

Adoption of Cloud Based E-learning in Developing Countries: A Combination of DOI, TAM and UTAUT

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<p>Article history Submitted: 29 October, 2020 Revised: 11 November, 2020 Accepted: 22 November 2020</p>	<p>Abstract Cloud computing (CC) has created a paradigm shift in using technology. Prior literature focused on the adoption of this technology among business organization while studies that are related to educational institutions are few. The aim of this study is to investigate the factors that affect the cloud based e-learning (CBEL) adoption among students. Based on the literature, it is proposed that relative advantage (RA), perceived ease of use (PEOU), social influence (SI), and user satisfaction affect the behavioural intention (BI). BI is expected to affect the adoption of CBEL. In addition, attitude is proposed to mediate the effect of RA, PEOU, SI and user satisfaction on BI. The population of this study is four universities in Lebanon. Stratified sampling technique was used to collect the data using a questionnaire. A total of 422 students participated in this study. Data was analysed using Smart Partial Least Square (PLS). The findings indicated that the user satisfaction is the most important predictors of BI followed by RA, SI, and PEOU. BI affected use behaviour significantly. Attitude mediated the effects of SI and user satisfaction on BI. Decision makers are recommended to focus on user satisfaction and increase the benefits of CBEL.</p>
<p>Keywords: <i>TAM</i> <i>UTAUT</i> <i>User satisfaction</i> <i>Cloud Based E-learning</i> <i>Higher education</i></p>	

1. Introduction

Cloud computing (CC) has revolutionized the way of doing business. It was developed during the last decade and it has caused a paradigm shift in Information Technology (IT) [1]. CC is referred to as a dynamic innovation platform that addresses a wide variety of requirements by giving a digital framework to broaden information storage abilities. Moreover, CC gives access to programming and equipment without substantial capital costs and gives easy access to applications and administrations that can be acknowledged with insignificant service provider interaction [2]. This has empowered CC to create a technological advancement that can deal with large amount of data that are exchanged and stored via means of electronic applications [1], [3]. Organizations have found in CC the solutions that they seek for the cost minimization, efficiency, effectiveness and competitive advantage [4]. The cost advantages were achieved through virtualization, scalability, and on demand hardware and software [5], [6]. In this sense, most previous studies focused on how to deploy and migrate to the cloud and the requirement for such move [7]–[9].

Researchers believe that the biggest challenge of CC is not technological oriented rather, it is related to the perception and attitude of the users [10]–[12]. For this reason, many studies focused on the behavioural factors that leads to the adoption of CC. However, the majority of the previous studies were conducted on business organizations addressing the organizational aspect of CC adoption [2], [13]–[15]. The adoption of CC by educational institutions has not received much attention from researchers [16], [17]. CC enables users such as students to have full access to applications, packages, software, databases, assignment, and projects from inside and outside the campus. In addition, CC is one of the widely used services by students for storing data and entertainment [18]. Nevertheless, the widespread of CC adoption and the factors that affect the users' adoption in universities remains unexplored [19], [20].

Theoretical adoption theories and models such as TAM [21] suits well the developed nation but in the case of developing nation such as Lebanon, the model has not been extensively tested [22]. Other models such as UTAUT [23] was developed to test the individual adoption of technology [23], [24] but the use of the model in CC is still limited [25], [26]. Meta-analyses studies showed that the literature of CC is dominated by TAM model and 1% have used UTAUT [27]. Previous studies on the adoption phase of CC has not focused on the usage of the technology in educational settings and studies in this domain are few ([16], [17]). Most prior studies focused on the adoption of CC in developed countries [28]. However, due to technological gap between developed and developing countries, more challenges are existed in the latter [29]–[31]. Thus, it is important to investigate the issues surrounding the adoption of CC to ensure its success [32].

In Lebanon, previous studies and the result of preliminary study showed that universities are using cloud based e-learning (CBEL) with acceptance rate of less than 20%. The main issues that face the students' adoption of CBEL is related to the effectiveness of the systems. Previous studies that have been conducted in the country showed that the acceptance of technology is at the rate of 21% [33], [34]. A comparison between Lebanese universities and United Kingdom (UK) universities showed that the first is far behind the latter in term of using the technology [34]. In addition, the studies pertaining to CBEL worldwide are few [26], [35]. Accordingly, the purpose of this study is to identify the factors that affect the adoption of CBEL services by Lebanese students. The remaining of this paper discusses the literature, methodology, findings, discussion and implications as well as the conclusion.

2. Literature Review

2.1 Cloud Computing in Education

Universities, especially in developing countries, are facing challenges in delivering the level of Information Communication Technology (ICT) required to foster the development of learning, teaching, research, and other development activities by typical university [36]. These ICT requirements are needed by the university to follow up with the advancement in technology and to update their services to match the current technological environment [37]. The need currently are more sever because of the increasing cost of operating the university and the need to provide additional fund to support and maintain the technological infrastructure in university such as the need for updated software and hardware [38].

CC has been proposed as a solution to reduce the operational cost of universities because the CC technology promises users with enhanced IT and availability as well as reliability of these services from anywhere at any time with advantage of paying per use basis [39]. The CC technology has made the services less complicate and increased the speed as well as the quality of IT services provided to users and institutions such as universities. Nevertheless, despite the advantage that are provided by CC, the adoption of cloud is not well investigated in some sector such as the educational sector and higher education still hesitant to start using the technology of CC [37].

In higher learning institution, the most widely area of benefiting from CC is the course delivery as well as the distance learning [40]. In addition, the daily communication between students and instructors or lecturers are also considered one of the increasingly area of using CC in universities. Recently, one of the indispensable applications that is used by students and lecturers in higher education is the Gmail and its applications such as Google Drive and questionnaire tools [17]. More application area are also used by students and lecturers are the LMS, library management system, and document storage [41]. Several stakeholders can benefit from the CBEL. However, the main purpose of developing the CBEL is to serve the students at the university so that the university can attract more students and improve its operations. This study focuses on the students and their adoption of CBEL.

2.3 Theoretical Framework

Many theories have been used in previous studies to investigate the adoption of new technology. A meta-analysis study showed that only 4% of studies investigated e-learning have used UTAUT [42]. The authors suggested researchers to investigate the e-learning using different theories such as the UTAUT. In a recent study, a meta-analysis review was conducted on 285 articles published between 2009 and 2015 in leading journals, found that only 1% of the studies have used UTAUT as a theoretical adoption theory while the majority have focused on TAM [27]. UTAUT summarized the eight previous theories and model that include TAM and proposed that the adoption of new technology is determined by performance expectancy (PE) which is similar to relative advantage, effort expectancy (EE) which is similar to PEOU, social influence (SI), and facilitating conditions (FC) which expected to affect the behavioural intention (BI) and the use behaviour (UB). According to Venkatesh et al. (2003), perceived usefulness is similar to PE expectancy. In addition, perceived ease of use is similar to EE. The attitude is not mentioned to be equal to any variable in the study of Venkatesh et al. (2003). Thus, in this study, the variable attitude which was used as a mediating variable in TAM to mediate the effect of perceived usefulness on BI is used in this study as a mediating variable among the variables of this study.

2.4 Conceptual Framework and Hypotheses Development

The conceptual framework of this study was developed mainly based on the combination between UTAUT and TAM. Variables of UTAUT such as PE, EE, SI are expected to have direct effect on BI. User satisfaction proposed in the Information System Success (ISS) model to be important predictor of technology adoption [43] and in this study it is proposed to affect the behavioural intention. Behavioural intention is proposed to have direct effect on the adoption of CBEL. Figure 1 presents the conceptual framework of this study.

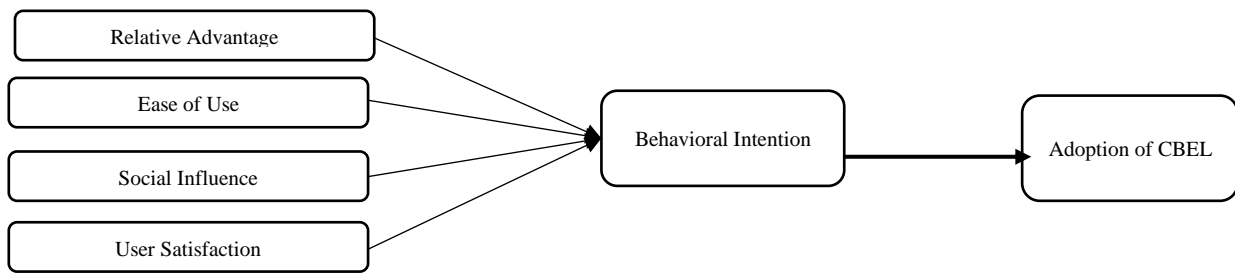


Figure 1: Conceptual Framework

2.4.1 Relative advantage and Behavioral Intention

Several researchers investigate the effect of RA on BI and found significant effect of the variable on the BI to use the technology. For example, [44] examined the effect of RA on the intention of continued use of e-learning and found that PE determined the intention to continue using e-learning. [25] in China found that RA/PE affected the BI to adopt cloud storage by Chinese students. [26] investigated the effect of PE on the adoption of CBEL and found this effect is positive and significant. In this study, it is expected that the effect of PE on the BI toward CBEL is positive and significant. Accordingly, it is hypothesized:

H1: RA has a significant effect on the BI to use CBEL.

2.4.2 Ease of Use and Behavioral Intention

[12] tested the effect of PEOU on the acceptance of e-learning and found that EE affects significantly the BI to use e-learning. [25] found that PEOU affects the intention to use cloud-based storage by students. [26] found that EE affects the BI to use CBEL. Accordingly, in this study, it is expected that EE has a positive effect on students' BI to use CBEL in Lebanese universities.

H2: EE has a significant effect on the BI to use CBEL.

2.4.3 Social Influence and Behavioral Intention

[12] suggested future research to pay attention to the role of friends and peers in CC acceptance studies. [45] found there is a significant and positive effect between SI and BI. [25] found that SI has significant effect on the students' adoption of cloud storage in China. [26] found that SI affects significantly the BI to use CBEL in Vietnam. This study expects that students will be affect by their peers, friends, family member, social media, and lecturer as well as the management of the university to adopt and use the CBEL. Accordingly, in this study, it is hypothesized:

H3: SI has a significant effect on the BI to use CBEL.

2.4.4 User Satisfaction and Behavioral Intention

User satisfaction with cloud services investigated in few studies [46]. A high quality cloud services is more preferable for active users than low quality services [46]. [47] developed the ISS. The authors highlighted the importance of user satisfaction with the e-services to adopt the technology. [48] proposed that user satisfaction with cloud affect the BI to use CC services. [49], [50] found that user satisfaction with the cloud is an important predictor of the intention to switch to CC services. [51] investigated the effect of user satisfaction on the intention to use mobile cloud services and found the effect is significant. [52] found that satisfaction with the technology affects positively the trust as well as the usefulness of the cloud. In this study, it is anticipated that user satisfaction with CBEL affects positively their BI to use the technology. Therefore, it is hypothesized:

H4: User satisfaction has a significant effect on the BI to use CBEL.

2.4.5 Behavioral Intention and Use Behavior

Most of previous theories of technology adoption such as TAM and UTAUT has linked the BI to UB [21], [53]. [54] investigated the effect of intention on the use of Google.Doc by university students and found significant relationship. Cao et al. (2013) investigated the effect of BI on UB of CC and found significant effect between the two variables. Several studies have derived similar results [18], [38], [55]. Therefore, in this study, it is hypothesized:

H5: BI has a significant effect on the UB CBEL.

3. Methodology

The population of this study is four university in Lebanon. A stratified random sampling technique was used to better represent the university. The use of this technique is due to the differences in the number of students in each university. Due to the concern of low response rate when distributing online survey, 790 questionnaire were distributed online. A questionnaire is the research instrument of this paper. The questionnaire consists of three main sections. In the first section, a cover letter and introduction to the questionnaire is given. In the second section, the background of the respondents such as their age, gender, education and tools of using CC. Third section seeks to find information related to the variables of the study. The items are evaluation based on five Likert scale where (1) is strongly disagree and (5) is strongly agree. Relative advantage (5 items), ease of use (5 items), social influence (5 items) were adapted from [53] and [63]. User satisfaction (4 items) was adapted from [51], behavioral intention (5 items) was adapted from [53]. Adoption of CBEL (6 items) was adopted [53].

The questionnaire was validated by experts and pilot study was conducted prior to field data collection to assess the reliability of the measurement. The data was collected from 459 students in four universities in Lebanon. A total of 37 questionnaire were removed due to missing value and outliers resulting in 422 complete and usable questionnaires. This data are sufficient for the purpose of analysis. Previous studies used similar amount of data to analyze using Smart PLS [64]–[66]. The data was normally distributed and no multicollinearity issues among the variables.

4. Findings

4.1 Background of the Respondents

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.

4.2 Measurement model

[67] suggested researchers to assess the measurement model by confirming the convergent validity, discriminant validity as well as factor loading (>0.70), composite reliability (CR) and Cronbach’s Alpha (CA) (>0.70). The convergent validity is achieved when the average variance extracted (AVE) is greater than 0.50. The factor loading was checked and all the loading are greater than 0.70. In addition, CA is greater than 0.70 as well as the CR is greater than 0.70. The convergent validity is achieved because the AVE for all variables is greater than 0.50. The discriminant validity were achieved because the value of square root of AVE are greater than the cross loadings.

4.3 Structural Model

The structural model is assessed by the R-square as well as the predictive relevance (Q^2), effect size (f^2), and path coefficient [29], [65], [66], [68]–[73]. The value of R-square 0.25, 0.50, 0.75 is considered weak, moderate, and substantial respectively. Value of Q^2 should be greater than zero and it is obtained by conducting blindfolding analysis. Acceptable value of f^2 is greater than 0.02 [10], [11], [74].

4.4 Hypotheses Testing

4.4.1 Direct Effect Hypotheses

The direct effect of RA/PE, EE, SI, and user satisfaction on BI is presented in Table 3. In addition, the table shows the direct effect of BI on UB. Table 1 shows the coefficient (β), Standard Deviation (STDEV), T-statistics (T Values), P values (P), effect size (f^2), predictive relevance (Q^2), and R-square (R^2). The Table shows that 36.7% of the variation in BI can be explained by RA/PE,EE,SI, and US. In addition, 19.4% of the variation in UB can be explained by BI. The independent variables can predict the dependent variable because the Q^2 is greater than zero for BI and UB. Further, the f^2 for all the causal effect are acceptable.

Table 1: Direct Effect Hypotheses

Hypothesis No.	Path	β	STDEV	T Values	P Values	f^2	Remark
H1	RA \rightarrow BI	0.162	0.054	2.986	0.003	0.02	Supported
H2	PEOU \rightarrow BI	0.145	0.047	3.062	0.002	0.02	Supported
H3	SI \rightarrow BI	0.151	0.050	2.991	0.003	0.02	Supported
H4	US \rightarrow BI	0.305	0.042	7.195	0.000	0.11	Supported
H5	BI \rightarrow UB	0.440	0.040	10.869	0.000	0.24	Supported
R^2 for BI is .367, for UB is .194 Q^2 for BI is .272, for UB is .143							

Note: BI: behavioral Intention, UB: use behavior, US: user satisfaction, RA: relative advantage, PEOU: Ease of use expectancy, SI: social influence.

The first hypothesis predicted the effect of RA/PE on BI is significant. The prediction is true. RA/PE affect significantly BI ($\beta=0.162$, $P=0.003$). Thus, H1 is supported. H2 assumed that EE has a significant effect on BI. The assumption is true. EE affects BI significantly ($\beta=0.145$, $P=0.002$). Therefore, H2 is supported. For H3 and H4, they are supported because

the effect of SI on BI is significant ($\beta=0.151$, $P=0.002$) and the effect of US on BI is significant ($\beta=0.305$, $P<0.001$). for H5, the effect of BI on UB is significant ($\beta=0.440$, $P<0.001$). Thus, H5 is supported.

5. Conclusion, Limitation, Future Work

This study was conducted to examine the effect of the variables of UTAUT as well as the relative advantage and ease of use and user satisfaction on the BI to adopt CBEL among students in Lebanon. Based on a combination between TAM and UTAUT as well as ISS, the study proposed that RA, EE, SI, and user satisfaction affect the BI. BI was proposed to affect the UB. Findings indicated that user satisfaction is the most important predictors of BI followed by RA/PE, SI, and EE. BI affected UB.

Findings of this study can be generalized on the population due to the use of random sampling. However, all the universities included in this study are private. Thus, for better generalization, a study on public universities is recommended. The study collected data from students. Thus, future studies are recommended to examine the academic and non-academic staff. Further studies are also recommended to examine the technological factors such as privacy, security, and trust. In developing countries, internet speed and connection are essential. Thus, technical factors such as availability, coverage, Internet speed and connection could be an area of focus for future studies in the developing countries.

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