Research Article

Adopting the UTAUT model to understand academic use of emerging technologies among Moroccan nursing students

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Background: The COVID-19 pandemic transitions from traditional classroom learning to online learning. However, there is a paucity of data in Moroccan nursing students on the plausibility of emerging technologies to support online learning.

Objective: Using the unified theory of acceptance and use of technology (UTAUT) model, this study investigated whether socioeconomic factors and voluntariness of use moderated the associations of domains of UTAUT model with number of emerging technologies during the COVID-19 pandemic. Subsequently, this study examined the moderation effect of user status and learning devices on the relationship between domains of UTAUT model and number of emerging technologies.

Method: Data were from a publicly available survey among Moroccan nursing students. Socioeconomic factors were explored as potential moderators of the associations of performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) with number of emerging technologies. Poisson pseudolikelihood regression with multiple levels of fixed effects were applied to analyze the associations in the groups of Level 2 of study, Level 3 of study, class size<=50, and class size>50.

Results: The sample was dominated by females, age between 21 and 24 years, level 3 of study, previous users, future users, and using desktop. There were the moderate correlations among domains of the UTAUT model. Laptop, desktop, and smartphone are key driving factors of learning performance of nursing students. The classical UTAUT models were confirmed to be in the samples of Level 2 of study, Level 3 of study, and class size <=50. The revised UTAUT model indicated that laptop, desktop, smartphone, previous user, and future user moderated the relationships of PE, EE, SI, and FC with number of emerging technologies.

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Conclusion: Findings highlight the importance of learning devices in the number of emerging technologies among Moroccan nursing students. The findings of this study provide policy makers to rethink about how to improve academic performance among the nursing students.

Background

The COVID-19 pandemic dramatically changed the learning environment and disrupted existing communities of learning for nursing students. Globally, online nursing learning during the COVID-19 pandemic has been reported in North of Jordan [1], South Korea [2], Israel [3], and Spain [4]. COVID-19 pandemics forced students and lecturers to use virtual learning like Google Classroom for online learning processes [5]. Blended online and offline pedagogy have been implemented in delivering the nursing knowledge among nursing students. Personal, community, and social factors can influence a transition from the traditional classroom to online education [6].

Some facilitators to online learning were reported. A mix-methods study design showed an online team-based learning strategy works well in teaching and fostering caring in an online environment among nursing students [7]. A cross-sectional approach demonstrates that nursing educators were able to design and implement innovative teaching strategies in a virtual environment to promote learning performance [8].

Some barriers to online learning were also reported. For example, an online cross-sectional study believed that e-learning reduces the quality of knowledge attained and is not an efficient method of teaching [9]. A study suggests that emergency remote teaching can pose a lack of practice caution in acquiring nursing skills [10]. An India online survey research indicated that barriers which effect online learning is low voice and language clarity, reliability and connectivity problem, physical health barriers [11].

The systematic challenges were reported by the scholars at Western University in Canada [12]. The psychosocial challenges like psychosocial adjustment and challenges to clinical experiences [13], burdensome challenge [14], dissatisfaction with learning experiences [15], and anxiety [16] were reported. For nursing students, some challenges of distance learning were documented like applied nature [17]. Technological challenges were reported in the United Arab Emirates [18], the Pacific Northwestern United States [19], and Nepal [20]. Online teaching obstacles also come from

teachers [21], nurse instructors [22], peer and teacher support [23], home-based learning [24] and students themselves [25].

Unlike previous studies, this paper added learning devices and use status as the new moderators of online learning experiences among Moroccan nursing students. Also, this paper is one of the few studies under the framework of the unified theory of acceptance and use of technology (UTAUT) model in a Moroccan nursing education. The significant facilitators and barriers to online learning during COVID 19 can be explored by multiple regressions.

Literature review and hypotheses development

Since the creation of the unified theory of acceptance and use of technology (UTAUT) model [26], it has been often used to assess the acceptance of information and communication technologies. For example, the UTAUT model was used to predict tablet adoption [27], analyze e-learning course [28], and analyze acceptance of mobile learning [29]. For example, the UTAUT model was utilized to explore willingness to accept AI-assisted learning environments [30] and facilitate the adoption of mobile learning [31]. Using the UTAUT framework, the personal and social factors were associated with massive open online course (MOOC) adoption [32]. The UTAUT model was integrated with other models in current studies to reveal facilitators and barriers to online learning during COVID 19 [33].

The four core constructs of UTAUT model were performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) [34]. UTAUT model was often examined and obtained various outcomes in the academic community. However, facilitated condition had no significant effects on the use of e-learning [35]. In a study from Jordan, the relationship of PE and EE → behavioural intentions to use Moodle was confirmed [36]. As for online courses during the COVID-19 lockdown, a study indicated that EE, FC, PE, and SI, respectively were the primary predictors for students' intention to use e-training [37].

Since the creation UTAUT, it has been often revised and integrated with other models. For example, a study reported the strong relationships between hedonic motivation and behavioral intention and between perceived effectiveness and hedonic motivation. Age, gender, and experience moderate the model's relationships [38]. UTAUT often was integrated with control-value theory [39], self-determination theory and core self-evaluation theory [40]. The classical UTAUT model was effective for new technologies for learning by employees [41].

A recent study revealed that the interaction between voluntariness and EE, and voluntariness and SI significantly predicted usage intentions [42]. A study on Internet-based cognitive behavioral therapy demonstrates that PE, EE, and SI together significantly influenced behavioral intention among nonusers [43]. Meanwhile, a cross-sectional study suggests that IT acceptance is influenced by PE, EE, SI and voluntariness in Thailand [44]. In addition, a study determined that SI, PE, FC, and EE positively impacted nurses' behavioral intention to use mobile learning [45]. Further, FC and EE are also predictors of the perception of remote emergency learning [46].

Another study in Indian settings highlights the positive influence of price value, hedonic motivation, FC, PE and EE on MOOC adoption. However, SI and teacher influence unexpectedly do not have an impact on behavioural intention towards MOOC adoption [47]. Meantime, effort expectation, community influence, performance expectation, and promotion conditions have a significant positive impact on the willingness to online Chinese learning [48]. Expected performance and effort were reported to be highly related to intention to use e-Health [49]. Simultaneously, another study showed that EE and SI were reported to affect continuous intention indirectly via PE [50].

The finding of the study expects to contribute to the students and teachers in the nursing education with valuable insights on the important of learning devices in academic use. The findings of this study introduce a new momentum for the online learning, which is inadequately covered in the Moroccan context. The research findings will be particularly important for educators in understanding the number of emerging technologies in order to improve learning performance. This research contributes to nursing theory and practice as well as education policy formulation. These findings may assist policymakers to address existing nursing students concerns for a successful transition towards an online education.

Methods

Data source

The data was obtained from 702 nursing students from the 23 ISPITS centers in Morocco [51]. The questionnaire in English and the raw responses in excel formats have been made publicly available via http://dx.doi.org/10.17632/f9dbktdr3f.2. The data was collected by an online questionnaire administered via google form. The questionnaire mainly reflected information about respondents'

intention, willingness to use various information and communication technologies (ICT), and social media platforms for learning during the COVID-19 era. 23 surveyed ISPITS centers were Agadir (3.70%), Al Hoceima (5.98%), Beni Mellal (1.85%), Casablanca (7.69%), Dakhla (1.00%), Errachidia (5.41%), Essaouira (3.28%), Fes (5.84%), Kenitra (6.13%), Laayoun (0.71%), Marrakech (5.98%), Meknes (7.41%), Nador (1.14%), Ouarzazate (1.85%), Oujda (3.85%), Rabat (3.56%), Safi (1.99%), Settat (2.85%), Tanger (9.40%), Taza (4.42%), Tetouan (14.67%), and Tiznit (1.28%) in 702 Moroccan nursing students. The web-based survey contained items on sociodemographic, social networking, and mental health data. In addition, performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) of UTAUT questionnaire were also included. In the dataset, behavioural intention was not included. The actual use of technology was reflected by number of emerging technologies for academic purposes.

Several studies underscored religiosity [52] and satisfaction [53] among nursing students with distance learning during the COVID-19 pandemic in Morocco. Poor knowledge and attitudes towards COVID-19 [54] and average knowledge of social accountability [55] were reported in them.

Ethics Statement

The data collection was planned in accordance with the Helsinki Declaration of ethics. The online questionnaire was anonymous and the data was coded. On the main page, the respondents were supplied with a summary of the data collection's purpose as well as an online consent letter. Only respondents who agreed to participate in the survey were given access to the questionnaire. Therefore, no respondent was coerced to participate in the survey.

Measures

Socioeconomic factors

Gender consisted of female (=0, accounting for 65.53%) and male (=1, accounting for 34.47%). Age range (in years) was distributed by 17- 18 years (1.99%), 19- 20 years (39.03%), 21- 22 years (56.55%), and 23- 24 years (2.42%). For statistical convenience, the variable was grouped by a binary variable 17- 20 years (=0) and 21- 24 years (=1). Level of study consisted of level 2 (35.04%) and level 3 (64.96%).

ICT device was reflected by the question: "How do you access your social media platforms?" The answers were laptop (35.47%), desktop (55.70%), smartphone (7.69%), tablet or Ipad (1.14%). Here, three binary variables of laptop, desktop, and smartphone were generated.

Number of classmates was reflected by the question: "How many of your classmates are your contacts/friends on your social networking sites?" The response options were 20-50 (29.63%), 51-100 (9.97%), almost everyone (40.03%), and less than 20 (20.37%). Here, class size was dichotomized into a binary variable 0 (<=50) and 1 (>50).

Use timing included three variables of previous user, future user, and present user. With respect to emerging technologies and social media, previous user was reflected by the question: "Did you use emerging technologies and social media during the clinical internship to learn?" The response options were recode as no (=0, accounting for 24.22%) and yes (=1, accounting for 75.78%). Future user was reflected by the question: "Do you intend to use emerging technologies and social media in clinical internship to learn?" The response options were recode as no (=0, accounting for 21.94%) and yes (=1, accounting for 78.06%). Present user was reflected by the question: "Are you presently involved in e-learning using any social media platform or emerging technologies earlier highlighted?" The response options were recode as no (=0, accounting for 61.40%) and yes (=1, accounting for 38.60%).

Independent variables

The items in UTAUT model and voluntariness of use were in Supplementary table 1. Responses were on a 5-point Likert scale ranging from 1 for "strongly disagree" to 5 for "strongly agree". Cronbach's alphas mostly ranged from acceptable (>0.5) to good (>0.8), confirming a reasonable to high internal consistency within our questionnaire. Meanwhile, the means and standard deviations of each item were calculated.

Outcome variables

Emerging technologies were based on the question: "Select all the emerging technologies that you have used or participated in for academic purposes" The options were Zoom; Facebook Live; Google Classroom; MOOC like Coursera, Udemy, EDX etc; Microsoft's Team; Learning Management System (Moodle, Talent, Docebo etc.); Mobile Learning via Mobile Apps (Sololearn, Simplilearn, Grasshopper...); Artificial Intelligence (AI) via AI tutoring system using Robots, Holographic; teacher; Augmented (Virtual) Reality & Simulations; Gamification via Games-based learning; Web-based

Elearning Platforms; and Other. Thus, number of emerging technologies was created by summing up all the response options.

Statistical strategies

The means, standard deviation, and correlations among academic use of emerging technologies, UTAUT domains, and voluntariness of use were calculated. To express that the effect of socioeconomic factors might have associations with UTAUT domains and voluntariness of use, several ordinary least square regressions would be conducted. To test and verify the classical UTAUT model, the moderating effects of VU, age, and gender might be expressed by PE × VU, EE × VU, SI × VU, FC × VU, PE × age category, EE × age category, SI × age category, FC × age category, PE × gender, EE × gender, SI × gender, and FC × gender. When we add user status and learning devices, the revised UTAUT model need be considered. To test and verify the revised UTAUT model, the moderating effects of VU, age, and gender might be expressed by PE × laptop, EE × laptop, SI × laptop, FC × laptop, PE × desktop, EE × desktop, SI × desktop, FC × desktop, PE × smartphone, EE × smartphone, SI × smartphone, FC × smartphone, PE × previous user, EE × previous user, SI × previous user, FC × previous user, PE × future user, EE × future user, SI × future user, FC × future user, PE × current user, EE × current user, SI × current user, and FC × current user. The classical and revised UTAUT models were analyzed by poisson pseudolikelihood regression with multiple levels of fixed effects.

Results

Sample characteristics

Most of the respondents were females (65.53%), aged between 21 and 24 years (58.97%), students of level 3 of study (64.96%), previous users (75.78%), future users (78.06%), and used desktop (55.70%). The proportions of nursing students in the classes with class size <=50 and class size >50 were the same: 50.00% vs. 50.00%. Meanwhile, most of them was not current users (61.40%), did not use laptop (64.53%) or smatphone (92.31%). Number of emerging technologies were distributed by 1(8.40%), 2(14.39%), 3(12.25%), 4 (14.81%), 5(16.24%), 6(15.53%), 7(12.54%), 8(5.70%), and 9(0.14%).

Pearson's correlation

The correlations among the subject's subjective variables are shown in Table 1. PE has significant positive correlations with EE (r =0.6747, p < 0.001), SI (r =0.4756, p < 0.001), FC (r =0.2320, p < 0.001) and VU (r =0.5531, p < 0.001), respectively. EE has significant positive correlations with SI (r =0.5486, p < 0.001), FC (r =0.2246, p < 0.001) and VU (r =0.5770, p < 0.001), respectively. SI has significant positive correlations with FC (r =0.1909, p < 0.001) and VU (r =0.4577, p < 0.001), respectively. FC has significant positive correlations with VU (r =0.2753, p < 0.001). ET has a significant negative correlation (r =-0.0821, p =0.0296) with PE.

Variable	Mean	SD	1	2	3	4	5
ET	4.422	2.035					
PE	1.877	.627	-0.082**				
EE	1.905	.6977	-0.041	0.675***			
SI	1.991	.776	-0.061	0.476***	0.549***		
FC	2.337	.594	0.007	0.232***	0.225***	0.191***	
VU	1.892	.762	-0.099	0.553*	0.577***	0.458***	0.275***

Table 1. Correlations among academic use of emerging technologies, UTAUT domains, and voluntariness of use (N=702).

*Note: *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.*

SD= Standard deviation. ET = Emerging technologies. PE= Performance expectancy, EE= Effort expectancy, SI= Social influence, FC= Facilitating conditions, VU= Voluntariness of use.

Associations of socioeconomic factors with subjective variables

In Table 2, age, gender, level of study, class size have no significant associations with PE, EE, SI, FC, and VU, respectively. Laptop, desktop, and smartphone have positively significant associations with PE, EE, SI, FC, and VU, respectively. Simultaneously, previous user has positively significant associations with PE and FC, respectively. Moreover, future user has negatively significant

associations with PE, EE, FC, and VU, respectively. Current user has negatively significant associations with VU.

	PE	EE	SI	FC	VU
Age	Ref.: 17-20 years	Ref.: 17-20 years	Ref.: 17-20 years	Ref.: 17-20 years	Ref.: 17-20 years
21-24 years	-0.030(0.068)	0.015 (0.077)	0.059 (0.084)	0.136** (0.067)	-0.033 (0.080)
Gender	Ref.: female	Ref.: female	Ref.: female	Ref.: female	Ref.: female
Male	0.069 (0.054)	0.066 (0.061)	0.002 (0.066)	0.039 (0.053)	0.063 (0.064)
Level of study	Ref.: level 2	Ref.: level 2	Ref.: level 2	Ref.: level 2	Ref.: level 2
Level 3	0.047 (0.071)	0.086 (0.080)	-0.042 (0.087)	0.020 (0.070)	0.084 (0.084)
Class size	Ref.: <=50	Ref.: <=50	Ref.: <=50	Ref.: <=50	Ref.: <=50
class size >50	-0.051 (0.050)	-0.006 (0.056)	0.043 (0.062)	0.078 (0.049)	-0.092 (0.059)
Laptop	Ref.: no	Ref.: no	Ref.: no	Ref.: no	Ref.: no
Yes	2.048*** (0.083)	1.961*** (0.093)	2.155*** (0.102)	2.234*** (0.082)	2.161*** (0.098)
Desktop	Ref.: no	Ref.: no	Ref.: no	Ref.: no	Ref.: no
Yes	2.031*** (0.080)	1.921*** (0.090)	2.037*** (0.098)	2.195*** (0.079)	2.058*** (0.095)
Smartphone	Ref.: no	Ref.: no	Ref.: no	Ref.: no	Ref.: no
Yes	1.971*** (0.115)	1.971*** (0.130)	2.038*** (0.142)	2.250*** (0.113)	2.006*** (0.136)
Previous user	Ref.: no	Ref.: no	Ref.: no	Ref.: no	Ref.: no
Yes	0.250** (0.110)	0.163 (0.124)	-0.035 (0.136)	0.200* (0.109)	0.171 (0.131)
Future user	Ref.: no	Ref.: no	Ref.: no	Ref.: no	Ref.: no
Yes	-0.432*** (0.114)	-0.288**(0.128)	-0.080 (0.140)	-0.205* (0.112)	-0.297**(0.135)
Current user	Ref.: no	Ref.: no	Ref.: no	Ref.: no	Ref.: no
Yes	-0.052 (0.052)	-0.060 (0.059)	-0.077 (0.065)	-0.043 (0.052)	-0.288***(0.062)
R-squared	0.8925	0.8693	0.8594	0.9295	0.8574
Adj R-squared	0.8909	0.8674	0.8574	0.9284	0.8553

Table 2. Associations of socioeconomic factors with subjective variables (Number =702).

*Note: *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively. Ref.= Reference.*

Tentative analyses of classical UTAUT model

In Table 3, in the sample of level 2 of study, FC and FC × VU have significant associations with number of emerging technologies. Thus, VU moderated the association between FC and number of emerging technologies. In the sample of level 3 of study, EE, FC, EE × age category, FC × age category, PE × gender, EE × gender, and FC × gender have significant associations with number of emerging technologies. Thus, age category moderated the association between EE, FC and number of emerging technologies, gender moderated the associations of PE, EE, and FC with number of emerging technologies. In the sample of class size <=50, SI × age category, FC × age category, SI × gender, and FC × gender have significant associations with number of emerging technologies. Thus, age category and gender moderated the associations of SI, FC with number of emerging technologies, respectively. Meanwhile, there are no significant associations in the sample of class size >50.

	Level 2 of study	Level 3 of study	Class size <=50	Class size >50
PE	-0.255(0.224)	-0.047(0.132)	-0.129(0.178)	-0.050(0.140)
EE	0.032(0.194)	0.301*** (0.108)	0.196(0.143)	-0.049(0.127)
SI	-0.066 (0.123)	-0.023(0.116)	0.148(0.122)	0.038(0.102)
FC	0.350*** (0.110)	-0.219** (0.088)	-0.160(0.099)	0.039(0.092)
PE × VU	0.102(0.105)	0.016(0.044)	0.028(0.065)	-0.017(0.049)
EE × VU	-0.114(0.095)	-0.016(0.036)	-0.057(0.059)	-0.015(0.047)
SI × VU	0.083(0.070)	-0.024(0.036)	0.014(0.043)	-0.013(0.041)
FC × VU	-0.117** (0.050)	0.023(0.033)	-0.015(0.035)	0.034(0.032)
PE × age category	-0.075(0.205)	0.053(0.086)	0.169(0.117)	0.042(0.112)
EE × age category	0.104(0.190)	-0.273*** (0.092)	-0.090(0.105)	0.075(0.104)
SI × age category	-0.123(0.152)	0.040(0.082)	-0.189** (0.096)	-0.065(0.072)
FC × age category	0.122(0.098)	0.169*** (0.062)	0.152** (0.064)	-0.014(0.075)
PE × gender	0.016(0.168)	-0.283*** (0.093)	-0.078(0.120)	-0.115(0.111)
EE × gender	0.226(0.149)	0.193** (0.092)	0.130(0.112)	0.119(0.114)
SI × gender	-0.032(0.093)	-0.099(0.073)	-0.221** (0.091)	0.069(0.073)
FC × gender	-0.112(0.084)	0.114** (0.052)	0.154** (0.074)	-0.064(0.080)
Constant	1.304*** (0.236)	1.555*** (0.127)	1.445*** (0.150)	1.524*** (0.162)
Fixed effects				
Laptop	Yes	Yes	Yes	Yes
Desktop	Yes	Yes	Yes	Yes
Smartphone	Yes	Yes	Yes	Yes
Previous user	Yes	Yes	Yes	Yes
Future user	Yes	Yes	Yes	Yes

	Level 2 of study	Level 3 of study	Class size <=50	Class size >50
Current user	Yes	Yes	Yes	Yes
Pseudo R2	0.0323	0.0245	0.0238	0.0216
Number of observations	246	456	351	351

Table 3. Associations with emerging technologies with classical UTAUT model.

*Note: *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.*

Analyses of revised UTAUT model

In Table 4, in the sample of level 2 of study, PE, EE, FC, EE × laptop, FC × laptop, PE × desktop, EE × desktop, FC × desktop, PE × smartphone, and EE × smartphone have significant associations with number of emerging technologies. Thus, laptop moderated the associations of EE and FC with number of emerging technologies, respectively. Desktop moderated the association of PE, EE, and FC with number of emerging technologies, respectively. Smartphone moderated the association of PE and EE with number of emerging technologies, respectively. In the sample of level 3 of study, EE × laptop and FC × laptop have significant associations with number of emerging technologies. Thus, laptop moderated the association of EE and FC with number of emerging technologies, respectively.

In the sample of class size <=50, EE, SI, EE × laptop, SI × laptop, EE × desktop, SI × desktop, and EE × smartphone have significant associations with number of emerging technologies. Thus, laptop moderated the associations of EE and SI with number of emerging technologies, respectively. Desktop moderated the associations of SI with number of emerging technologies. Smartphone moderated the associations of EE with number of emerging technologies.

In the sample with class size >50, PE, EE, SI, PE × laptop, EE × laptop, SI × laptop, PE × desktop, EE × desktop, SI × desktop, PE × smartphone, EE × smartphone, and SI × smartphone have significant associations with number of emerging technologies. Thus, laptop moderated the associations of PE, EE, and SI with number of emerging technologies, respectively. Desktop moderated the associations of PE, EE, and SI with number of emerging technologies, respectively. Smartphone moderated the associations of PE, EE, and SI with number of emerging technologies, respectively.

	Level 2 of study	Level 3 of study	classmates<=50	classmates>50
PE	-0.852** (0.380)	0.112(0.207)	-0.046(0.210)	4.319* (2.309)
EE	1.023** (0.404)	-0.451(0.336)	-0.716** (0.322)	-9.870*** (2.993)
SI	-0.029(0.140)	0.306(0.510)	0.516* (0.274)	5.728*** (1.230)
FC	-0.221* (0.125)	0.082(0.051)	0.382(0.365)	0.031(0.126)
PE × laptop	0.543(0.407)	-0.204(0.220)	-0.119(0.226)	-4.466* (2.317)
EE × laptop	-1.070** (0.417)	0.590* (0.341)	0.899*** (0.334)	9.802*** (2.993)
SI × laptop	0.199(0.156)	-0.369(0.514)	-0.523* (0.283)	-5.705*** (1.234)
FC × laptop	0.321** (0.153)	-0.142** (0.073)	-0.491(0.364)	0.017(0.151)
PE × desktop	0.813** (0.391)	-0.159(0.214)	0.184(0.222)	-4.456* (2.311)
EE × desktop	-1.051*** (0.410)	0.509(0.340)	0.698** (0.330)	9.888*** (2.992)
SI × desktop	-0.034(0.156)	-0.326(0.513)	-0.598** (0.286)	-5.747*** (1.230)
FC × desktop	0.363*** (0.134)	-0.053(0.058)	-0.429(0.363)	0.069(0.126)
PE × smartphone	1.577*** (0.396)	-0.024(0.238)	0.115(0.260)	-3.965* (2.271)
EE × smartphone	-1.431*** (0.371)	0.500(0.348)	0.592* (0.347)	9.865*** (3.045)
SI × smartphone		-0.531(0.548)	-0.421(0.318)	-6.099*** (1.198)
FC × smartphone		0.036(0.115)	-0.390(0.370)	
Constant	1.400*** (0.185)	1.539*** (0.105)	1.556*** (0.132)	1.608*** (0.140)
Fixed effects				
Age	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes
Previous user	Yes	Yes	Yes	Yes
Future user	Yes	Yes	Yes	Yes
Current user	Yes	Yes	Yes	Yes
Pseudo R2	0.0342	0.0195	0.0230	0.0256
Number of observations	246	456	351	351

Table 4. Associations with emerging technologies with classical UTAUT model.

*Note: *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.*

In Table 5, in the sample of level 3 of study, PE × previous user, FC × previous user, EE × future user, and FC × future user have significant associations with number of emerging technologies. Thus, previous user moderated the association between PE, FC and number of emerging technologies, future user moderated the associations of EE and FC with number of emerging technologies. In the sample with class size <=50, PE, EE, PE × previous user, FC × previous user, and EE × future user have significant associations with number of emerging technologies. Thus, previous user moderated the associations of PE and FC with number of emerging technologies, respectively. And, future user moderated the associations of EE with number of emerging technologies. Meanwhile, PE × previous user, FC × previous user, EE × future user, and FC × future user have significant associations with number of emerging technologies in the sample with class size >50. Thus, previous user moderated the associations of PE and FC with number of emerging technologies, respectively. Simultaneously, future user moderated the associations of EE and FC with number of emerging technologies, respectively. Meanwhile, there are no significant associations in the sample of level 2 of study.

	Level 2 of study	Level 3 of study	Class size <=50	Class size >50
PE	0.132(0.197)	0.086(0.056)	0.286** (0.112)	-0.022(0.088)
EE	-0.190(0.159)	-0.050(0.065)	-0.216** (0.105)	-0.067(0.082)
SI	-0.079(0.152)	0.018(0.049)	-0.038(0.097)	-0.015(0.060)
FC	0.099(0.107)	-0.048(0.049)	-0.090(0.073)	0.074(0.076)
PE × previous user	-0.445(0.379)	-0.311*** (0.098)	-0.407** (0.191)	-0.377* (0.202)
EE × previous user	-0.117(0.372)	-0.122(0.187)	-0.052(0.186)	-0.180(0.347)
SI × previous user	0.078(0.202)	0.015(0.155)	0.054(0.171)	0.006(0.137)
FC × previous user	0.424(0.278)	0.350*** (0.077)	0.394* (0.228)	0.429*** (0.150)
PE × future user	0.203(0.409)	0.117(0.099)	0.109(0.180)	0.275(0.201)
EE × future user	0.176(0.392)	0.307* (0.185)	0.344* (0.187)	0.252(0.350)
SI × future user	0.096(0.242)	-0.111(0.151)	-0.058(0.177)	-0.020(0.139)
FC × future user	-0.412(0.284)	-0.241*** (0.080)	-0.341(0.227)	-0.382** (0.162)
PE × current user	-0.067(0.157)	0.001(0.093)	-0.033(0.123)	-0.065(0.104)
EE × current user	0.110(0.141)	-0.045(0.103)	-0.001(0.110)	0.028(0.113)
SI × current user	-0.037(0.098)	0.059(0.071)	0.005(0.101)	0.056(0.073)
FC × current user	-0.016(0.088)	-0.032(0.059)	0.006(0.069)	-0.023(0.067)
Constant	1.450*** (0.197)	1.506*** (0.102)	1.532*** (0.137)	1.528*** (0.127)
Fixed effects				
Age	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes
Laptop	Yes	Yes	Yes	Yes
Desktop	Yes	Yes	Yes	Yes
Smartphone	Yes	Yes	Yes	Yes
Pseudo R2	0.0240	0.0237	0.0207	0.0240
Number of observations	246	456	351	351

Table 5. Associations with emerging technologies with revised UTAUT model.

*Note: *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.*

Discussion

Principal Findings

This study reported the moderate correlations among domains of the UTAUT model. Nursing students with laptop, desktop, and smartphone are likely to reported higher values of domains of the UTAUT model than those without. Tentative analyses documented the establishment of classical UTAUT model in the samples of Level 2 of study, Level 3 of study, and class size <=50. Analyses of revised UTAUT model indicated that laptop, desktop, smartphone, previous user, and future user moderated the relationships of PE, EE, SI, and FC with number of emerging technologies.

With respect to importance of hardware in the online learning, this study is consistent with findings in India [56] and Sri Lanka [57]. Simultaneously, a study in Zambia showed that insufficient access to ICT, electricity, and internet services led to unacceptable online learning models [58]. Learning devices play an important role in the online learning among Moroccan nursing students. This can be explained by some early studies. For example, an investigation indicated that ICT [59] and accessibility of the online environment [60] could facilitate online learning. Moreover, a cross-sectional study in India showed that high intentions to use social media alleviated the negative effects of communication apprehension on perceived learning [61]. A cross-sectional study indicated the cost and ease of use influence student perception of online educational programs among nursing students [62]. Thus, digital literacy need to be improved in online nursing education [63].

This result is consistent with the findings of an early study which found previous experience in online teaching was an emerging factor that could enhance teachers' self-efficacy [64]. This can be explained by a study which highlighted perceived technical skill requirements and class format in the perceived online learning [65]. Facilitating condition had a remarkable moderating effect to predict the student's behavioral intention in using e-learning [66].

Regarding the outcomes from UTAUT models, this study was in line with a study in Jordan that users' behavioral intention to adopt eLearning is significantly affected by their PE and EE [67]. A present study shows that the behavioural intention towards adoption of technology into their training was influenced by PE and EE [68]. With the UTAUT, a study on online payment indicated performance expectations, ease-of-use expectations, and social impact enhance consumers' behavioral intention significantly influenced usage behavior [69].

Limitations

When interpreting our findings, certain limitations emerged and should be considered. Some influential facilitating factors did not appear in this study regarding nursing students of online education but in other studies. The nursing students may have used their own devices to practice online learning during the pandemic. A study underscores the enjoyment, interactivity, flexibility, and quality of online learning systems in the UTAUT model [70]. However, this did not report the quality of electronic devices. The most influential barrier for students possibly was the accessibility of the network. Before COVID-19 pandemic, a study reported information technology issues, communication and non-preferred learning method were reasons for were barriers for online learning [71]. Moreover, a limited number of socio-demographic variables, such as gender, age and postcode make it difficult to provide a detailed explanation of the online education.

Future directions of research

In future studies, technical variables and objective data can be added to reflect change in learning behaviors caused by education digitization. Additionally, clinical practice and faculty characteristics should be considered since the teaching activities are possibly different before and after the COVID outbreak. Future studies should also identify and closely examine knowledge, attitude and behavior of information and communication technology among the students of interest. Prospective studies are needed to further investigate this association and how learning devices improves learning performance. This would contribute to improved academic performance and wellbeing among nursing students.

Policy implication

The empirical outcomes in this study indicated learning devices constituted major influencing factor of academic use of emerging technologies among nursing students. Thus, it is necessary to improve the student's ability to operate learning devices during their online learning. Meanwhile, the misperceptions of nursing students' about online teaching should be overcome by some powerful strategies. Several studies highlight the roles of clinical resources [72] and faculty engagement [73] among the nursing students with remote teaching. Without clinical practice, virtual learning made nursing students unable to fully establish their competence to actual hospital work [74]. Online teaching should provide a simulated clinical environment for the students to improve individual learning process and curricular integration.

Conclusions

In sum, this study highlights the access device to social media platforms for online learning. Previous experience and use intension also play a vital role in the choice of emerging technologies for academic purposes. In practice, the revised UTAUT model can be utilized to analyze the academic activities among Moroccan nursing students.

Abbreviations

- EE=effort expectancy
- FC=facilitating conditions
- PE=performance expectancy
- SI=social influence
- UTAUT=Unified Theory of Acceptance and Use of Technology

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