Cloud Computing Issues for Higher Education: Theory of Acceptance Model

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Abstract—This study investigates the readiness and basis for adoption of cloud computing for higher education in the United Arab Emirates using the Theory of Acceptance Model [1] and structured equation modeling. After the concept of cloud computing was introduced through an educational technology course, empirical data were derived from an online questionnaire with 239 pre-service teachers and undergraduate students. Hypotheses about users' acceptance and adoption of cloud computing were tested. The findings revealed that perceived ease of use affected the intention to use the technology in the future, and intention to use was demonstrated in the teachers' actual use. The study's outcomes provide educational institutions and cloud service providers a better understanding of cloud computing adoption issues. It also supports the foundation for upcoming research focused at improving our awareness of technology adoption and continued-use factors for innovation in instructional technologies. The implications are discussed in the context of education.

Keywords—Cloud computing, intention to use, perceived ease of use, perceived usefulness, structural equation model

1 Introduction

Cloud computing is a new technology model used for hosting services, and it has become highly popular among business owners and their customers for providing services. Cloud computing has been defined by the National Institute of Standards and Technology (NIST) as a "model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [2, p.2]. It is considered a highly effective, convenient and centralized sharing pool through which computer resources can be deployed and accessed with minimum overhead. The most often used examples of cloud computing sharing services are Dropbox and Google Drive [3]. Cloud computing is also proving useful in fields other than business, and given the exponentially increasing popularity of online learning, it is important to explore how it can be used to address the challenges faced by e-learning enterprises and web-based learning environments. With its rapidly growing rate of use, its impli-

cations for education and e-learning systems continue to spread. It can be applied in these environments to enhance the efficiency of e-learning and to act as an intermediary communication system leveraging IT resources for the benefit of an institution's consumers [4]. In addition, within the existing competitive market environment, cloud computing is becoming increasingly necessary in education and e-learning environments because it facilitates access to knowledge by users (learners, instructors and administrators). By using cloud computing for e-learning, educational institutions can perform all of their learning tasks more efficiently at lower cost through cloud-based applications that are made available by cloud service providers [5]. The characteristics of cloud computing as a scalable, virtual, reliable and highly efficient system makes it well suited to e-learning institutions because they usually experience quick growth spurts in short periods of time. While cloud computing usually requires strong hardware and software infrastructure, e-learning systems in and of themselves require such resources, and cloud computing has the added benefit of facilitating the utilization of resources to result in a much more effective user experience [6].

Technology has facilitated learning in today's competitive environment, as it can be effectively used both inside and outside the classroom environment. An educational institution embraces new technology by finding the optimal way to harness its benefits at crucial times of learning. The applications of cloud computing for educational efficiency are vital today because they maximize educational outcomes and allow students to benefit from technologies while gaining a greater understanding of the latest technological advancements. Dong, Zheng, Yang, Li & Qiao [7] showed that cloud computing can be implemented in educational and online learning institutions to significantly enhance the learning of their users. It has become highly useful in educational and learning institutions and online web services, providing effective and user-friendly learning and teaching practices [8].

Learning can be categorized using different theories, such as humanist, behavioral, cognitive, social learning and critical reflection. Each of these learning techniques has its own strengths and limitations. E-learning allows knowledge in any of these formats to be spread to learners in different parts of the world in a quick and efficient way. It provides users a rich learning environment by reducing their learning time and cost in accordance with their individual competencies. E-learning can use both the Internet and other digital technologies to connect teachers to users online from places around the world [9]. By adopting the benefits of a modern educational system, e-learning thus provides new mechanisms of communication.

The successful implementation of cloud computing involves six stages: connecting mainframes, networking computers, employing main computers, grid computing, Internet computing and, finally, cloud computing. Through this process, standalone personal computers become highly well connected and more powerful and are thus able to meet the requirements of their users. Cloud computing allows consumers on-demand access to their computer facilities, including server time and network storage. Facilities can be accessed whenever they are required without the need for interaction with service providers. This enhances the level of computing by enabling various types of clients to effectively access the network through their smartphones, tablets, laptops and desktop computers [10].

In recent years, cloud computing has become highly popular among educational institutions and learners. Beyond saving time and money for learners, it can be used to upgrade labs with hardware or software licenses while ensuring that periodic maintenance operational expenses are aligned with real-time usage and revenue [11]. Most online educational systems prefer to adopt cloud computing for their e-learning systems because it supports their aim to motivate learners to use their services. This preference results partly because educational cloud computing services are more efficient and reliable than traditional e-learning platforms, and they provide the most unified user experience. These benefits can even be reaped by traditional educational institutions due to the development of innovative solutions that enable educational institutions to transform some of their systems to e-learning [12]. To make the transition educational institutions must decide whether to build their own cloud computing platforms or to use services from specific service providers in a public cloud. It is optimal to make this choice after they have identified their own parameters. Therefore, it is highly recommended that educational institutions identify which services they prefer before committing to transforming e-learning systems to cloud computing. They should create a service catalog by identifying and determining what parameters they will need to access in order to share this information with their service providers; doing so will also help them whenever they need to update the system [9].

Consequently, despite the fact that e-learning is still in its infancy in many developing countries, most universities in the United Arab Emirates (UAE) show a great enthusiasm in the adoption of teaching/learning tools and technologies. Thus, identifying the significance factors effecting the usage of such a tool and technology is vital before its adoption. Unfortunately, based on our review of existing scientific literature on cloud computing, limited studies have been led to scientifically explore the ways in which individuals adopt and the factors that influence individual adoption of innovation [13][14][15]. No studies to date have explored usage and acceptance of cloud computing in a university setting in UAE.

Since universities benefit significantly from the available cloud-based applications offered by service providers and as a result support their students to perform academic tasks, the purpose of the current research is to examine the factors influencing students at the college of education at Al Ain University (AAU) to use cloud computing and benefit from services such as Google Docs and Google Drive.

To achieve the aforementioned aim of this study, the paper was organized as follows. Following the introductory section which includes the research motivation and objectives, comes the literature review which covers relevant research dealing with cloud computing and the proposed research hypotheses. This is followed by the methodology, the results, and the discussions of the issues raised in the paper and suggestion of specific implications for practitioners. Then the paper's limitations, contribution and future research directions are suggested.

2 Cloud Computing

Definitions of cloud computing vary widely depending on the services and applications for which it is being used. According to Voas and Zang [16], cloud computing refers to clusters of distributed computers that provide on-demand resources and services over the Internet. Thomas [17] defines cloud computing as virtualized computers that allow users to begin or stop the services subscribed to when necessary. Because cloud computing is involved in applications ranging from Google services (e.g., G-mail, Google Docs and Google Drive) to Dropbox, the services depend on the servers provided to users. The applications are diverse, ranging from business to education. Thomas divides cloud computing into three service categories. First, cloud computing manages service software that provides application tools in the cloud, such as Google Docs, Google Drive, YouTube and social networks. Students are able to upload their work in any format to the web while feeling that their documents and files are secure and will not be lost. Second, cloud computing acts as a service platform from which to purchase online products (e.g., Amazon). Third, it works as an infrastructure that provides the utility of virtual hardware, including data storage and web hosting. These categories of cloud computing and its functions provide an enormous benefit to students in higher learning. Students are able to store their work, share with their peers and collaborate through editing and adding information.

However, every technology system has its drawbacks. Users must rely on the Internet when they want to exchange files with others. Thus, cloud computing may not be the best solution for all academic activities or business. In addition, findings from Prasetio and Dhewanto [18] show low user acceptance of cloud computing in firms due to security, privacy and data integrity concerns. These authors study cloud computing acceptance using two theories, i.e., the theory of disruptive innovation technology by Bower and Christensen [19] and the theory of acceptance model (TAM) by Davis [1] to investigate the acceptance of cloud computing in firms. Previous research has attempted to understand users' behavior in accepting Dropbox under the theory of planned behavior [20].

The means/ criteria of adopting new technology has been studied intensely in the past several decades. Bhattacherjee and Sanford [21, p.805] attested that "understanding IT acceptance is important because the expected benefits of information technology (IT) usage, such as gain in efficiency, effectiveness, or productivity, cannot be realized if individual users do not accept these systems for task performance". In contrast Wisdom, Chor, Hoagwood and Horwitz [22, p.1] admitted that "Little is known, however, about factors related to decisions to adopt innovations and how the likelihood of adoption of innovations can be increased". On the other hand, one of the most well-known facts that adopter categorization on the basis of innovativeness has to follow a certain pattern/curve [23] as illustrated in Figure 1.

One of the most distinguished theories of technology adoption is TAM. It has been broadly applied to a range of technologies and users. TAM has been proved to be extremely efficient in the prediction and adoption of several IT systems [24]. It provides evidence on how external variables influence intention to use, belief and attitude [25].

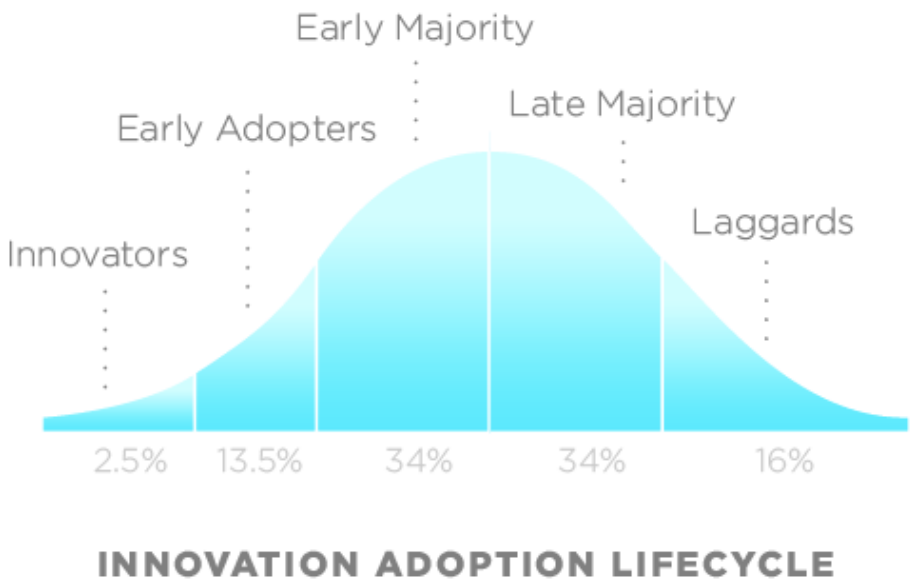

Fig. 1. Innovation Adoption Lifecycle

TAM is derived from the theory of reasoned action [26], which expressed how attitude impacts behavior. It provides evidence on how external variables influence intention to use, belief and attitude. On the other hand, it was documented that the behavioral intention and usage will supplement the approval of the system during the real usage in the workplace [27]. Consequently, in the present study TAM is utilized as a framework to investigate what criteria determine usage in an educational context. This theory is chosen because it is widely applied in the research on technology usage in many different contexts. Underpinned by the framework of the TAM, this study will attempt to remedy a lack of empirical evidence on the practical use of cloud computing in institutions of higher learning. Although previous studies have shown a research trend in computing, specifically cloud computing, research has focused primarily on systems related to technical security [28], changing working styles [29], and the potential in teaching and learning [17]. There has been a lack of empirical evidence, however, regarding the practical use of cloud computing in higher educational institutions. This study will therefore estimate the postulated TAM in the context of cloud computing with a focus on the validation of the relationships involved specifically, perceived usefulness, ease of use, intention to use and actual use.

The purpose of this study is to attempt to reveal the workings of the TAM among pre-service teachers and undergraduate students (bachelor's degree) in their use of cloud computing. The findings will reveal the students' perceptions of the importance of cloud computing, their actual use of cloud computing and their intention to use cloud computing in the future within a school setting. The research is guided by the hypotheses developed in the methodology section.

3 Literature Review on Cloud Computing in E-Learning

Dong et al. [7] examine an e-learning ecosystem that depends on the infrastructures developed in cloud computing. The researchers elaborate that the community believes that the growth of the new generation depends on the growth of e-learning. In current models of e-learning infrastructures, cloud computing has become a promising infrastructure development platform that is specifically used for data storage and necessary computational services. Therefore, the researchers introduce cloud computing into an e-learning infrastructure that ensures the stability, equilibrium, efficient resources and sustainability of e-learning ecosystems. Bora and Ahmed [4] demonstrate the significance of cloud computing in recent years, showing that many companies prefer to rely on cloud solutions. Cloud computing is a type of distributed data center that is based on massive resources to provide a mechanism for reimaging, rebalancing workloads and monitoring available resources. The researchers highlight the architecture of e-learning, which depends largely on cloud computing infrastructures. Three infrastructure layers are used in the areas of cloud computing, i.e., the basic infrastructure layer, the content layer and the application layer. The researchers describe these three layers of e-learning used in cloud computing and explain how they can be beneficial to organizations' overall operations [10]. Nasr and Ouf [30] also identify the significance of cloud computing in e-learning environments. They believe that e-learning represents the demand of the next generation to meet the challenges of resource-allocation optimization. The ecosystems in e-learning depend on cloud computing because they help individuals manage the dynamic demands of obtaining necessary knowledge and information anywhere and anytime.

E-learning's dependence on cloud computing is increasing over time to ensure the management of rapid storage growth, cost control and greater flexibility. Madan, Pant, Kumar & Arora [31] highlight the significance of cloud computing in e-learning by elaborating that e-learning infrastructures must be improved to fulfill their computational and storage resources. They also suggest that cloud computing technologies play a significant role in managing and changing the way applications will be developed and accessed in the future. Additionally, they discuss the focus of cloud computing technology on providing low-cost solutions to academic institutions and providing additional support to all browser-based applications accessible through mobile devices. The researchers identify the significance of cloud computing in e-learning, demonstrating that this technology provides complete support to e-learners by allowing access to a variety of devices (e.g., laptops and desktop computers) and ensuring constant Internet access. El-Ala, Awad and El-Bakry [32] suggest the solution of cloud computing in e-learning by integrating cloud computing as a platform and Web 2.0 to build an effective e-learning system.

Bora & Ahmed [4] posit that cloud computing has become an adaptable technology that can be used in many organizations. They propose that various organizations are able to adopt this technology for dynamic scalability of their available resources and to obtain access to virtualized resources as a service through the Internet. The researchers also state that cloud computing technology is growing rapidly and that it is available through various e-learning applications to be used in educational learning

programs. E-learning is also becoming very popular and gaining acceptability among younger generations.

In addition, the e-learning field is broadening its relationship with the field of cloud computing technology and receiving promising responses from users as a result. Madan et al. [31] highlight that the accessibility of e-learning systems usually depends on various hardware and software compatibilities. Given this dependence, these authors propose that the previous research work conducted on cloud computing in e-learning has presented the benefits of using the cloud for e-learning. They find that many schools, colleges and educational institutions cannot afford major capital outlays and depend largely on cloud computing solutions as an alternative. In parallel, they state that the significance of cloud computing in e-learning has increased over time because universities prefer to use computers with more intensive and common applications used by both students and teachers. The researchers also identify how cloud computing can drive the integration of information and communication technologies in education and improve the use of learning resources.

El-Ala et al. [32] put forward that the integration of cloud computing in e-learning is possible due to the greater role of global trends in the Middle East, where e-learning providers are adopting cloud computing in the form of services within their service-oriented architecture. They explain how e-learning can also be used to mix the inputs and outputs within the components of the educational data system to enhance the simulation of reality by educational virtual worlds. The researchers also identify that creative environments can be derived from both virtual and personal learning environments that depend largely on the components of cloud computing, which contains a variety of tools and techniques that can be used to enhance and stimulate the educational processes of various learning institutions. According to the researchers, the proposed cloud computing environment would be beneficial because it focuses on the effective design and monitoring of educational institutions and their learning environments, which largely depend on the existence and reuse of web tools, techniques and services to be provided in browser-based applications.

4 Study Background

4.1 Application of Cloud Computing in Higher-learning Institutions

The use of cloud computing in institutions of higher learning is widespread, driven by the pedagogical potential that is created by this technology of sharing. McCrea [33] has suggested that cloud computing is able to replace existing complex IT configurations and software systems, thus enabling institutions of higher learning to be more focused on teaching and research than on IT management. Thorsteinsson, Page and Niculescu [34] and Pocatilu, Alecu and Vetrici [35] state that cloud computing provides a platform for collaborative methods of instruction where users can store data and share them with others. Mircea and Andreescu [36] use the term agility to describe cloud computing's ability to move forward quickly with reduced cost and effort. They also analyze the limitations of cloud computing. For example, users'

work effectiveness and confidence can be hindered by the fact that not all applications can use the cloud; there are potential data security and protection risks; there is a lack of maturity of solutions; and the speed of Internet access can be variable or unreliable. All of these factors can affect work effectiveness and lack of confidence among users. However, they provide evidence related to solutions for security, such as masking data, providing firewalls and encrypting data with key management. Thus, in adopting cloud computing, users must be aware of the limitations and put measures in place to address them to ensure effective usage in the workplace and in educational institutions.

4.2 Theory of Acceptance Model: A Theoretical Framework

Davis [1] presents the idea of the acceptance model from the computer system perspective. When a new technology is introduced, the psychological theory is addressed, thus revealing the perceptions or behavior as a reaction towards technology use. Davis [1] defines perceived usefulness (PU) as the degree to which a person believes a system can enhance his job performance. Perceived ease of use (PEU) is referred to as the least amount of effort needed to use a system. The basic theory of the TAM has been further evaluated and extended.

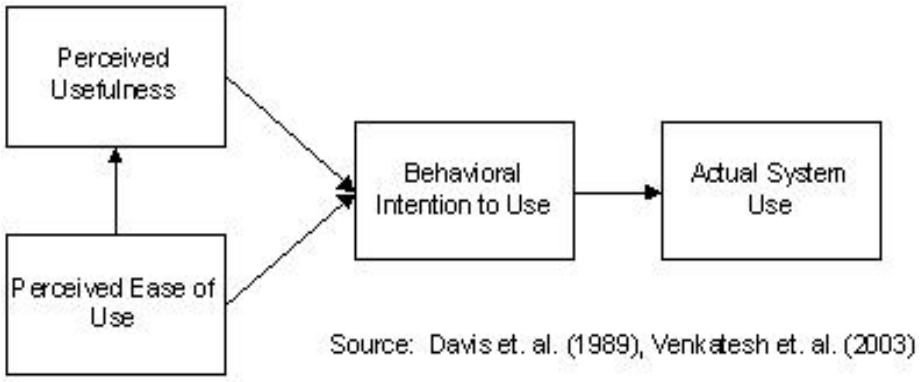

Fig. 2. Theory of acceptance model by Davis

Figure 2 indicates the factors affecting the intention to use in the future and the actual use by Davis [1] and Venkatesh, Moris, Davis & Davis [37]. Behavioral intention to use is indicated as the degree of strategic planning to perform or not to perform a specified future behavior. Actual use is related to the acceptance of the technology to be applied in the context. This model has been widely used in the context of cloud computing adoption [38], in health information [39] and in the examination of factors affecting its adoption [40]. Although the TAM has been integrated within the education and technology perspective since the 1980s, it is extended and expanded in a different context whenever a new technology is introduced.

The TAM suggests that the acceptance of a technology in the social community is a reflection of positive attitude towards the technology. Care must be taken, however,

in determining positive attitudes; questions posed to the community must be carefully addressed to ensure the appropriate context for acceptance. Shroff, Deneen and Ng [41] examine the TAM in an application of the model to an e-portfolio system, where factors in the TAM represent characteristics of the system encompassing the design and features that affect whether the system is accepted by users. Usability evaluation and testing do not necessarily result in the same conclusions as the TAM. Chiou, Perng and Lin 42] find that the TAM seems more suitable for studying the acceptance of a system for a general purpose, whereas the usability test is more appropriate for a task-based context. Research on usability reveals the user friendliness of an environment, e.g., a website, for users to explore learning. Usability is an important component for a technology to be accepted by users. Thus, Davis [43] relates usability factors to the TAM to determine users' acceptance and usage of technology systems.

5 Research Methodology

5.1 Methodology

The study was conducted during the second semester of the 2013-2014 academic year and the first semester of the 2015-2016 academic year at an education college in the United Arab Emirates (UAE). Participants in the study consisted of pre-service teachers and undergraduate students who were taking the 'Educational Technology' course at Al-Ain University (AAU) in the UAE.

Although cloud computing was a part of the educational technology course syllabus, answering the study questionnaire/participating in this study was strictly voluntary. A total of 239 of 260 (91.9%) student participants were recruited from a convenience sample of students who were enrolled in the course during the selected semesters and correctly completed the questionnaire.

All the participants—both pre-service teachers (N=200) and undergraduate students (N= 39)—stated that Arabic was their first language; therefore, the original version of the research instrument (questionnaire) was in Arabic. The instrument was independently translated into English by two expert bilingual speakers. Consequently, the research team and English professors compared the translated English version and the original version of the research instrument and discussed the differences. As a result, the final version was adjusted and agreed upon. The questionnaire was piloted prior to the data collection with a small sample of 20 AAU respondents to assess the questionnaire's reliability, to improve its internal validity and thus to modify any questions that may have created confusion.

AAU's academic year typically consists of two 16-week semesters. Participants were exposed to the concept and technology of cloud computing through a three-credit hour course that incorporated cloud computing usage through a course management system (Moodle) and different types of Web 2.0 applications. The course meetings lasted 90 minutes per session and occurred twice weekly for 16 weeks. Weeks 12 to 15 were dedicated to covering the theory and practice of cloud compu-

ting. This translated to a total of 24 hours of live and active teaching of cloud computing. Week 16 was devoted to students' presentations of their final course projects.

The key aim of the cloud computing training that took place over the four weeks of the educational technology course was to develop the students' knowledge of cloud computing and enable them to incorporate it to enhance the teaching/learning process. The training also aimed to increase participants' awareness of the following technology benefits:

- Promoting real-time association and collaboration among students and teachers
- Storing and retrieving data
- Helping make course materials more accessible and easier to share.
- Moreover, the content of the cloud computing training focused on the different aspects of the technology, including the following topics:
- Definition of cloud computing and associated terminologies
- Benefits and challenges of storing and sharing data on the cloud (Dropbox & Google Drive)
- Cloud service implementation mediums (including web services)
- Implications of the cloud for education and collaboration in and out of the classroom.

Each of the aforementioned topics was initially introduced to the students to acquaint them with the overall subject matter that would be covered. Then, a brief and clear presentation encouraged students to participate and helped direct them toward the anticipated learning outcomes. This was followed by hands-on exercises to clarify the concepts presented.

At the end of the semester, students were given a questionnaire consisting of 30 self-constructed questions. Participants were encouraged to respond on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) to express their level of agreement or disagreement with the items. All respondents were guaranteed that their responses were confidential.

This feedback enabled the instructor-cum-researcher to identify the level of acceptance and to ensure that the variables of usability in the TAM predicted the intention to use in the students' teaching practice in the future.

5.2 Analysis Procedure

The Statistical Package for Social Science (SPSS) Version 15.0 [44] was used to compute the descriptive statistics and to perform the reliability test. A Cronbach's alpha of .07 and above indicates a good reliability of an instrument [45]. Analysis of Moment Structures (AMOS) Version 4.0 [46] with maximum likelihood estimation (MLE) was used to perform confirmatory factor analyses (CFA) and covariance structure analyses or structural equation modeling (SEM). The selection of variables was based on CFA, where only loadings of 0.5 and above were taken for the final SEM analysis. All violations were addressed (error variances > 0.8) with model fit indices in the threshold point (root mean square error of approximation [RMSEA] < 0.08,

comparative fit index [CFI] > 0.9, Tucker-Lewis fit index > 0.9, goodness-of-fit index [GFI] > 0.9). The number of measured variables (p) was ignored, however, because the chi-square statistic is sensitive when associated with a large sample size, as noted by Kline [47]. Usually, a sample size is considered large when it exceeds 200.

6 Results

6.1 Descriptive data

Table 1 shows a distribution of the level of studies among the sample size, in which higher diploma students represent 83.7% and undergraduate students represent 16.3%. All participants were females; male students are rare in the education faculty at Al Ain University of Science and Technology in the UAE.

Table 1. Distribution of Samples

		Frequency	Percent	Valid Percent
Valid	Higher diploma	200	83.7	83.7
	Undergraduate	39	16.3	16.3
	Total	239	100.0	100.0

6.2 Theory of acceptance in the usage of cloud computing and Web 2.0

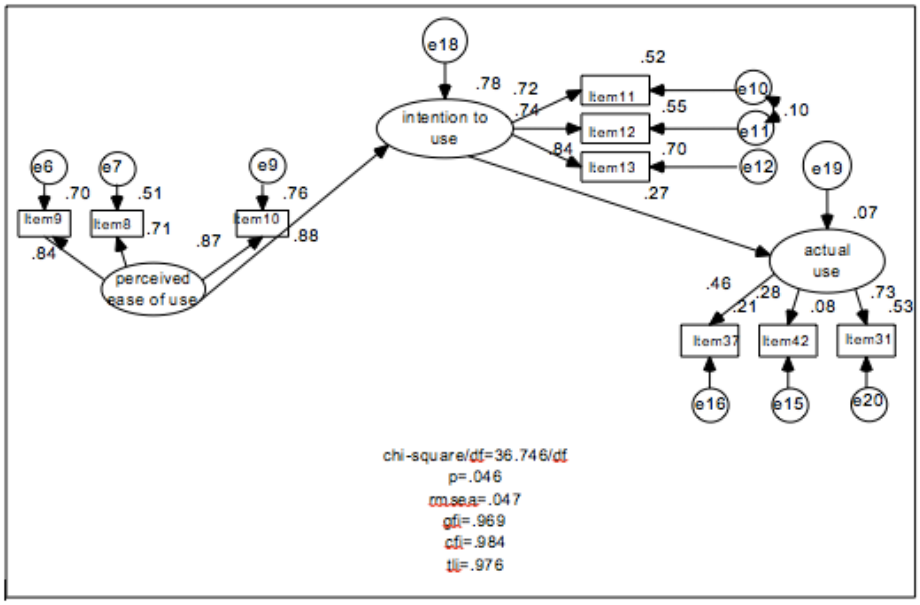

Fig. 3. Re-specified model of theory of acceptance model in the context of cloud computing

In this study, Davis' TAM structural model [1] was tested and validated in the context of cloud computing among of teacher trainees at an education college. Four hypotheses were tested to reveal significant relationships.

H1: Perceived ease of use significantly influences perceived usefulness.

H2: Perceived ease of use significantly influences behavioral intention to use.

H3: Perceived usefulness significantly influences behavioral intention to use.

H4: Behavioral intention to use significantly influences actual use.

The initially hypothesized model was rejected because it did not satisfy the required fit indices. The model was further re-specified with the deletion of perceived usefulness. In this manner, the model was improved. Other fit indices revealed the following: RMSEA = 0.047; GFI = 0.969; CFI = 0.964 and TLI = 0.976 (see Figure 3).

Table 2. Standardized Regression Weights

			Standardized Estimate
Direct effect			
Intention to use	←	perceived ease of use	.884
Actual use	←	intention to use	.271
Items			
Sharing files easily	←	perceived ease of use	.837
Understand content	←	perceived ease of use	.714
Exchange knowledge	←	perceived ease of use	.873
Will use in future	←	intention to use	.721
Will introduce to others	←	intention to use	.745
Saves time and effort	←	intention to use	.836
Use Social Media	←	actual use	.285
Use Google Drive	←	actual use	.458
Use Dropbox	←	actual use	.730

Note: The critical ratio is greater than 1.96 with error variances free from violation.

Table 2 reveals all the significant items selected to explain the TAM, where perceived usefulness was dropped. Only three relationships were identified as significant. The results show that the factor of perceived ease of use in cloud computing influenced students' intention to use in the future (β=0.884). Furthermore, the intention to use influenced students' actual use of Dropbox, Google Docs and social media sites by the standardized effect of 0.271. Thus, it can be concluded that the original hypothesis postulated by Davis—i.e., perceived usefulness and perceived ease of use both influence the intention to use in the future—did not prevail in this study. The results indicate a high correlation ($r > 0.8$) between the two factors (perceived usefulness and perceived ease of use), which encourages the researcher to choose one. This could be because the items were constructed to be closely related and not distinct. Thus, further research must be performed to further cross-validate the instrument constructed.

7 Discussion and Implications

The tested model resulted in a re-specified model where perceived ease of use and perceived usefulness were found to be highly related; thus, the factors did not have distinct meanings from one another. It can be concluded that in the context of cloud computing, only perceived ease of use will affect pre-service teachers' use of cloud computing in the future. In higher learning, perceived usefulness in cloud computing is insufficient to influence pre-service teachers to use cloud computing, unless they know the applications and understand how to use the technology. The students were able to share files, share information and understand how to maneuver the documents in cloud computing by editing and collaborating; this ability will affect their perceptions of ease of use and their actual use in the future in a teaching and learning context. The findings also include a low popularity of Dropbox as a platform for sharing information among students, while other cloud computing technologies, such as Google Docs and social media, were widely used among the pre-service teachers and undergraduate students. The high rate of acceptance among the users was mainly due to the technologies' ease of use, which affected the students' intention to use in the future. The mainstream characteristic of these technologies allows social communication and the easy exchange of information without the need to understand a complex system. Concerns regarding technical drawbacks discussed earlier in this paper and risks in the areas of security, privacy and data integrity [48], however, may affect usability in terms of decreasing the perceived ease of use.

TAM has been shown to be a more suitable model when investigating the acceptance of technology for a general purpose, while usability is the more reasonable test within a task-based context [42]. Accordingly, TAM enables us to explain the acceptance of cloud computing in general among pre-service teachers; however, further information must be gathered because different technology yields different acceptance levels. Thus, future research should include the acceptance of specific cloud computing technologies, such as Dropbox and Google Docs, in academic environments.

8 Conclusion

This study supports the implication in the educational context that cloud computing can be utilized to teach students in higher learning and school settings. The study confirmed that when users feel that the technologies can be used in an easy way, it is more probable that they will adopt cloud services in their educational practices, so ease of use will affect university students' attitudes and behaviors.

These findings advance the theory of technology adoption behavior and future research is expected to improve our understanding of it. The result of this study goes well in accordance with previous research studies including a study conducted by Aharony [49, p.1] that declared "it seems that if information organizations directors would like their employees to enhance their use of technological innovations, they

should expose them to the latest technologies, emphasizing their usefulness, ease of use, and benefits".

The outcomes of this study also provide supporting facts and data to facilitate decision-making for all higher education institutions when considering shifting their present learning systems to cloud based systems. One of the main limitations of the study is that the research focused on one university in UAE. To achieve more accurate and comprehensive results the study should be conducted in other universities and other countries. The study can also be repeated in varied time periods and assess the progress and change of the important factors. Accordingly, the research could be stretched to include working professionals in a university setting such as college instructors or lecturers or lab assistants.

Going forward, TAM should be further studied in the context of other emerging technologies because each specific technology requires specific acceptance variables in the TAM. More variables must be further investigated because cloud computing involves security, privacy and data integrity, as forwarded by Truong [50].

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