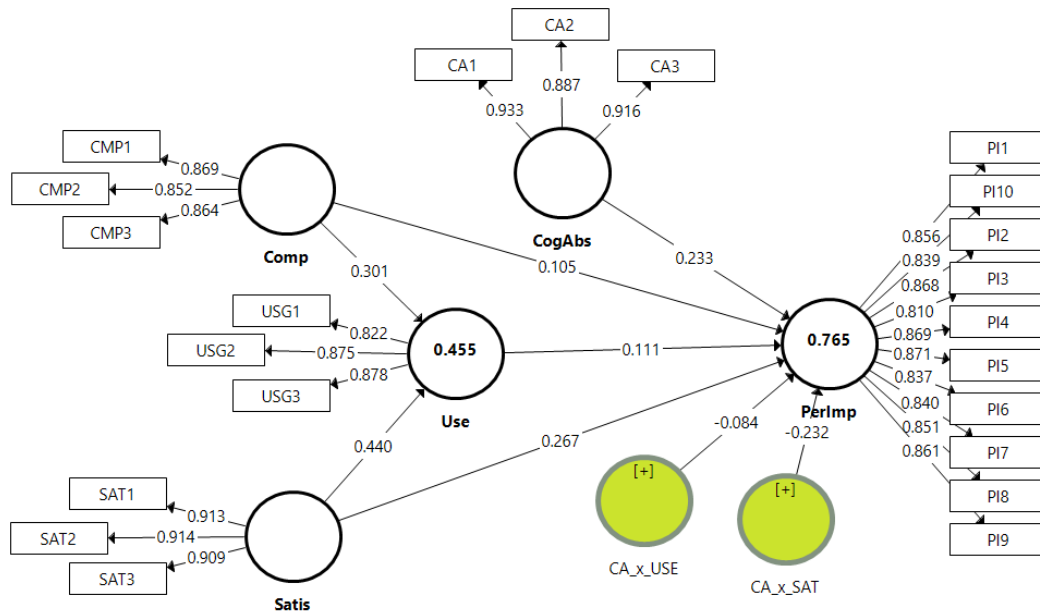


Figure 2: PLS algorithm results

4.3.1 Direct Effect Hypotheses

The assessment of structural model as shown in Table 5 and Figure 2 provides the hypothesis test indication. Compatibility determines actual usage and performance effect. Thus, H1.a and H1.b are acknowledged with ($\beta = 0.105$, $t = 4.287$, $p < 0.001$) as well as ($\beta = 0.301$, $t = 6.101$, $p < 0.001$), respectively. Similarly, user satisfaction essentially determines actual usage and performance effect. Therefore, H2.a and H2.b is acknowledged with ($\beta = 0.267$, $t = 5.684$, $p < 0.001$) as well as ($\beta = 0.440$, $t = 8.479$, $p < 0.001$), respectively. Furthermore, actual usage significantly determines the performance effect. Thus, H3 is accepted with ($\beta = 0.111$, $t = 3.056$, $p < 0.01$).

Observe that the normalised path coefficient shows the strengths of the correlation between endogenous and exogenous constructs, so the direct impacts of user satisfaction on performance effect is stronger compared to the influence of actual usage and compatibility on performance effect.

User satisfaction, compatibility, and actual usage justify 77% of the variance performance effect. Furthermore, user satisfaction and

compatibility explain 46% of the actual usage variance. The R^2 values attained an acceptable level of descriptive power as suggested by Cohen (1988) and Chin (1998), showing a substantial model.

Besides, by employing the blindfolding process, this research examined the power of proposed research model considering the predictive relevance. As suggested by Hair et al. (2017), the process of blindfolding should be only used on the endogenous parameters with a reflective measurement. In case the value of Q^2 is higher than 0, then the proposed model's predictive relevance exists for some endogenous construct (Fornell, C., & Cha, 1994; Hair et al., 2017). As shown in Table 5, all the Q^2 values above 0 suggest that there is a satisfactory predictive relevance for the recommended model. As per Hair et al. (2017), the values of Q^2 in this research have strong predictive relevance.

Table 5: *Direct effect hypotheses*

Hypothesis	Relationship	Std Beta	Std Error	t-value	p-value	Decision	R ²	Q ²
H1. a	CMP→PI	0.105	0.032	4.287	0.000	Supported		
H1. b	CMP→USE	0.301	0.049	6.101	0.000	Supported		
H2. a	SATIS→PI	0.267	0.055	5.684	0.000	Supported		
H2. b	SATIS→USE	0.440	0.052	8.479	0.000	Supported	0.46	0.33
H3	USE→PI	0.111	0.036	3.056	0.002	Supported	0.77	0.53

Key: CA: Cognitive Absorption, PI: Performance Impact, COMP: Compatibility, SATIS: User Satisfaction, USE: Actual Usage.

4.3.2 Indirect Effect Hypotheses (Mediation Effect)

Mediating hypotheses H4.a and H4.b were validated using the Preacher & Hayes (2004) and Preacher & Hayes (2008) indirect effect bootstrapping technique.

H4: Real world use mediates how compatibility affects user satisfaction and performance effects.

Bootstrapping assessment indicated that indirect aspects were statistically significant with t-value

2.683 and 2.782, specified at $p < 0.01$. Preacher & Hayes (2008) suggested that when performance effects are indirectly influenced by compatibility and user satisfaction by way of true usage, at 95% Boot CI: [LL = 0.011, UL = 0.06], and CI: [LL = 0.017, UL = 0.086], lacking a zero value between the range, mediation is indicated. Therefore, mediation is considered statistically significant, suggesting that H4.a and H4.b were accepted (see table 6).

Table 6: *Indirect effect hypotheses*

Hypothesis	Relationship	Std Beta	Std Error	t-value	LL	UL	p-value	Decision
H4. a	CMP→USE→PI	0.033	0.012	2.683	0.011	0.06	0.007	Supported
H4. b	SATIS→USE→PI	0.049	0.018	2.782	0.017	0.086	0.005	Supported

Key: CA: Cognitive Absorption, PI: Performance Impact, COMP: Compatibility, SATIS: User Satisfaction, USE: Actual Usage

4.3.3 Moderating Effect Hypotheses

This work emphasises the correlation between true usage and user satisfaction (independents) and performance impact (dependent) varies based on cognitive absorption (moderator). Table 7 indicates three hypotheses used under the primary hypothesis: (1) Validating the causal impact of the independent variable on results (2) Validating the causal impact of moderator variable on results (3) Validating the causal impact of the combination (predictor*moderating) on results (Field, 2013).

Moderation analysis for this research was validated based on hypotheses H5 and H6. A bootstrapping technique comprising a 5,000 element resample was implemented to determine the extent of interaction. Table 7 lists the outcomes where cognitive absorption has a moderating (strengthening) effect on true use, and user satisfaction on performance effects ($\beta = -0.084$, $t = 2.314$, $p < 0.05$) and ($\beta = -0.232$, $t = 6.545$, $p < 0.01$), respectively. Hence, H5, and H6 are accepted.

Table 7: *Result of Moderating effects Hypotheses*

Hypothesis	Relationship	Std Beta	Std Error	t-value	p-value	Decision
H5. a	USE→PI	0.111	0.036	3.056	0.002	
H5. b	CA→PI	0.233	0.042	5.545	0.000	Supported
H5.c	CA*USE→PI	-0.084	0.036	2.314	0.021	
H6. a	SATIS→PI	0.267	0.055	5.684	0.000	
H6. b	CA→PI	0.233	0.042	5.545	0.000	Supported
H6.c	CA*SATIS→PI	-0.232	0.036	6.545	0.000	

5. Discussion and Implications

This work ascertained that compatibility positively and significantly impacts actual use and performance effects of connected learning for students belonging to three public higher education institutions in the UAE, namely (United Arab Emirates University, Zayed University, and Higher Colleges of Technology (HCT)). Results align with previous works (Ainin et al., 2015; Aldás-Manzano et al., 2009; Aldholay et al., 2018; Islam & Azad, 2015; Koenig-Lewis et al., 2010) that indicate increased online-learning duration and usage frequency when students believe connected learning is aligned with their way of life, values, and requirements. Moreover, student performance is increased from three viewpoints: efficiency (completing activities with speed and ease, leading to cost-effectiveness), knowledge gathering (building new skills and learning new material, ideas, and facilitating learning), and productivity (learning and academic efficacy). Concurrently, competence is the fourth positively impacted aspect (reduced error rate and better understanding of long-term targets). The outcomes also indicate that user satisfaction had a noteworthy impact on performance and actual use, in agreement with previous research (Aldholay et al., 2019; Hou, 2012; Islam, 2015; Kim et al., 2015). When scholars at public educational institutions in the UAE are satisfied with the provisions, they are more inclined to use online learning frequently and extensively, causing performance increase from three viewpoints: efficiency (completing activities with speed and ease, leading to cost-effectiveness), knowledge gathering (building new skill and learning new material, ideas, and facilitating learning), and productivity (learning and academic efficacy).

In contrast, real world usage significantly impacted performance aspects, in alignment with previous research outcomes (Isaac, Abdullah, Ramayah, & Mutahar, 2017b; Ramirez-Correa et al., 2017; Stefanovic et al., 2016). It is demonstrated by the notion that if scholars at public institutions in the UAE dedicate more time and access online learning frequently, they will deliver better performance based on three aspects: efficiency (completing activities with speed and ease, leading to cost-effectiveness), knowledge gathering (building

new skill and learning new material, ideas, and facilitating learning), and productivity (learning and academic efficacy). Concurrently, there is a moderate effect on competence (reduced error rate and better understanding of long-term goals). However, this observation is not aligned with the assertions of Cho et al. (2015) and Khayun & Ractham (2011); these researchers indicated an insignificant correlation between real-world use and performance impact. Such opposing outcomes might be explained based on study scenario variability and aspects used to determine actual usage.

Moreover, the mediation role of actual usage was proven to be significant in the relationships between each of compatibility and user satisfaction in one side and performance impact on the other. It is elucidated by the idea that better satisfaction associated with online learning by way of fulfilled expectations and a feeling of alignment with individual lifestyle, values, and requirements increases academic efficacy and impact, considering that students access online educational material more frequently and for longer periods. Furthermore, cognitive absorption had a statistically significant moderator aspect because it reinforces satisfaction, real-world use, and performance effects. Hence, when students are engrossed in online learning activities because they feel rewarded, there are positive effects on satisfaction and usage time because these aspects affect performance more profoundly.

This research focuses on the education domain that has been among the worst sufferers because of the COVID-19 pandemic. Education is of supreme importance for socio-economic development; therefore, this conceptual work can guide online learning adoption, which is unavoidable in the COVID era (Alawamleh et al., 2020). Research outcomes offer decision-makers from public education establishments in the UAE a general guideline to build online learning a powerful instrument for increasing scholar outcomes by aligning online learning aspects with students' beliefs, aspirations, and requirements. Furthermore, a user-friendly interface is critical to provide satisfaction and joy during online learning. University strategies must focus on established aspects that make learning more impactful.

6. Conclusion

The primary objective of this work was to assess the factors influencing the performance effects of online learning for scholars at three UAE public universities (United Arab Emirates University, Zayed University, and Higher Colleges of Technology (HCT)). The United Arab Emirates is committed to educational excellence and wants to build a higher education public institution framework that provides better performance. The outcomes of the present study might be regarded among the steps undertaken to further the cause. This study assessed how user satisfaction and compatibility correlated with real-world use and performance effects. It also evaluated the mediating effect of real-world use and the moderating effect of cognitive absorption. This study builds a case that verifies aspects of the DeLone & Mclean information system success framework. The outcomes indicate that all proposed hypotheses were significant. Predictors account for about 76.5% impact on performance. The education industry can use research outcomes in the UAE to strengthen the system. Also, online learning has not yet been emphasised as a research subject; therefore, this study is critical because researchers can build upon the outcomes and determine the performance effects of UAE public university scholars in the context of online education.

Reference

- [1] Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, 24(4), 665–694.
- [2] Ainin, S., Parveen, F., & Moghavvemi, S. (2015). Factors influencing the use of social media by SMEs and its performance outcomes. *Industrial Management & Data Systems*, 115(3), 570–588. <https://doi.org/10.1108/IMDS-07-2014-0205>
- [3] Alawamleh, M., Al-Twait, L. M., & Al-Saht, G. R. (2020). The effect of online learning on communication between instructors and students during Covid-19 pandemic. *Asian Education and Development Studies*. <https://doi.org/10.1108/AEDS-06-2020-0131>
- [4] Aldás-Manzano, J., Ruiz-Mafé, C., & Sanz-Blas, S. (2009). Exploring individual personality factors as drivers of M-shopping acceptance. *Industrial Management & Data Systems*, 109(6), 739–757. <https://doi.org/10.1108/02635570910968018>
- [5] Aldholay, A., Abdullah, Z., Isaac, O., & Mutahar, A. M. (2019). Perspective of Yemeni students on use of online learning: Extending the information systems success model with transformational leadership and compatibility. *Information Technology and People*, 33(1), 106–128. <https://doi.org/10.1108/ITP-02-2018-0095>
- [6] Aldholay, A. H., Isaac, O., Abdullah, Z., Alrajawy, I., & Nusari, M. (2018). THE ROLE OF COMPATIBILITY AS A MODERATING VARIABLE IN THE INFORMATION SYSTEM SUCCESS MODEL: THE CONTEXT OF ONLINE LEARNING USAGE. *International Journal of Management and Human Science (IJMHS)*, 2(1), 9–15.
- [7] Aldholay, A., Isaac, O., Abdullah, Z., & Ramayah, T. (2018). The role of transformational leadership as a mediating variable in DeLone and McLean information system success model: The context of online learning usage in Yemen. *Telematics and Informatics*, 35(5), 1421–1437. <https://doi.org/10.1016/j.tele.2018.03.012>
- [8] Allen, I. E., & Seaman, J. (2007). *Online Nation*. October, 25.
- [9] Almuraqab, N. A. S. (2020). SHALL UNIVERSITIES AT THE UAE CONTINUE DISTANCE LEARNING AFTER THE COVID-19 PANDEMIC? REVEALING STUDENTS' PERSPECTIVE. June. <https://doi.org/10.34218/IJARET.11.5.2020.0024>
- [10] Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modelling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411–423. <https://doi.org/10.1037/0033-2909.103.3.411>
- [11] Aparicio, M., Bacao, F., & Oliveira, T. (2017). Grit in the path to e-learning success. *Computers in Human Behaviour*,

- 66(1), 388–399.
<https://doi.org/10.1016/j.chb.2016.10.009>
- [12] Ashfaq, M., Yun, J., Yu, S., & Loureiro, S. M. C. (2020). I, Chatbot: Modelling the determinants of users' satisfaction and continuance intention of AI-powered service agents. *Telematics and Informatics*, 54(July), 101473.
<https://doi.org/10.1016/j.tele.2020.101473>
- [13] Barclay, D. W., Higgins, C., & Thompson, R. (1995). The partial least square (PLS) approach to causal modelling: Personal computer adoption and use as an illustration. *Technology Studies*, 2(2), 285–309.
- [14] Bowen, W. (2013). The Potential for Online Learning: Promises and Pitfalls. *Educase Review*, 48(5), 12–26.
- [15] Busari, A. H., Mughal, Y. H., Khan, S. N., Rasool, S., & Kiyani, A. A. (2017). Analytical cognitive style moderation on promotion and turnover intention. *Journal of Management Development Journal of Training and Development Iss European Journal of Training and Development Iss*, 36(21), 438–464.
<https://doi.org/10.1108/JMD-12-2015-0184>
- [16] Chen, C. (2017). intention Five-star or thumbs-up? The influence of rating system types on users' perceptions of information quality, cognitive effort, enjoyment and continuance intention. *Internet Research*, 27(3), 478–494.
<https://doi.org/10.1108/IntR-08-2016-0243>
- [17] Chen, L., Gillenson, M. L., & Sherrell, D. L. (2002). Enticing online consumers: an extended technology acceptance perspective. 39.
- [18] Chin, W. W. (1998). Issues and opinion on structural equation modelling. *MIS Quarterly*, 22(1), 7–16.
- [19] Cho, K. W., Bae, S.-K., Ryu, J.-H., Kim, K. N., An, C.-H., & Chae, Y. M. (2015). Performance Evaluation of Public Hospital Information Systems by the Information System Success Model. *Healthcare Informatics Research*, 21(1), 43–48.
<https://doi.org/10.4258/hir.2015.21.1.43>
- [20] Clark, R. C., & Mayer, R. E. (2016). *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning* (4th ed.). Wiley.
- [21] Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences* (Second Ed.). Routledge.
- [22] DeLone, W H, & Mclean, E. R. (2003). The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems / Spring*, 19(4), 9–30.
<https://doi.org/10.1073/pnas.0914199107>
- [23] DeLone, William H., & McLean, E. R. (2016). Information Systems Success Measurement. In *Series in Information Technology Management*. now Publishers Inc. PO.
- [24] Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4th ed.). SAGE Publications Ltd.
- [25] Fornell, C., & Cha, J. (1994). Partial least squares. In R. P. Bagozzi (Ed.), *Advanced methods in marketing research* (pp. 52–78). Cambridge: Blackwell.
- [26] Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modelling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*, 4(1), 1–79.
- [27] Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: an organizational capabilities perspective. *Journal of Management Information Systems*, 18(1), 185–214.
- [28] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Pearson.
- [29] Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM)* (2nd ed.). Thousand Oaks: SAGE.
- [30] Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science*, 34(1), 115–135.
- [31] Hou, C.-K. (2012). Examining the effect of user satisfaction on system usage and individual performance with business intelligence systems: An empirical study of Taiwan's electronics industry. *International Journal of Information Management*, 32(6), 560–573.

- <https://doi.org/10.1016/j.ijinfomgt.2012.03.001>
- [32] Isaac, O., Abdullah, Z., Ramayah, T., & Mutahar, A. M. (2017a). Internet usage, user satisfaction, task-technology fit, and performance impact among public sector employees in Yemen. *The International Journal of Information and Learning Technology*, 34(3), 210–241. <https://doi.org/10.1108/IJILT-11-2016-0051>
- [33] Isaac, O., Abdullah, Z., Ramayah, T., & Mutahar, A. M. (2017b). Internet Usage and Net Benefit among Employees Within Government Institutions in Yemen: An Extension of Delone and Mclean Information Systems Success Model (DMISM) with Task-Technology Fit. *International Journal of Soft Computing*, 12(3), 178–198. <https://doi.org/10.3923/ijscmp.2017.178.198>
- [34] Isaac, O., Abdullah, Z., Ramayah, T., Mutahar, A. M., & Alrajawy, I. (2017). Towards a Better Understanding of Internet Technology Usage by Yemeni Employees in the Public Sector: An Extension of the Task-Technology Fit (TTF) Model. *Research Journal of Applied Sciences*, 12(2), 205–223. <https://doi.org/10.3923/rjas.2017.205.223>
- [35] Isaac, O., Aldholay, A., Abdullah, Z., & Ramayah, T. (2019). Online learning usage within Yemeni higher education: The role of compatibility and task-technology fit as mediating variables in the IS success model. *Computers and Education*, 136(February), 113–129. <https://doi.org/10.1016/j.compedu.2019.02.012>
- [36] Islam, A. K. M. N. (2015). E-learning system use and its outcomes: Moderating role of perceived compatibility. *Telematics and Informatics*, 33(1), 48–55. <https://doi.org/10.1016/j.tele.2015.06.010>
- [37] Islam, A. K. M. N., & Azad, N. (2015). Satisfaction and continuance with a learning management system. *The International Journal of Information and Learning Technology*, 32(2), 109–123. <https://doi.org/10.1108/IJILT-09-2014-0020>
- [38] Jeyaraj, A. (2020). DeLone & McLean models of information system success: Critical meta-review and research directions. *International Journal of Information Management*, 54(November 2019), 102139. <https://doi.org/10.1016/j.ijinfomgt.2020.10.2139>
- [39] Kannana, V. R., & Tan, K. C. (2005). Just in time, total quality management, and supply chain management: understanding their linkages and impact on business performance. *Omega: The International Journal of Management Science*, 33(2), 153–162.
- [40] Khayun, V., & Ractham, P. (2011). Measuring e-excise tax success factors: Applying the DeLone & McLean information systems success model. In *Proceedings of the Annual Hawaii International Conference on System Sciences*, 1–10.
- [41] Kim, C., Lee, I.-S., Wang, T., & Mirusmonov, M. (2015). Evaluating effects of mobile CRM on employees' performance. *Industrial Management & Data Systems*, 115(4), 740–764. <https://doi.org/10.1108/IMDS-08-2014-0245>
- [42] Kline, R. B. (2010). *Principles and practice of structural equation modelling* (3rd ed.). The Guilford Press.
- [43] Koenig-Lewis, N., Palmer, A., & Moll, A. (2010). Predicting young consumers' take up of mobile banking services. *International Journal of Bank Marketing*, 28(5), 410–432. <https://doi.org/10.1108/02652321011064917>
- [44] Kolasa, I., Papa, T., & Ziemba, E. (2020). Information systems projects' success in government units: The issue of information systems integration. *Procedia Computer Science*, 176, 2274–2286. <https://doi.org/10.1016/j.procs.2020.09.286>
- [45] Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Behavioral Science and Psychological Measurement*, 38(1), 607–610. <https://doi.org/10.1177/001316447003000308>
- [46] Lapovsky, L. (2015). *Online Learning: What Next?*
- [47] Lin, C.-P., Yang, Z.-T., & Huang, H.-T. (2016). Evaluating team performance and

- the mediating role of customer knowledge development: An absorptive capacity framework. *Journal of Engineering and Technology Management*, 42(1), 46–64. <https://doi.org/10.1016/j.jengtecman.2016.10.001>
- [48] Lin, W. S., & Wang, C. H. (2012). Antecedences to continued intentions of adopting e-learning system in blended learning instruction: A contingency framework based on models of information system success and task-technology fit. *Computers and Education*, 58(1), 88–99. <https://doi.org/10.1016/j.compedu.2011.07.008>
- [49] Liu, J., Liao, X., Qian, S., Yuan, J., Wang, F., Liu, Y., Wang, Z., Wang, F.-S., Liu, L., & Zhang, Z. (2020). Community Transmission of Severe Acute Respiratory Syndrome Coronavirus 2, Shenzhen, China, 2020. *Emerging Infectious Disease Journal*, 26(6), 1320. <https://doi.org/10.3201/eid2606.200239>
- [50] Magni, M., Paolino, C., Cappetta, R., & Proserpio, L. (2013). Diving Too Deep: How Cognitive Absorption and Group Learning Behaviour Affect Catholic University of the Sacred Heart and SDA Bocconi School of Management. *Academy of Management Learning & Education*, 12(1), 51–69.
- [51] Masrek, M. N., & Gaskin, J. E. (2016). Assessing users' satisfaction with web digital library: the case of Universiti Teknologi MARA. *The International Journal of Information and Learning Technology*, 33(1), 36–56. <https://doi.org/10.1108/IJILT-06-2015-0019>
- [52] Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. 192–223.
- [53] Ozkara, B. Y., Ozmen, M., & Kim, J. W. (2017). Examining the effect of flow experience on online purchase: A novel approach to the flow theory based on hedonic and utilitarian value. *Journal of Retailing and Consumer Services*, 37(1), 119–131. <https://doi.org/10.1016/j.jretconser.2017.04.001>
- [54] Pallud, J. (2017). Impact of interactive technologies on stimulating learning experiences in a museum. *Information and Management*, 54(4), 465–478. <https://doi.org/10.1016/j.im.2016.10.004>
- [55] Pearson. (2020). Global Learner Survey (Issue August). https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/news/gls/Pearson_Global-Learners-Survey_2020_FINAL.pdf
- [56] Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behaviour Research Methods, Instruments, & Computers*, 36(4), 717–731.
- [57] Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behaviour Research Methods*, 40(3), 879–891.
- [58] Premkumar, G. (2003). A Meta-Analysis of Research on Information Technology Implementation in Small Business. *Journal of Organizational Computing and Electronic Commerce*, 13(2), 91–121. https://doi.org/10.1207/S15327744JOCE1302_2
- [59] Ramirez-Correa, P. E., Rondan-Cataluna, F. J., Arenas-Gaitan, J., & Alfaro-Perez, J. L. (2017). Moderating effect of learning styles on a learning management system's success. *Telematics and Informatics*, 34(1), 272–286. <https://doi.org/10.1016/j.tele.2016.04.006>
- [60] Ringle, C. M., Wende, S., & Becker, J.-M. (2015). *SmartPLS 3*. Bonnstedt: SmartPLS.
- [61] Roca, J. C., Chiu, C.-M., & Martínez, F. J. (2006). Understanding e-learning continuance intention: An extension of the Technology Acceptance Model. *International Journal of Human-Computer Studies*, 64(8), 683–696. <https://doi.org/10.1016/j.ijhcs.2006.01.003>
- [62] Rogers, E. (1995). *Diffusion of Innovations* (4th ed.). The Free Press, New York, NY.
- [63] Rogers, E. M. (1995). *Diffusion of Innovations* (4th editio). The Free Press.
- [64] Rouis, S. (2012). Impact of Cognitive Absorption on Facebook on Students' Achievement. *Cyberpsychology, Behaviour, and Social Networking*, 15(6), 296–303. <https://doi.org/10.1089/cyber.2011.0390>
- [65] Saadé, R., & Bahli, B. (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-

- line learning: An extension of the technology acceptance model. *Information and Management*, 42(2), 317–327. <https://doi.org/10.1016/j.im.2003.12.013>
- [66] Schumacker, R. E., & Lomax, R. G. (2004). *A Beginner's Guide to Structural Equation Modelling*. Lawrence Erlbaum.
- [67] Shim, M., & Jo, H. S. (2020). What quality factors matter in enhancing the perceived benefits of online health information sites? Application of the updated DeLone and McLean Information Systems Success Model. *International Journal of Medical Informatics*, 137(December 2019), 104093. <https://doi.org/10.1016/j.ijmedinf.2020.10.4093>
- [68] Stefanovic, D., Marjanovic, U., Delic, M., Culibrk, D., & Lalic, B. (2016). Assessing the success of e-government systems: An employee perspective. *Information & Management*, 53(1), 717–726. <https://doi.org/10.1016/j.im.2016.02.007>
- [69] Tabachnick, B. G., & Fidell, L. S. (2012). *Using Multivariate Statistics* (6th ed.). Pearson.
- [70] Tam, C., Loureiro, A., & Oliveira, T. (2019). The individual performance outcome behind e-commerce: Integrating information systems success and overall trust. *Internet Research*, 30(2), 439–462. <https://doi.org/10.1108/INTR-06-2018-0262>
- [71] UAE Government Portal. (2020). Distance learning in times of COVID-19. <https://u.ae/en/information-and-services/education/distance-learning-in-times-of-covid-19>
- [72] Wang, Y. S., & Liao, Y. W. (2008). Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success. *Government Information Quarterly*, 25(4), 717–733. <https://doi.org/10.1016/j.giq.2007.06.002>
- [73] Weniger, S., & Loebbecke, C. (2011). Cognitive absorption: Literature review and suitability in the context of hedonic IS usage. Department of Business, Media and Technology Management, University of Cologne, Germany, 1–19.
- [74] Werts, C. E., Linn, R. L., & Jöreskog, K. G. (1974). Intraclass reliability estimates: Testing structural assumptions. *Educational and Psychological Measurement*, 34(1), 25–33.
- [75] Wu, J., & Wang, S. (2005). What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. 42, 719–729. <https://doi.org/10.1016/j.im.2004.07.001>
- [76] Xinli, H. (2015). Effectiveness of information technology in reducing corruption in China A validation of the DeLone and McLean information systems success model. *The Electronic Library*, 33(1), 52–64. <https://doi.org/10.1108/EL-11-2012-0148>
- [77] Zheng, Y., Ren, D., Guo, Z., Hu, Z., & Wen, Q. (2019). Research on integrated resource strategic planning based on complex uncertainty simulation with case study of China. *Energy*, 180, 772–786. <https://doi.org/10.1016/j.energy.2019.05.120>