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The Effect of Individual Factors Mediated by Trust and Moderated by IT Knowledge on Students' Adoption of Cloud Based E-learning

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Abstract*:Usage and adoption of cloud computing (CC) outperform its usage in educational institutions. Studies that are related to the adoption of cloud based e-learning (CBEL) are limited. The purpose of this paper is to investigate the effect of individual factors (PE, EE, SI, and SA) on the BI to adopt CBEL. It also aims to test the mediating effect of TR and the moderating effect of ITK. The population of this study is student from four Lebanese universities. Stratified random sampling was deployed. A total of 422 complete and usable responses were collected and data was analyzed using Partial Least Square (PLS). Individual factors affect significantly the BI toward CBEL. SA is the most important determinant followed by PE, SI and EE. BI affects positively the UB and TR partial mediates the effect of individual factors on BI while ITK does not moderate this effect. This study tested the UTAUT in CBEL and it included TR and ITK with UTAUT. The study also enriched the literature in the developing countries and the literature of CBEL

***Keywords* : *ACloud Based E-learning (CBEL), UTAUT, Trust, IT knowledge, Cloud Computing*.**

I. INTRODUCTION

Technology has become indispensable part of modern societies and universities are no exception. Universities have started the deployment of cloud-based technology to minimize the cost and enrich its contents. In addition, the cloud-based technology are used for delivering lecture and to utilize learning management system (LMS) and application such as Microsoft Office 365 as well as to facilitate the daily communication between students and lecturers [1]–[4].

The issues are prior literature on CC have focused on technical application and implementation of the CC [5]–[8]. However, researchers viewed the perceptual or attitudinal related factors as the main obstacles for adopting the technology by individual who are expected to use the technology [6]. Such findings encouraged the researchers toexamine the factors that lead to the adoption of CC. Nevertheless, the prior studies focused on the business organization adoption of CC while the adoption of CC by universities has not received much attention from researchers [9], [10].

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Despite the fact that CC allows students to access application software, packages, databases, assignment and projects from off campus [11], the widespread of CC adoption by users in universities remains unexplored [12][13]; [9], [10] and studies related, in particular, to CBEL are few [14], [15].

Several models have been deployed to investigate the CC adoption. These include theories such as TAM by [16] and UTAUT by [17]. UTAUT is newer than others and has higher exploratory power of 70% [18]; [19]–[22]. Nevertheless, UTAUT was not used very frequently in CC related studies and there is a need to test the effectiveness of the model in CC [14], [21] Nevertheless, the model UTAUT was criticized for not including variables such as TR [23], [24]; [25]. TR is essential for any transaction [26]–[28]. TR in cloud provider is crucial for ensuring the successful adoption of an appropriate cloud [29]–[32].

Majority of prior literature was conducted in developed countries while few studies looked into the issue in the developing countries [33]; [34]; [35]. However, due to technological gap between developed and developing countries, more challenges are existed in the developing countries and ITK is one of the obvious differences between these countries [36], [37]. The level of ITK can be an essential variable for technology's adoption [38], [39].

According to preliminary interview with heads of ICT department at selected Lebanese universities, the adoption of CBEL by students was 20%, this has motivated this paper to investigate the effect of individual factors on the adoption of CBEL in four Lebanese universities.

II. LITERATURE REVIEW

A. Cloud Based E-learning (CBEL)

Currently, tools of google such as Gmail is one of the widely used cloud tool in higher education [10]. This is followed by LMS [40], library management systems [41], and document storage [42]. All the stakeholder such as students, university, lecturer can benefit from the CBEL because it provides advantages that can make tasks easier [14]. Since this study is conducted on the CC adoption, it focuses mainly on the students and considers the cloud as a service that might facilitate and encourage students to adopt the CBEL

In Lebanon, previous studies and the result of preliminary study showed that universities are using CBEL with acceptance rate of less than 20%. Our preliminary study showed that only four universities are using the CBEL.

A web based preliminary interview with heads of ICT departments in some Lebanese universities indicated that students are not using the CBEL technology.

Results of empirical studies in Lebanon indicated that web-based learning system is still in its infancy [43].

This is supported by the empirical evidence of studies which showed that only 21% of the students in Lebanon are using the technology of e-learning [44], [45]. Technology acceptance in Lebanon has not received adequate research and technology adoption in this country is still relatively limited compared with regional countries such as United Arab Emirate (UAE) with percentage of adoption up to 95% [46] or Western Countries with high adoption rate of technology [47]; [48]. A comparison between Lebanese universities and United Kingdom (UK) universities showed that the former is far behind the latter in term of using the technology [45]. These facts encouraged the authors to conduct the current study to understand what factors could lead to better adoption of CBEL in higher education in Lebanon.

B. Theories of CC adoption

UTAUT was developed to find the factors that affect specifically the users' perception of adoption of new technology [49], [50]. In 2012, [51] come up with new model called UTAUT2. Lian (2015) compared between UTAUT and UTAUT2 and chose to use UTAUT justifying the choice as it better explains the research context in the CC services by adding other variables. In this paper, UTAUT is used as the theoretical foundation. UTAUT has been widely used in many areas. However, the use of the model in CC studies still limited (Cao et al., 2013). Thus, the factors of UTAUT will be used in this study along with other factors such as ITK and TR among other because they are crucial for ensuring the successful adoption of an appropriate cloud [24], [31], [32], [52]. In addition to UTAUT individual factors, researchers suggested that TR and ITK are essential for the adoption of CBEL. TR is an essential variable for using the technology of CBEL and level of ITK determine to large extend the adoption of CBEL [53], [54]. Thus, in this paper TR and ITK are incorporated along with the UTAUT variables.

C. Conceptual framework and hypotheses development

This paper proposed that individual factors affect positively the BI to use CBEL. Individual factors are a multidimensional construct that consists of four sub-constructs, which are PE, EE, SI and SA. The reason behind grouping these variables together is the fact that [49] considered PE, EE, and SI are individual related variables while the SA was grouped due to the definition of the variable which indicate that it is an individual related variable. In addition, the paper proposed TR as a mediator between individual factors and BI and ITK as a moderator between individual factors and BI. Figure 1 shows the proposed model.

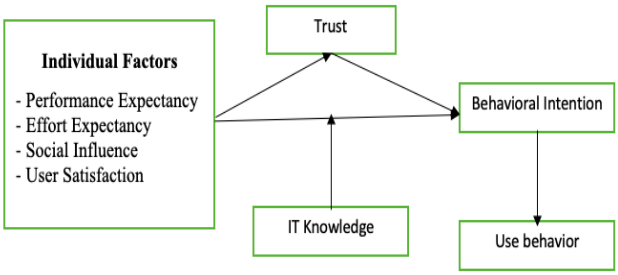

Figure 1: Proposed Model

D. Individual Factor and BI

Individual factors are defined as factors related to the individual perspectives of the technology. In the study of [55] human factors has important effect on the adoption of CC. Similar findings were derived by [56] and [57]. Therefore, it is hypothesized:

H1: Individual factors have a significant effect on the BI to use CBEL.

E. PE and BI

Findings of previous studies in regard of the relationship between PE and BI indicate that there is a significant effect between the two variables (e.g. [58]. [14] found this effect is positive and significant in CBEL. Accordingly, it is hypothesized:

H1a: PE has a significant effect on the BI to use CBEL.

F. EE and BI

Results of empirical studies [59] found that EE affects significantly the BI to use e-learning. [60] found that EE affects the BI to use CBEL. [15] found that EE affected the intention to use cloud-based storage by students. Accordingly, it is hypothesized:

H1c: EE has a significant effect on the BI to use CBEL.

G. SI

Several researchers investigated the effect of SI on the adoption of new technology. For example, [61] investigated the effect of SI on the intention of end user to switch to CC and found there is a significant and positive effect between the two variables. [21] found that SI has significant effect on the students' adoption of cloud storage in China. [60] found that SI affects significantly the BI to use CBEL in Vietnam. Therefore, it is hypothesized:

H1c: SI has a significant effect on the BI to use CBEL.

H. SA

Park and Kim [62] found that there is an important role of user satisfaction on the use of mobile learning. [63] found that satisfaction with the technology affects positively the TR as well as the usefulness of the cloud. [62] also investigated the effect of SA on the intention to use mobile cloud services and found the effect is significant. Thus, the following is hypothesized:

H1d: SA has a significant effect on the BI to use CBEL.

I. BI and UB

Most of previous theoretical adoption models proposed a link between BI and UB. [64] and [65] as well as [11], [18], [66] indicated that the relationship between BI and UB is positive and significant.

Therefore, it is proposed:
H2: BI has a significant effect on the UB CBEL.

J. Mediating role of TR

Few studies deployed TR as a mediator [67], [68]. Burda and Teuteberg (2014) investigate the mediating role of TR between ease to use and intention to use. The findings showed that TR play a mediating role.

In a mobile banking study, [69] developed a conceptual model to investigate the adoption of mobile banking in Malaysia.

In their model, TR proposed to play a role of mediator. [70] used TR as a mediator between ease of use, usefulness, and BI. The findings showed that TR fully mediate the effect of perceived ease of use on BI. Hew et al. (2016) incorporated TR as a mediator between perceived competency and BI. The findings showed that TR partial mediates the effect of perceived competency on BI. Accordingly, it is hypothesized:

H3: TR mediates the effect of individual factors on BI to use CBEL.

K. Moderating role of ITK

Researchers [71] found that the level of ITK among end users determines the extent to which they can adopt the technology such as e-commerce [72][73]. Those with low level of ITK will have knowledge anxiety [38]. [39] pointed out that students with high level of ITK will use the technology of mobile learning and will not be affected by other's opinion. Conversely, those with low ITK are find it difficult to use M-learning and will be affected by other's opinion. Therefore, it is hypothesized:
H4: ITK moderates the effect of individual factors on the BI to use CBEL.

III. METHODOLOGY

A. Population and Sampling

Four universities in Lebanon were chosen as the population. Using a stratified sampling technique, the data was collected. According to [74], for a population of 33,712 with margin error 0.05 and confidence level of 0.95, the sample size is 380. However, due to the concern of low response rate when distributing online survey, 790 questionnaire were distributed online and the universities were asked to assess in the distribution. Table 1 shows the population of this study as well as the sample size of each group.

Table 1: Population and Sample Size

University	Population size	Percentage of the population	Actual sample size	Distributed number
University 1	8,315	24.7%	94	195
University 2	8,000	23.8%	90	188
University 3	2,397	7%	27	56
University 4	15,000	44.5%	169	351
Total	33,712	100%	380	790

A questionnaire was used to collect the data. The items of PE, EE, UB, and SI was adopted from [49], [75]. Items of SA was adopted from [62] and Items of TR was adopted from [76] while items of BI were adopted from [61]. ITK was self-developed. Six experts validated the questionnaire and changes were made according to the suggestions of the validators. A pilot study showed that the Cronbach's alpha is larger than 0.70.

B. Data Collection

An online questionnaire was created and the link were mailed out to the universities and directly sent to students in the four universities. Data collection took place from May to November 2017. Reminders and follow up procedures were applied. As a result, a total of 459 questionnaires were collected. A total of 37 questionnaire were removed due to missing value and outliers resulting in 422 complete and usable questionnaires.

IV. FINDINGS

A. Background of the Respondents

The background information of the respondents is presented in Table 2. The age of the respondents, (66.6%) are less than 23 years old with 54% are males with bachelor degree and they use smartphone to access the CBEL.

Table 2: Background of Respondents

Variable	Label	Frequency	Percent
Age	18-23	281	66.6
	24-29	109	25.8
	30 and above	32	7.4
Gender	Male	228	54.0
	Female	194	46.0
Education	Bachelor	307	72.7
	Master	76	18.0
	PhD	39	9.2
Tools	Smart phone	343	81.3
	Notebook	48	11.4
	PC	31	7.3

B. Data examination

The data were examined to clean it and prepare it for further analysis. A total of 27 were removed due to major missing value (more than 50%) and 10 responses deleted due to outliers. The normality was check, the data is normally distributed with value of skewness, kurtosis is less than absolute two (2), and the histograms showed normal distribution curve. There is no multicollinearity issue among the variables of this study.

C. Measurement model

Table 3 presents the results of the measurement model. The factor loading (FL) of all the items is greater than 0.70. The Cronbach's alpha (CA) is larger than 0.70 as well as the composite reliability (CR) is larger than 0.70. The convergent validity is achieved because the AVE for all variables is greater than 0.50.

Table 3: Convergent Validity, Factor Loading, Cronbach's Alpha, and Composite Reliability

Variable	**Item**	**FL >0.70**	**CA >0.70**	**CR >0.70**	**AVE >0.50**
UB	UB1-UB6	0.888-0.797	0.928	0.942	0.732
BI	BI1-BI5	0.905-0.885	0.934	0.950	0.791
PE	PE1-PE5	0.907-0.884	0.936	0.951	0.795
EE	EE1-EE4	0.931-0.896	0.937	0.955	0.841
SI	SI1-SI5	0.879-0.816	0.907	0.931	0.729
SA	SA1-SA4	0.896-0.888	0.914	0.940	0.795

TR	TR1-TR4	0.972-0.722	0.911	0.880	0.651
ITK	ITK1-ITK5	0.926-0.897	0.947	0.959	0.825

D. Discriminant Validity

The square root of AVE is greater than the cross loading. Thus, it is concluded that the discriminant validity was achieved.

Table 4: Discriminant Validity

	BI	EE	ITK	PE	SI	TR	UB	SA
BI	**0.889**							
EE	0.459	**0.917**						
ITK	0.203	0.171	**0.908**					
PE	0.466	0.608	0.173	**0.892**				
SI	0.474	0.587	0.222	0.586	**0.854**			
TR	0.504	0.272	0.130	0.256	0.254	**0.807**		
UB	0.528	0.371	0.150	0.294	0.381	0.257	**0.855**	
SA	0.503	0.411	0.110	0.419	0.472	0.218	0.412	**0.892**

E. Hypotheses Testing

Four main hypotheses were developed in this study. This includes the direct effect hypotheses, mediating effect hypotheses of TR, and moderating effect hypotheses of ITK.

F. Direct Effect Hypotheses

Table 5 presents the result of direct effect hypotheses. The table presents the result of individual factors and its sub variables effect on BI as well as the effect of BI on UB.

Table 5: Direct Effect Hypotheses

Hypothesis		β	St.D.	T-Value	P-Value
H1	Individual Factors -> BI	0.528	0.038	13.743	0.000
H1a	PE -> BI	0.162	0.054	2.994	0.003
H1b	EE -> BI	0.146	0.047	3.133	0.002
H1c	SI -> BI	0.151	0.051	2.978	0.003
H1d	SA -> BI	0.305	0.043	7.142	0.000
H2	BI -> UB	0.527	0.038	13.842	0.000

Based on the hypotheses testing in Table 5, the first main hypotheses assumed that individual factors have significant effect on BI. The hypotheses was true, individual factors has significant effect on BI. Therefore, H1 was accepted. For H1a, the PE has a significant effect on the BI (β=0.162, T-value=2.994, P-value =0.003), thus, H1a is accepted. For H1b, it was accepted that EE has a significant effect on BI (β=0.146, T-value=3.133, P-value =0.002). For H1c and H1d, both hypotheses were accepted. The effect of SI on BI is significant (β=0.151, T-value=2.978, P-value =0.003), and the effect of SA on BI is significant (β=0.305, T-value=7.142, P-value =0.000). The second main hypothesis predicted that the BI has a significant effect on the UB, the prediction was true. BI affect significantly the UB (β=0.527, T-value=13.842, P-value<0.001). Thus, H2 was accepted.

5.5.2 Mediating Role of TR

For testing the mediating, Table 6 shows a comparison between the direct effect without mediator (TR) and the direct effect with TR included. The table shows that the direct effect reduced from β=0.528 to β=0.489 and stayed significant. In addition, the indirect effect is also significant (β=0.100, T-value=5.080, P-value <0.001). Thus, it was concluded that the TR mediated the effect of individual factors on BI and this mediator is partial.

Table 6: Result of the Mediating Effect of TR

	β	STD	T-Value	P-Value
Direct effect without TR				
Individual Factors -> BI	0.528	0.038	13.743	0.000
Direct effect with TR included				
Individual Factors -> BI	0.489	0.045	10.974	0.000
TR -> BI	0.334	0.056	5.949	0.000
Indirect effect				
Individual Factors -> TR -> BI	0.100	0.020	5.080	0.000

G. Moderating effect of ITK

Repeated indicator approach was used to test the moderating effect of ITK. This is because when using second order construct such as individual factors, researchers suggested to use the repeated indicator approach and to use two stage approach (). The result of moderating effect of ITK between individual factors and BI is presented in Table 7. It shows that ITK does not have moderating effect (β=0.037, T-value=1.173, P-value <0.241). Thus, H4 was rejected. Surprisingly, Table 7 shows the ITK has a direct significant effect (β=0.086, T-value=2.164, P-value <0.031).

Table 7: Result of Moderating Effect of ITK

	β	STD	T-Value	P-Value
ITK -> BI	0.086	0.040	2.164	0.031
ITK*Individual Factors -> BI	0.037	0.032	1.173	0.241
Individual Factors -> BI	0.574	0.042	13.673	0.000

V. DISCUSSION

This study proposed that individual factors as a construct as well as its sub construct namely, PE, EE, SI, and SA has a direct effect on BI toward adopting the CBEL. In addition, the study proposed that BI has a direct effect on UB, TR mediates the effect between individual factor and BI, and ITK moderate the effect of individual factor on BI. The findings indicated that individual factors as well as its sub construct PE, EE; SI and SA have significant effect on behavior intention. SA is the most important sub construct followed by PE, SI and EE. In addition, BI has a direct significant effect on UB.

[55], [57], [77] found that individual factors are important for the adoption of cloud-based technology. PE, EE, and SI are key drivers for cloud adoption [59], [61], [78]–[80]. Researchers also pointed out that SA is essential for adopting new technology [61], [63]. BI is major driver for the UB [16], [49], [64] [82]. For universities to increase the acceptance rate, they must focus on increasing the SA. One possible way to increase this satisfaction is to establish speed internet connection as most of developing countries still suffer from slow internet connection. Universities can provide the internet on campus at high speed to increase the SA. PE increases if the universities manage to provide rich content of their CBEL such as to make available the courses and other materials that enrich the knowledge of student and contribute to their academic performance.

The SI also is important to spread the awareness about using CBEL. Workshops and lecturers can participate in increasing the SI effect toward adopting CBEL. Lastly, physical and mental effort to use the CBEL should be at minimal to encourage student to adopt CBEL. TR mediated partial the effect of individual factors on BI. This indicates that part of the relationship between individual factors and BI can be explained by TR. This is in agreement with the study of [63], [70], [81]. Top management of the universities is advised to ensure that they select the right cloud providers and ensure that the information of their students is not subject to be used by third party. ITK was found not a moderator between individual factors and BI. However, the effect was direct on BI.

In other words, the level of ITK does not play a moderating role on the relationship between individual factors and BI but ITK itself can affect the extent to which the student might adopt CBEL. This is in agreement with [71] as they pointed out that ITK determinant of e-commerce adoption. Low level of ITK creates anxiety [38]. The universities should conduct a workshop series every year to enlighten the newcomers about the application and usage of CBEL, they should also provide handbook that explain in detail with diagram and picture the way of using the CBEL.

The study fills the gaps in literature by investigating the role of TR as mediator and the ITK as moderator. It also contributes to the literature by incorporating TR with the UTAUT model. More importantly, the study validated the use of UTAUT in CBEL and managed to explain 44% of the variation in the BI.

VI. CONCLUSION, LIMITATION, FUTURE WORK

This study was conducted in Lebanon to investigate the effect of individual factors on CBEL adoption. The study also tested the mediating effect of TR and the moderating effect of ITK. The study incorporated four direct effect variables related to UTAUT and SA. It could explain only 44% of the variation in BI; future studies are recommended to include more variables such as the privacy, security, availability, and organizational factors such as top management support, and facilitating condition to increase the explanatory power of the models. The study also tested the mediating role of TR; future studies can look into the possible role of TR in the adoption of CC such as to test the direct effect or the moderating effect of this variable. Mainly, the study focused on the students, future studies can extend the scope to include academic and non-academic staff.

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