ABSTRACT

Technological advancements in the cloud computing sector have lured educational institutions to consider a shift to the cloud. In addition, the continual growth in the mobile sector has resulted in an integration of cloud technology and mobile technology to come up with a new technology known as mobile cloud computing. Mobile cloud computing refers to the integration or amalgamation of cloud computing technology into mobile devices in a bid to enhance their storage, computational power and memory capacity. The spreadof mobile cloud computing allows users to use infrastructure and software's provided by cloud service providers at a low cost.

Acceptance of mobile learning comes with numerous challenges such as low storage capacity, low battery life and low levels of data processing. Such challenges have resulted in unsuccessful implementations of mobile learning platforms in many institutions. For this reason, this study investigated the acceptance of mobile cloud computing among four universities in North Cyprus. The study was based on the integration of two research models, Technology Acceptance Model and the Theory of Planned Behaviour. A total of 659 questionnaires were analysed and results have shown that there was a moderate, positive and significant correlation between all the independent and dependent variables of the research model. Furthermore, results have shown that despite the increase in cloud storage services, students still prefer to use local storage devices such as USB/ Flash and Hard drives. In addition, WhatsApp and Facebook messenger were the two mainly used cloud services for communication among university students in North Cyprus. The high number of smartphone ownership among university students is a great indication of the potential of mobile cloud computing in North Cyprus.This study will be beneficial to educational stakeholders, the government, researchers, instructors and the ministry of education.

Keywords: Cloud computing; higher education; mobile cloud computing; North Cyprus; TAM; TPB

ÖZET

Bulut bilişim sistemlerindeki ilerlemeler, eğitim kurumlarının bulut bilişim sistemleri için bir rotasyonu göz önünde bulundurmasını cazip kılmıştır. Ek olarak, mobil sektöründeki devamlı büyüme, bulut teknolojisinin ve mobil teknolojisinin bütünleşip mobil bulut bilişim sistemi olması ile sonuçlanmıştır. Bulut bilişim sistemi, bu sistemin mobil cihazlara kapasitelerini, bilişimsel güçlerini ve hafıza kapasitelerini arttırmak için bütünleştirilmesi veya birleştirilmesine atıfta bulunmaktadır. Mobil bulut bilişim sisteminin yayılması kullanıcılara altyapıları ve bulut servisleri tarafından sağlanılan yazılımları ucuz bir maliyet ile kullanmalarını sağlamaktadır.

Mobil öğrenimin kabulü, düşük depolama kapasitesi, düşük pil ömrü ve az seviyede veri işlenmesi gibi birçok zorluklarla gelmektedir. Bu tür zorluklar, mobil öğrenim platformlarını birçok kurumda başarısız uygulanmasıyla sonuçlanmıştır. Bu nedenden dolayı, Kuzey Kıbrıs'ta yer alan dört üniversite içerisinde mobil bulut bilişim sisteminin kabullenilmesi çalışmamız tarafından incelenmiştir. Çalışma, iki araştırma modelinin bütünleşmesine dayalıdır ve bu modeller ise Teknoloji Kabul Modeli ve Planlanmış Davranış Teorisidir. Toplamda 659 anket analiz edilmiştir ve sonuçlar, araştırma modellerinin bağımlı ve bağımsız değişkenleri arasında, ılımlı, pozitif ve belirgin bir korelasyon olduğunu göstermiştir. Ayrıca sonuçlar, bulut depolama servislerindeki artışa rağmen öğrencilerin hala daha USB/Flash bellek veya sabit sürücü gibi yerel depolama aygıtlarını tercih ettiğini göstermiştir. Buna ek olarak, Whatsapp ve Facebook, Kuzey Kıbrıs'ta bulunan öğrenciler arasında iletişim için kullanılan iki esas bulut servisiydi. Üniversite öğrencileri arasında akıllı telefon kullanımının yüksek oluşu, Kuzey Kıbrıs'taki bulut bilişim sisteminin potansiyelinin büyük bir göstergesidir. Bu çalışma, hükümete, araştırmacılara, eğitmenlere, eğitim paydaşlarına ve Milli Eğitim Bakanlığına yararlı olacaktır.

Anahtar Kelimeler: Bulut Bilişim, yüksek eğitim; mobil bulut bilişim; Kuzey Kıbrıs; TAM; TPB

SAFA FADEL

ACCEPTANCE OF MOBILE CLOUD COMPUTING IN HIGHER EDUCATION
CASE OF NORTH CYPRUS UNIVERSITIES

NEU 2017

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name:

Signature:

Date:

To my family…

ACKNOWLEDGEMENTS

It is with great honour and pleasure to express my heartfelt thanks to my supervisor Assist. Prof. Dr. Seren Başaran who was there to continually guide me on this journey. It was not an easy road, but her constant support made a difference. In addition, I would also like to express my heartfelt thanks to the Chairperson of the Computer Information Systems department, Prof. Nadire Cavus for her support during my master's study.

My sincere gratitude also goes to all the Jury members for sacrificing their precious time to come and listen to me as well as for their input in this thesis. I would also like to thank my husband, my constant pillar of strength for his constant encouragement and not forgetting my family at large for having confidence in me and for sponsoring my studies.

Lastly I would like to thank all the students who sacrificed their time to fill the questionnaires, it was because of them that this study stands here today. I will of all you the best that life has to offer.

ABSTRACT

Technological advancements in the cloud computing sector have lured educational institutions to consider a shift to the cloud. In addition, the continual growth in the mobile sector has resulted in an integration of cloud technology and mobile technology to come up with a new technology known as mobile cloud computing. Mobile cloud computing refers to the integration or amalgamation of cloud computing technology into mobile devices in a bid to enhance their storage, computational power and memory capacity. The spread of mobile cloud computing allows users to use infrastructure and software's provided by cloud service providers at a low cost.

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LIST OF ABBREVIATIONS

CC: Cloud Computing

HES: Higher Education Sector

IaaS: Infrastructure as a Service

ICT: Information and Communication Technologies

MC: Mobile Computing

MCC: Mobile Cloud Computing

PaaS: Platform as a Service

SaaS: Software as a Service

TAM Technology Acceptance Model

TBP Theory of Planned Behavior

CHAPTER 1

INTRODUCTION

This chapter gives a brief background on what mobile cloud computing is and factors that led to its birth, the research problem, the aim of this study, why this study is important, limitations that come with this study as well as a brief description of the chapters contained in this entire study.

Overview

Mobile devices such as smartphones and tablets have become a necessity for people as these devices are not restricted by time or geographical location. Furthermore, advancements in technology have led to a wide range of applications being integrated into smartphones and other mobile devices such as tablets (Khan et al., 2014). However, these advancements were straining mobile devices due to their high demands of computational power and storage capacity. For this reason, the battery life of mobile devices was greatly affected until mobile cloud computing emerged to remedy the crisis. Cloud computing was first born offering unlimited dynamic resources and services before it gave birth to mobile cloud computing which the researcher will explain in detail in this study.

The invasion of mobile cloud computing allows users to use infrastructure and software's provided by cloud service providers at a low cost. Guo and Aberer (2016) defined mobile cloud computing as the integration or amalgamation of cloud computing technology into mobile devices to enhance their storage, computational power and memory capacity. In addition, the researchers stated that mobile cloud computing is a product of two independent computing disciplines namely; cloud computing and mobile computing.

Aepona (2015) defines mobile cloud computing as a technology that moves data storage and processing from the internal parts of the mobile device to the cloud. This means that, all the processing is done outside the mobile device itself hence enhancing the battery life of the mobile device. Data is processed using central servers which are located in the cloud and are accessible using internet. The beauty of using mobile cloud services is that, you get to pay for what you use (Hoang et al., 2011). Furthermore, the researcher stated that it is important to

note that internet plays a crucial role in mobile and cloud computing, without internet we cannot talk about mobile cloud computing or cloud computing in general.

1.1 Problem Statement

Mobile learning has gained momentum over the past few years around the world and this has also been the case in North Cyprus, however, mobile learning comes with numerous challenges such as low storage capacity, low battery life and low levels of data processing (Shahzad & Hussain, 2013). Such challenges have resulted in unsuccessful implementations of mobile learning platforms in many institutions. To remedy the problems, educational institutions are encouraged to integrate mobile learning platforms with mobile cloud computing. Integrating the two will result in extended battery life for mobile devices as the processing is done on the cloud hence saving mobile battery life. In addition, there won't be need for mobile users to upgrade their storage capacity or make use of external hard-drives or memory chips as information is stored on the cloud hence saving storage space for mobile devices. For this reason, the researcher seeks to find out if students are aware of the current limitations of mobile learning and if they are willing to move to mobile cloud computing.

1.2 Aim of Study

The aim of this study is to investigate students' acceptance of mobile cloud computing in higher educational institutions. To achieve the main aim of the study, following research questions and hypotheses were examined:

1. Which cloud-based platforms are used by students for educational purposes?
2. Which cloud based social network sites are used by students for communication purposes?
3. Is there a preference between cloud storage and local storage among students in North Cyprus?
4. **H1:** Perceived Usefulness (PU) has a positive effect on attitude towards using mobile cloud computing.
5. **H2:** Perceived Ease of Use (PEU) has a positive effect on attitude towards using mobile cloud computing.
6. **H3:** Attitude towards using mobile cloud computing will have a positive influence on behavioral intention.

7. **H4:** Perceived behavior control has a positive effect on intention to use mobile cloud computing.
8. **H5:** Intention will have a positive influence on usage of mobile cloud computing

1.3 Importance of study

This study is important to several educational stakeholders who are interested in integrating their learning systems with cloud based technologies. Below is a summary of how different educational stakeholders deem this study as essential:

- ***Educational Institutions:*** By adopting to mobile cloud computing, institutions will benefit from cost savings as they will only pay for the services they use. In addition to that, this study provides different frameworks on implementing mobile cloud in education, this information is beneficial to IT departments of different educational institutions.

- ***Students:*** Students will be able to enjoy numerous cloud benefits that range from ubiquity implying that they will have access to information and resources stored in the cloud 24/7without any geographical barriers as they use their mobile devices to access resources. In addition, students will be able to collaborate with peers and work on projects as well as share information with their peers.

- ***Researchers:*** Researchers who are interested in the same area of study will find this study beneficial as it will provide them with information on mobile cloud which can be a good starting point for their research.

- ***Society:*** The society as a whole will benefit as a whole through globalization that comes with the use of mobile based cloud platforms such as skype thereby allowing friends and families to stay in touch.

1.4 Limitations of the Study

The limitations to this study are explained below:

- ***Time:*** The study was conducted over a short period of time during the summer holiday and early months of the fall semester.

- ***Place:*** The study was only limited to four universities in North Cyprus namely; Near East University (NEU), Cyprus International University (CIU), Eastern Mediterranean University and Girne American University (GAU).
- ***Participants:*** Participants in this study are limited to students only currently enrolled at the above mentioned universities.
- ***Nature of research tool:*** Questionnaires are based on honest opinions of the participants and this could be a limitation when participants do not give out their honest opinion.

1.5 Overview of the Thesis

This study contains six chapters. The contents of each chapter are explained in detail below:

Chapter One: This chapter gives a brief background on what mobile cloud computing is and factors that led to its birth, the research problem, the aim of this study, why this study is important, limitations that come with this study as well as a brief description of the chapters contained in this entire study.

Chapter Two: In this chapter the researcher gives a detailed explanation of the adoption of mobile cloud computing in higher education, the benefits of mobile cloud computing, the challenges of adopting to the cloud as well as explaining the research models that will be used in the research model for the study.

Chapter Three: This section is designed to help institutions and students fully understand the different frameworks and components that make up mobile cloud and how mobile cloud computing functions. The researcher will explain models for mobile cloud delivery, mobile cloud applications and the different architectures of mobile computing.

Chapter Four: This section explains the research model that was adapted by the researcher, gives statistical information of research participants, describes the data collection tools, reliability tests of survey dimensions, the research procedure that was followed by the researcher as well as explaining the research schedule.

Chapter Five: In this section, the researcher explains the statistical tool that was used to analyze the data, the results that were found after analyzing the data, how these findings are similar or contrary to what other researchers found and the overall meaning of the results.

Chapter Six: This section gives a summary of the entire study, the researcher gives a brief narration of what the study was all about, the research findings and their meaning as well as recommendations for future research.

CHAPTER 2

RELATED RESEARCH

In this chapter the researcher gives a detailed explanation of the adoption of mobile cloud computing in higher education, the benefits of mobile cloud computing, the challenges of adopting to the cloud as well as explaining the research models that will be used in the research model for the study.

2.1 Mobile Cloud Computing in Higher Education

Mobile cloud learning is an amalgamation of cloud computing and mobile learning. In the literature, Minjuan et al. (2014) conducted a study to find out the benefits of using cloud services for Moodle in mobile learning platforms of Khalifa University in United Arab Emirates. Moodle is an open source management learning system that is available for mobile users and supports multiple users and is integrated with online learning tools, course software's, plagiarism checking tools and management systems. Results of the moving Moodle to the cloud were that there were notable cost savings in terms of resources as data was now stored in the cloud, In addition, another notable benefit was that students staying off-campus could now have access to Moodle using their mobile devices.

Sankalp et al. (2016) described educational institutions as the main beneficiaries for cloud based systems. Furthermore, the researchers pointed out that adopting to the cloud simplifies the admission and administrative process as well as enhancing overall communication among educational stakeholders. In addition, the researcher stated that cost-efficiency has been a notable benefit in many educational institutions that have moved to the cloud as outsourcing infrastructure and software has reduced costs among many Indian universities and colleges. Mobile cloud computing has also led to massive changes in distance learning and an increase in enrollment as students can now access data stored on the cloud virtually from anywhere in the world without geographical limitations and students can easily interact and collaborate with their peers in a cloud based environment so long there is internet connection.

Earp (2015) conducted a study to find out the benefits of mobile cloud computing in educational settings. The researcher split his findings into two distinct categories, benefits to the student and benefits to the institution. The researcher explained the benefits to the students

as 24/7 access to information without any geographical barriers as students can easily access information from their mobile devices, improved productivity, study materials can easily be downloaded from the cloud, cost savings as there the costs are borne by the educational institution who is responsible for paying the cloud service provider, the student can easily record educational sessions and later play them during their spare time, students can share information and ideas with their class mates. Figure 2.1 below depicts the benefits of mobile cloud computing to the student in an educational setting.

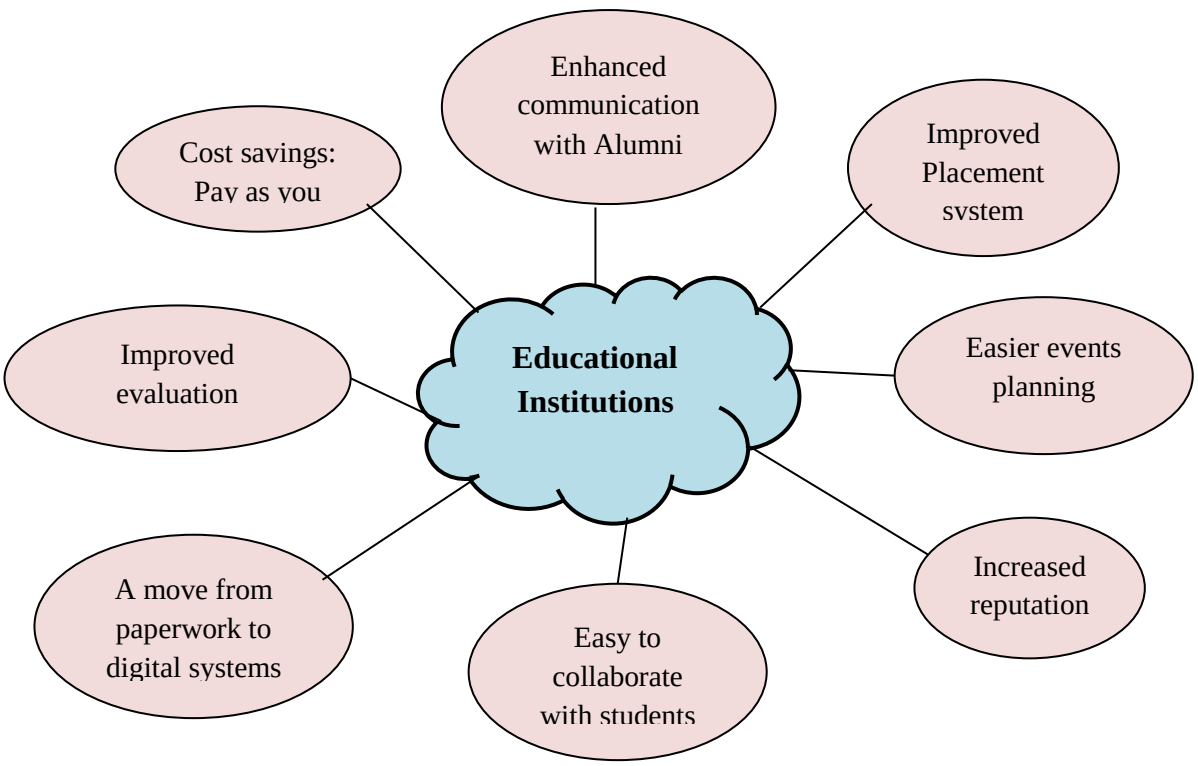

Figure 2.1: The benefits of mobile cloud computing to educational institutions (Earp, 2015)

Kosta and Zhang (2015) described the numerous benefits that educational institutions will also enjoy by moving to the cloud as depicted in Figure 2.2 below. The researchers explained that due to enhanced communication, institutions will be able to communicate efficiently with all their stakeholders including keeping in touch with former students, employment placements will be easier to manage as well as educational placements for students, cost savings as institutions only pay for the services they use, events can easily be planned and information shared across social platforms, the institution can easily collaborate and engage its students on current affairs as well as upcoming events, moving to the cloud implies less paper work and better tracking of information changes as information is stored in a digital format.

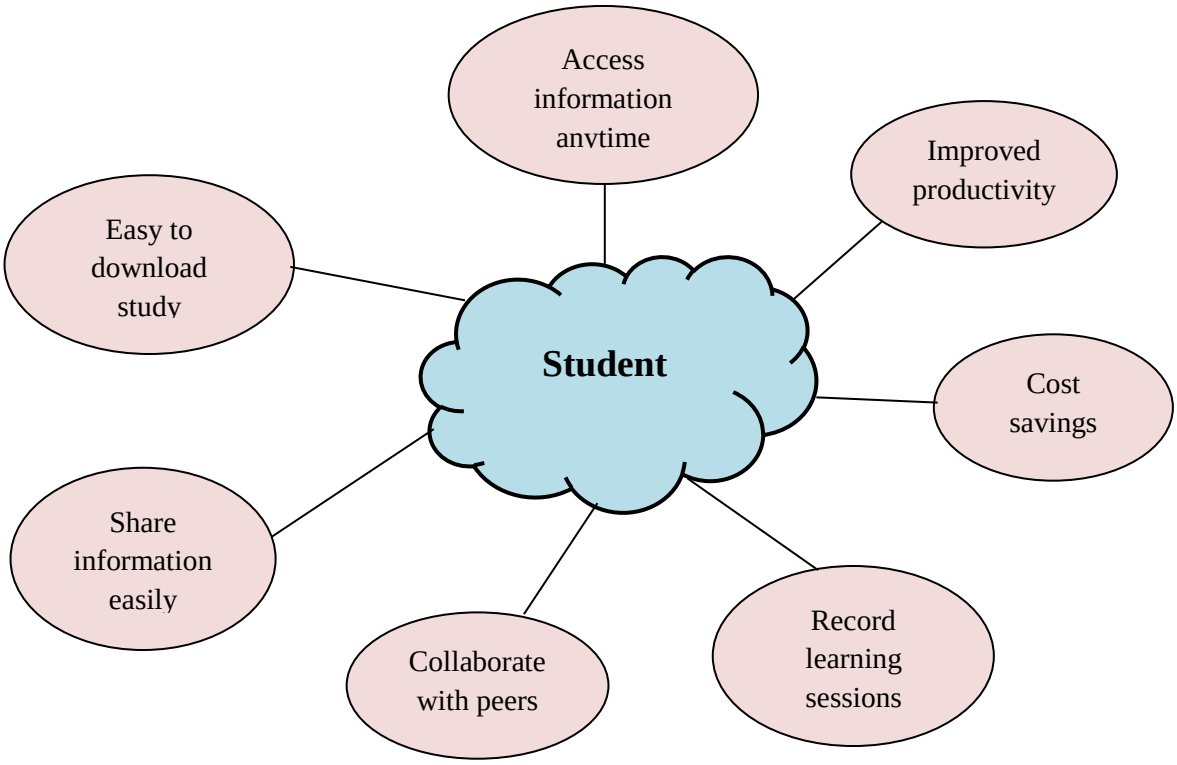

Figure 2.2: Benefits of mobile cloud computing to the student (Kosta & Zhang, 2015)

2.2 Benefits of Mobile Cloud Computing

In the literature, many researchers (Nan et al., 2015; Horrigan, 2017;Hoang et al., 2011; Guo & Aberer, 2016) have explained the integration of mobile architecture into cloud computing as an ideal approach and therefore the future of mobile cloud computing is promising. In addition, the numerous benefits of cloud computing are also evident in mobile cloud platforms and more benefits have been noted through the use of mobile devices which researchers have explained below:

Extended battery life: The major concern for mobile users is battery life. Successful adoption of mobile computing ensures that the life of the battery is prolonged. Hoang et al. (2011) explained several solutions that have been put forth as a remedy to enhance the overall speed and performance of mobile devices by managing the screen, disk as well as the CPU using intelligent mechanisms to save power. For such mechanisms to be put in place, the internal structure of mobile devices ought to be changed and new hardware should be in-cooperated which may be costly in the long-run. A technique known as computational offloading is the solution for increasing battery life. This process moves large data processing from the mobile device to mobile cloud servers which mean that the large processing that require a lot of data and power are done outside the device itself hence power is reserved for minor computations which in overall increase battery life. Other researchers have also done experiments on the

effectiveness of offloading techniques and their findings revealed that energy is saved significantly by remote processing (Rudenko et al.,2013; Smailagic & Ettus, 2014). According to Rudenko et al. (2013) energy savings account to 45%. In addition, the usage of Memory Arithmetic Unit and Interface (MAUI) integrated into cloud servers also result in mobile power savings of up to 27%.

Improving data processing and storage: capacity: Mobile devices have a major constraint when it comes to storage capacity. The integration of mobile technology with cloud computing will result in data being stored at central cloud servers allowing mobile users to access data through the use of wireless networks. Researchers outlines a number of cloud storage services which are offered by cloud service providers. To mention a few, Amazon Simple Storage Service and Image Exchange which allows users to instantly save their photos to the cloud after capturing them. Mobile cloud computing supports data warehousing, synchronization of online documents as well as document management result in storage saving on the mobile device itself.

Improved reliability: An effective method of improving the reliability of mobile applications is running applications on the cloud as well as storing data on the cloud. Mobile cloud computing reduces chances of losing data and also acts as a model for securing data to both users and cloud service providers for instance copyrighted content can be protected in the cloud by deploying security mechanisms that protect licenced users, verify authentication procedures, scanning and detecting virus and malicious activities.

Dynamic provisioning: The benefit of adopting to mobile cloud services is the ability of receiving services which you deem necessary and the benefit of paying as you go. Self-service implies that mobile users have the ability of using applications without having to pay for them prior which imply dynamic and on-demand resource provision.

Scalability: Upgrades for services can easily be done when demand increases. The cloud service provider will increase capacity based on the user or organization's needs. Provisioning of resources is flexible allowing the service provider to expand an application with little or no restrictions on resources.

Multitenancy: This implies that service providers such as network operators are able to share resources on the cloud as well as supporting a number of users and applications.

***Ease of integration*:** Services that are offered by different service providers can easily be integrated and shared on the cloud and users can access the information and applications using internet.

2.3 Challenges of Mobile Cloud Computing

Mobile devices such as smartphones have gained popularity over the years as a result of their ability to support a range of applications (Khan et al., 2014). For this reason, increases in complexity in a bid to support numerous applications increase the demand for computing resources. Apart from the benefits that mobile cloud computing brings, it is crucial to understand the challenges that mobile cloud computing brings. In the literature, many researchers have explained the Challenges that mobile cloud computing brings and the solutions to curb the challenges. Table 2.1 below gives a detailed explanation of the challenges.

Table 2.1: Mobile cloud computing challenges and suggested solutions (Khan et al., 2014)

Mobile Cloud Computing Challenges	Researcher	Remedy/ Solution(s)
Computation/Code offloading: This refers to the process of moving or transferring computational tasks from mobile devices to the cloud	(Kosta & Zhang, 2015; Chun et al., 2011; Rai, 2013)	• Automated computational offloading • Dynamic profiling • Static partitioning • Cloud processing
Task-Oriented Mobile services: This refers to the process of partitioning services to allow users to select services that best meet their needs.	(Guo & Aberer, 2016; Kemp et al., 2014)	• Providing location based services. • Establishing mobile task services that are human centric. • Data-as-a-service. • Offering multimedia as a service. • Offering mobile computing as a service.

Table 2.1: Mobile cloud computing challenges and suggested solutions continued

Mobile Cloud Computing Challenges	Researcher	Remedy/ Solution(s)
Scalability and Elasticity: Scalability refers to the process of increasing resources when demand increases whereas elasticity is the ability to both increase and decrease resources in the event of an increase in demand or a decrease in demand respectively.	(Ananthanara et al., 2014; Chun et al., 2011; Ferretti et al., 2013)	• Scheduling resources. • Allocating resources. • Intensive computation of data. • Designing as well as validating resource allocation by using traffic models to schedule algorithms.
Security: This refers to the extent to which a system or the cloud is protected. Does adopting to the cloud minimize security breaches?	(Chun et al., 2011; Nan et al.,2015; Zhu et al., 2012)	• Establish authentication mechanisms • Mobile to cloud authentication and vice-versa. • Data integrity tools • One time passwords on mobile devices to allow access into account.
Cloud Service Pricing: The challenge comes into play when deciding the price for a service. What determines the price of different cloud packages on offer?	(Guo & Aberer, 2016; Nan et al., 2015)	• Bidding or auctioning • Optimized pricing that make use of empirical validation

2.4 Mobile Cloud Delivery Models

Shahzad and Hussain (2013) described the three service delivery models and deployment models that are the basis of cloud computing. The same models are also found in mobile cloud computing platforms. The delivery models are explained in detail below and are also depicted in Figure 2.3 below:

Infrastructure as a service (IaaS)*:* In this layer, cloud service providers can share their resources and services with their clients. Resources and services shared include hardware, storage as well as network facilities. The basis of this model or layer is virtualization. An example of an IaaS cloud service provider is Amazon Web Services. It is important to note that, although clients do not have control over the infrastructure used by the service provider, they have control over the services they receive for instance storage capacity.

Platform as a service (PaaS)*:* In this model, the service provider grants access rights to the developers to access the application development platform. Developers can customize their applications using the APIs (Application Program Interface) provided by the service provider. Developers access all development tools from the cloud and they do not need to install any development tools on their local machines. An example of PaaS is Windows Azure.

Software as a service (SaaS)*:* This is the layer or model that grants mobile users access into the cloud to have access to the services provided by the first two layers. Customers or end users do not install any applications on their local machines as access to the services is provided enabling them to directly access cloud applications. Maintenance is the responsibility of the cloud service provider. Examples of SaaS applications in this category include, Google Apps and Microsoft Office.

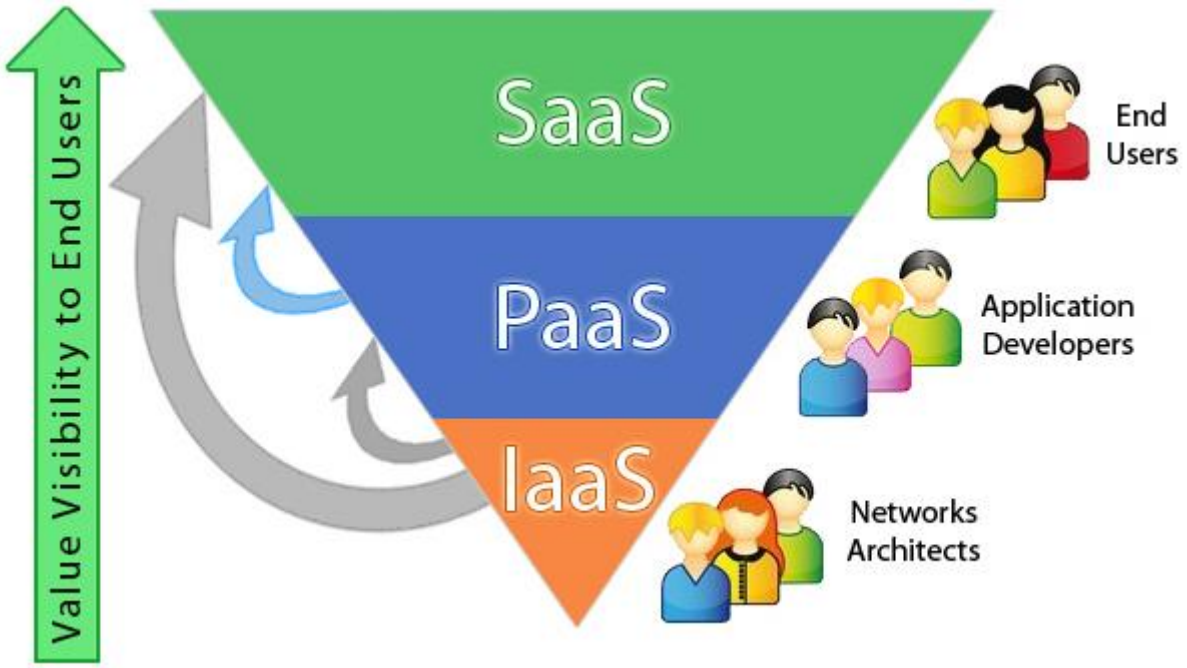

Figure 2.3: Service delivery layers for mobile cloud computing platforms (Shahzad & Hussain, 2013)

2.5 Mobile Cloud Computing Applications

In their study, Preeti and Vineet (2015) described the various applications that are at disposal to mobile cloud users as they require services and applications which they can use whilst in transit. Growth in mobile cloud services has been noted in different industries such as healthcare, education, accounting as well as when conducting payments. The researchers explained the applications in detail below:

a) ***Cloud email:*** This provides storage of data and messages on the server outside the mobile device and all processing is done on the cloud. An example is Gmail a free cloud based email service provided by Google.

b) Mobile Commerce: This involves a variety of services that are offered through a mobile phone such as mobile shopping, online payments done using a mobile device, advertising and mobile ticketing just to mention a few. However, it is crucial to note that, a lot of challenges are faced when using mobile commerce such as security risks, poor bandwidth and low latency levels. To remedy these problems, a 4G cloud based platform is proposed by many researchers.

c) Cloud music: Mobile cloud allows users to have access to music on the go. This is a service open to mobile users. Users can listen to music directly from the cloud without the need to download it first.

d) Mobile healthcare: Advancements in the technological sector have also led to cloud based healthcare simplifying treatment and diagnosis of diseases easy. Mobile devices are used to store patient details on the cloud making it easier for doctors to know the patient's medical history and this assists them in prescribing the right medication to patients based on their previous medical history which is accessible on the cloud. However, a lot of privacy concerns have been raised regarding the storage of confidential medical data on the cloud.

e) Mobile gaming: Mobile users have access to several games which are available on the cloud and can be accessed anytime. Offloading technique is mainly used in mobile games stored on the cloud allowing all processing to be done on the cloud.

f) Mobile learning: This refers to cloud-based learning platforms that allow users to gain access to learning material that is stored on the cloud. Users can access information from

anyway and at any time. The use of mobile learning has helped in bridging the digital divide as well as promoting –learning and distance learning.

g) Voice-based searching: With mobile devices users can now search for information directly from the cloud without typing but by speaking and embedded voice recognition tools translate the speech into codes that are understood by cloud servers.

2.6 Architectures of Mobile Cloud Computing

Khan et al. (2014) explained the two processed in which mobile devices access cloud services. Firstly, devices access the cloud through mobile network as depicted in Figure 2.4 below. A base station connects satellites to the mobile network which further connects to the internet allowing mobile users to gain access to resources, information and other services stored on the cloud. Secondly, the access points are available to mobile user that use Wi-Fi to connect to the internet. Once the user is connected, the access point authorizes the mobile user to gain access to cloud based services. However, it is crucial to note that, connections that use Wi-Fi consume less energy and they offer low latency

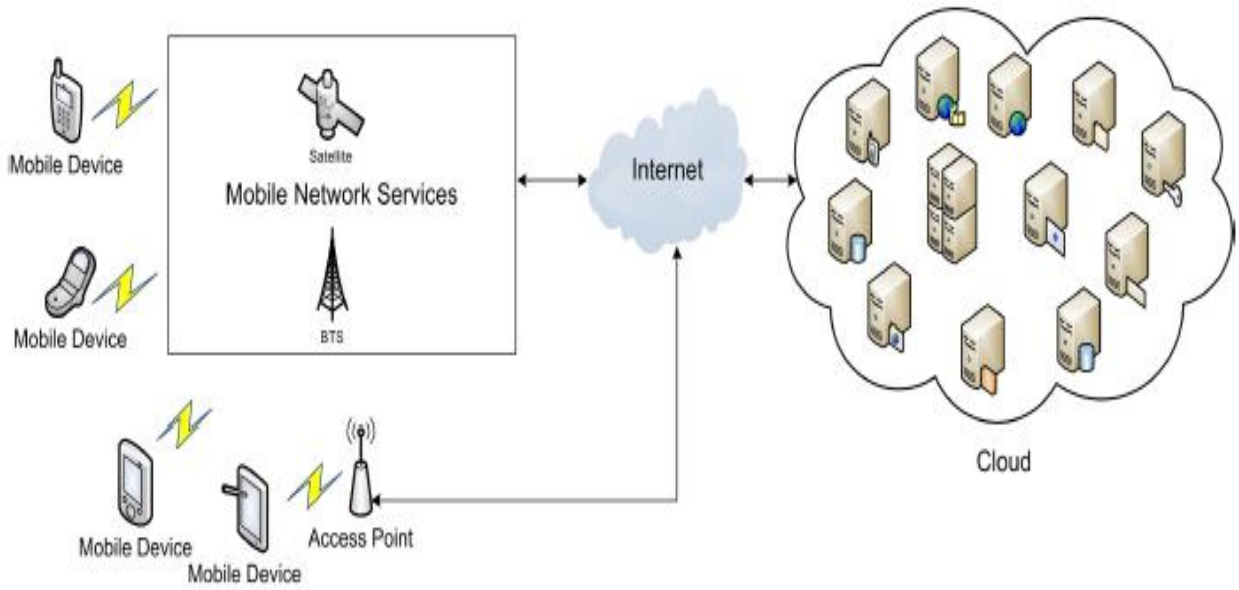

Figure 2.4: Mobile cloud architecture (Khan et al., 2014)

In the literature, Hoang et al. (2011) also described the architecture for mobile cloud computing as an architect designed in such a way that mobile users access the cloud via base stations which are often in the form of access points, transceivers or satellites. These base stations are responsible for establishing connections between mobile devices and the cloud database. Requests that are sent through the network by mobile users are sent to processors which are integrated with cloud servers. Mobile users are granted access to the cloud after servers authenticate and verify the information provided relative to the one stored on the database. The internet is responsible for forwarding client requests to the cloud. Once requests reach the cloud, cloud controllers process the requests and grant clients access to requested cloud services. Figure 2.5 below shows how mobile users access cloud based services.

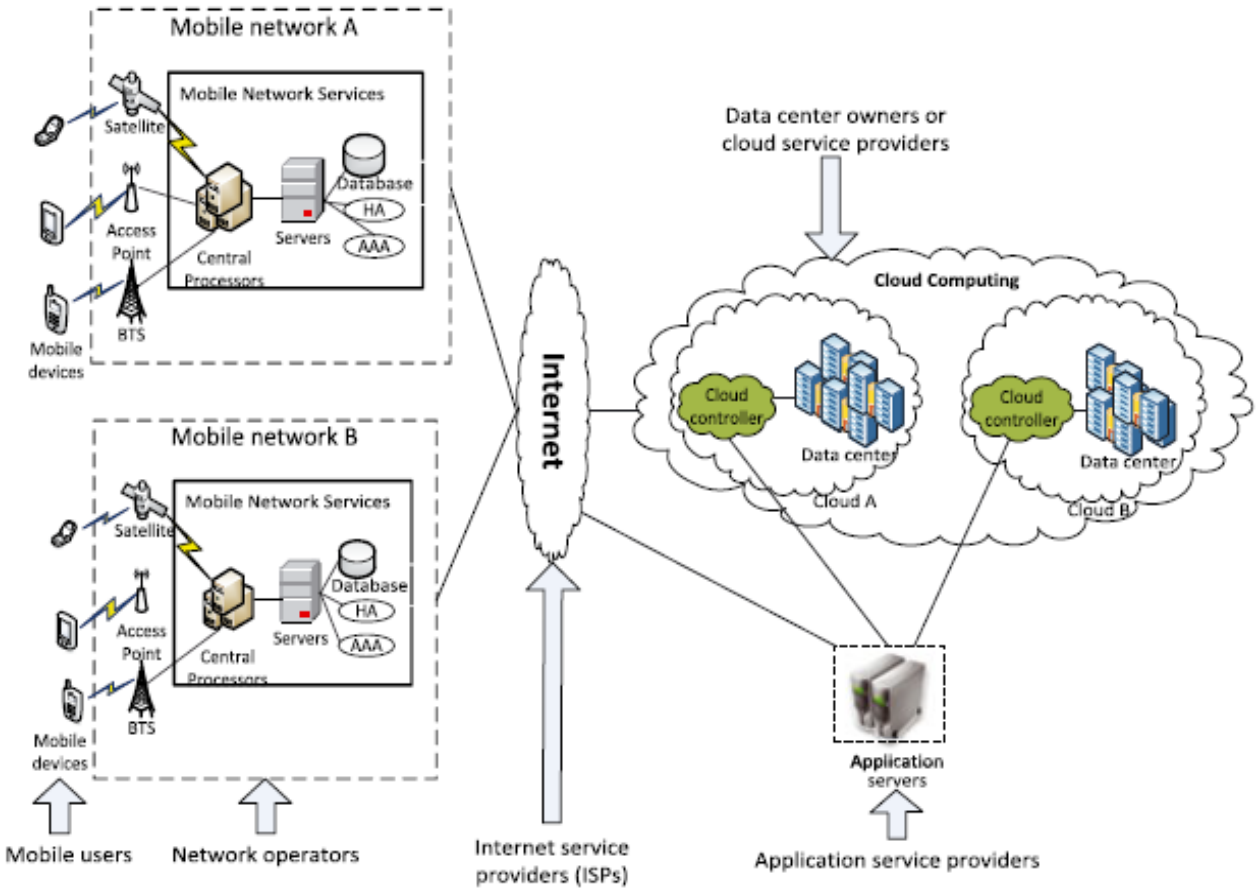

Figure 2.5: Showing how mobile users' access cloud based services (Hoang et al., 2011)

2.7 Research Gaps

A study conducted by Mohsen and Dennick (2016) to fully understand the adoption of mobile cloud computing technologies identifies a missing gap in the literature. The researcher stated that only 22 articles were published between the years 2014 to 2015 on mobile cloud adoption. The researcher emphasized the need for more research in this area, however other researchers

such as Wang et al. (2017) and Hashim and Hassan (2016) mentioned that between the years 2013-2015 more emphasis and research was on cloud computing adoption, from the end of 2015 that's when mobile cloud computing started to emerge. With this information, this could account for the low publication between 2014-2015 as noted by Mohsen and Dennick (2016).

Fadil et al. (2017) conducted a systematic literature review on mobile cloud computing adoption in higher educational institutions in Pakistan. In their conclusion, the researchers mentioned that there is a huge gap in the literature as far as research on mobile cloud computing is concerned. The researchers pointed out that most studies have focused on adoption in higher education as well as the educational industry, future research is greatly encouraged and recommended in other areas such as agriculture, health and transport industries. The researchers recommended the need for further research in other industries.

Muhammad et al. (2017) also pointed out that most of the research done in education tend to drift away from the focus of mobile cloud computing and shift to mobile learning. The researchers urged researchers not to drift their focus on mobile cloud computing. However, they emphasized that the amalgamation of the two technologies is useful in education but researchers should focus more on cloud technologies how they can be integrated into existing mobile learning platforms rather than emphasizing more on the benefits of mobile learning. Horrigan (2017) also pointed out that most research in education tend to focus on science department at the expense of other social science departments. In addition the researcher pointed out that this often brings out a false outcome as most students in these departments already know what mobile cloud computing is, however the researcher also urged researchers to focus on non-technical departments so as to fully understand students' acceptance of mobile cloud computing.

CHAPTER 3

CONCEPTUAL FRAMEWORK

This section is designed to help institutions and students fully understand the different frameworks and components that make up mobile cloud and how mobile cloud computing functions. The researcher will explain models for mobile cloud delivery, mobile cloud applications and the different architectures of mobile computing.

3.1 Technology Acceptance Model (TAM)

Acceptance of technology by users remain a critical concern among many researchers. The TAM is widely used by researchers in a bid to find out users' acceptance of technology. The two main factors that determine acceptability of IT systems are perceived usefulness and perceived ease of use (Chuttur, 2009). The extent or degree in which a person believes that by using a system he/she improve his/her overall performance is known as perceived usefulness. On the other hand, perceived ease of use is the extent to which a person believes that by using a system it will be easy or effortless.

Perceived ease of use and Perceived usefulness both influence attitude towards using a system in two ways namely self-efficacy and efficacy. Self-efficacy refers to the extent in which a user's sense of efficacy increases when a system is easy to use. Efficacy is influenced by intrinsic motivation enabling the user to have ample time to do other tasks since the system will be easy to use hence less effort and time.

In his study, Davis (1989) stated that the relationship that exists between behavioral intention and perceived usefulness is much stronger compared to the relationship that exists for perceived ease of use. This implies that the factor that influences acceptance of IT systems the most is perceived usefulness. Figure 3.1 below illustrates the TAM model.

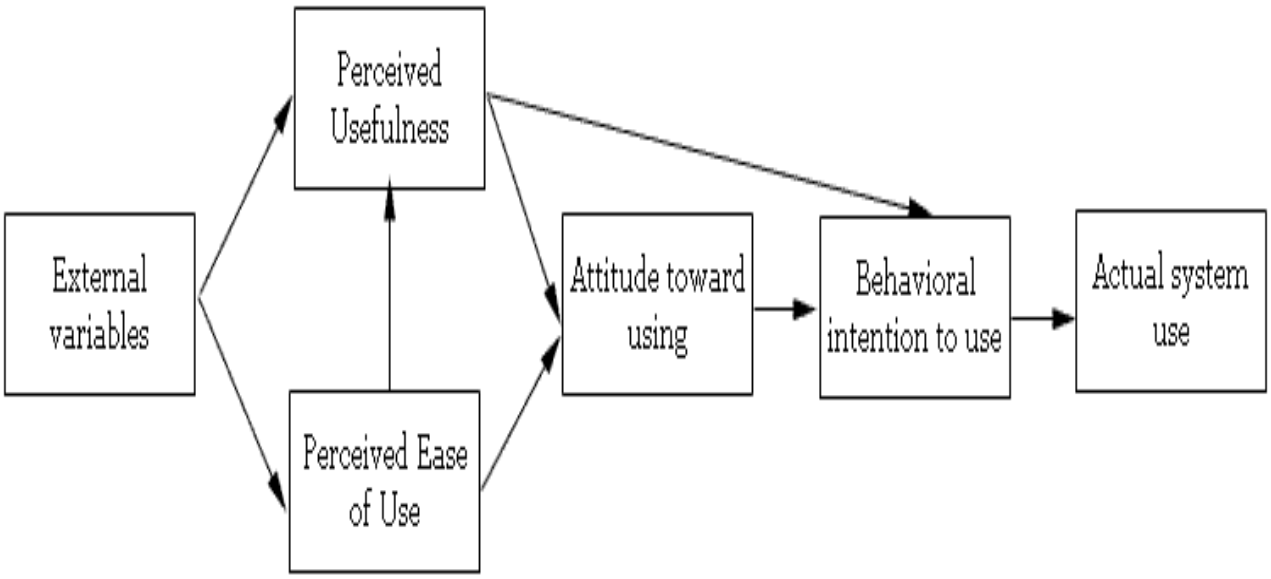

Figure 3.1: Technology Acceptance Model (Davis, 1989)

3.2 Theory of Planned Behavior (TPB)

TPB was a product of the Theory of Reasoned Action (TRA) that was put across in 1980 in a bid to predict the behavior of an individual at a particular time and place. The main component of this theory is behavioral intent which is influenced by attitude. The theory states that motivation (intention) and ability (behavioral control) affect overall behavior. In addition, there are six constructs involved in the theory that describes the extent to which one has control over behavior which are stated below:

- ***Attitude:*** The extent to which one has a favorable outlook or unfavorable outlook towards the use of something in our case this will refer to the usage of mobile cloud computing.
- ***Behavioral intention:*** This refers to external factors that influence ones behavior or overall view towards something. The greater the intention, then the likelihood of performing the task increases.
- ***Subjective norms:*** This refers to the views that affect an individual's behavior based on what his/her peers think. It is also known as social influence.
- ***Social norms:*** This refers to the overall code of behavior of a certain group of people in a society.
- ***Perceived power:*** This refers to external factors or variables that affects the overall behavior of an individual.

- ***Perceived behavioral control:*** This refers to the extent a person believes that it is easy or difficult to alter their behavior towards using a system.

The components that make up the theory of planned behavior are depicted in Figure 3.2 below.

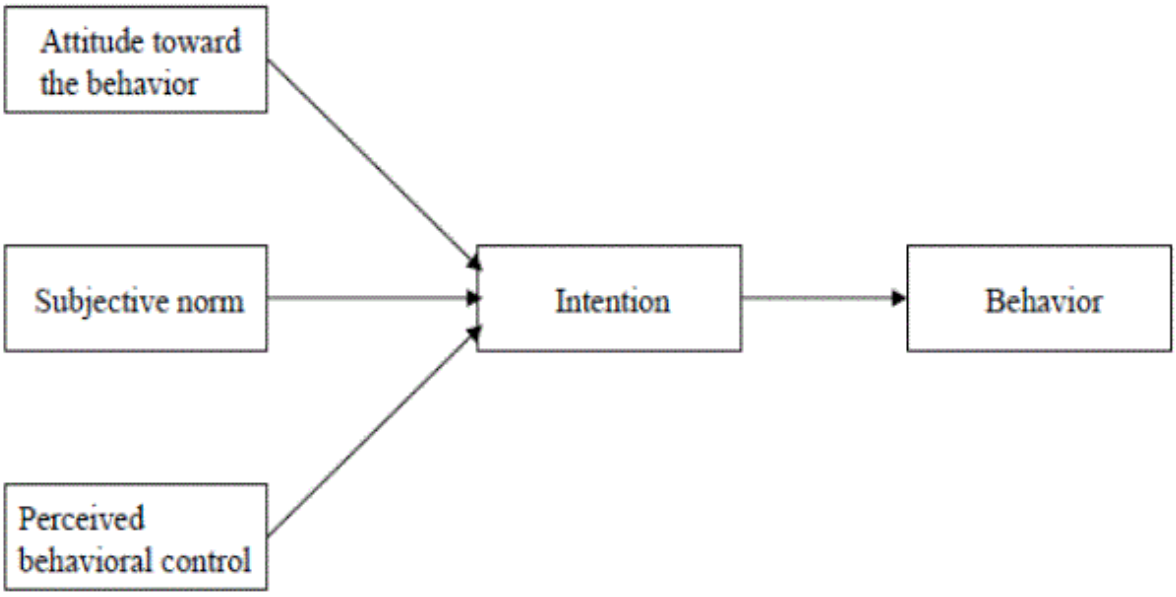

Figure 3.2: Theory of Planned Behavior Model (Ajzen, 1991)

3.3 TAM and TPB Studies

Bhatt (2014) conducted a study in India to find out the factors that influence students' acceptance of mobile cloud computing using the TAM model. Research findings showed that there are five main factors that influence consumer attitude which are as follows; Perceived Usefulness, Perceived Ease of Use, Attitude, Intention and Usage. 49.5% of students showed a positive attitude towards using cloud based services, 32% strongly agreed that cloud services are useful in academics, 46.5% have used cloud services, 3% of students strongly disagree that cloud services are easy to use, 29.5% of students feel comfortable to use mobile cloud services in education and 40.5% of the participants indicated that they frequently use cloud based storage.

Akbar and James (2016) conducted a study in Thailand in a bid to find out acceptance levels for cloud computing in colleges using the Theory of Planned Behavior (TPB) model. Research findings showed that there are 4 critical factors that influence students' attitude towards cloud computing. Multiple regression analysis was used to analyze the obtained data. The factors ranked from the strongest predictor to the lowest are Subjective norms, intention, perceived

behavioral control and usage respectively. In addition, the researchers emphasized the importance of workshops at colleges to encourage cloud computing so as to lure more users.

Shahriar and Masoud (2012) conducted a study in Iran to measure acceptance level of mobile cloud services among the working class. The sample consisted of 120 people from Tehran town and used descriptive study and stratified sampling. The researchers used the TAM model and results showed that intention to use mobile cloud services is affected by Perceived Usefulness and Perceived Ease of Use.

Gurvinder and Zhaobin (2015) also conducted a study in New Zealand to find out students' acceptance of mobile cloud services with a sample of 149 distance learning students using the TPB. The sampling technique used was non-probability and convenience sampling and the results showed that subjective norms are the main reason that influence student attitude towards using cloud based services.

Syuhaily et al. (2010) conducted a study to find out factors that affect adoption of mobile cloud computing among 100 undergraduate students. Convenience sampling was used to select the sample and the TAM1 model was used, Results showed that Perceived Usefulness play a major role in influencing students to use cloud based services. Furthermore, results showed that Perceived Ease of Use have a significant relationship on the adoption of cloud computing.

Alsmadi (2014) conducted a study in Jordan to find out challenges and opportunities of adopting cloud services at a training center. The sample consisted of 500 participants which were chosen using convenience sampling. The study was based on an integration of the TAM and TPB models. Results showed that behavioral intention influence consumer attitude towards cloud adoption. The researcher also concluded that the higher levels of social influence or subjective norms increased attitude towards using cloud based services.

Gary et al. (2016) conducted a study to find out characteristics of consumers and how that influences their acceptance of mobıle cloud computıng. Descriptive statistics was used to analyze responses collected from 232 internet users based on the TPB. Results showed that perceıved behavioral control and subjective norms strongly affect students' intention to use mobıle cloud services.

CHAPTER 4

RESEARCH METHODOLOGY

This section explains the research model that was adapted by the researcher, gives statistical information of research participants, describes the data collection tools, reliability tests of survey dimensions, the research procedure that was followed by the researcher as well as explaining the research schedule.

4.1 Research Model

Many researchers have tried to understand users acceptance of technology by using different models. In order to investigate students' acceptance of mobile cloud computing in higher educational institutions. Most widely used TAM model does not cover particular impact of technological and usage dimensions which are influential in acceptance of certain technology and how other unaccounted variables affect these still represent a research gap in technology adoption studies. Adopted model was employed from Chien et al. (2014). The model integrates two models namely, the Technology Acceptance Model (TAM) and the Theory of Planned behaviour (TPB) in order to fully understand the factors that determine users' acceptance of mobile cloud computing. The model constitutes of seven dimensions from the two models namely, subjective norms, perceived usefulness, ease of use, attitude, intention, usage and perceived behavioural control as depicted in Figure 4.1.

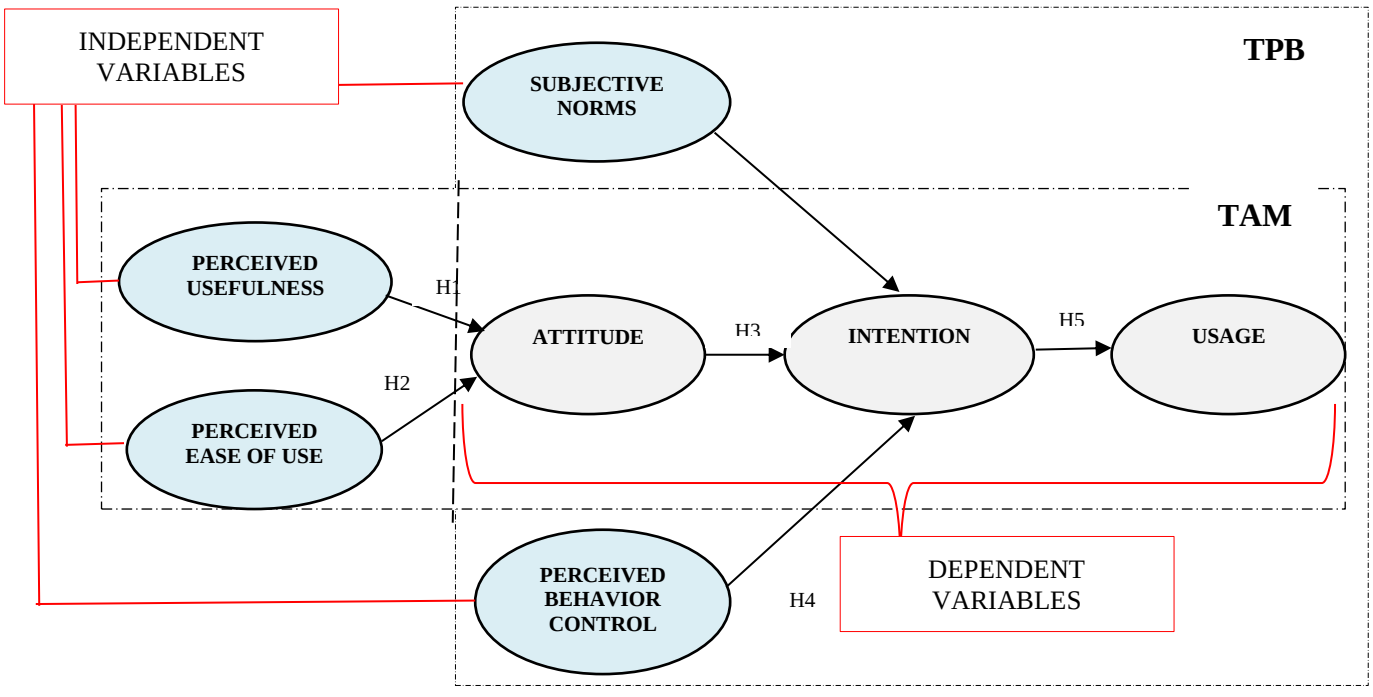

Figure 4.1: Research model for the study (Chien et al., 2014)

4.2 Research Participants

Participants of the study were students in both STEM (Sciences, Technology, Engineering and Mathematics) and other departments. . A total of 705 questionnaires were printed and distributed. The researcher managed to collect 668 questionnaires, 37 questionnaires went missing. Of the 668 returned questionnaires, 9 of them were not completely filled and were not entered into SPSS. The total number of questionnaire responses that were entered into SPSS was 659.Convenience sampling method was used to select participants. The minimum number of sample was determined by considering the ratio of at least 10 participants for 1 for each question included in the questionnaire and 10 participants for each construct included in the research model.

In 2017 total number of university students constituting the population is 93,292. If the margin of error is 5%, the confidence interval is 95% and the distribution of the response was expected to be normal i.e. 50% then the minimum recommended sample size is 383. In this study, 659 valid responses were included in statistical analysis. Students selected are currently enrolled at the following four universities in North Cyprus:

- Near East University (200)
- Cyprus International University (174)
- Girne American University (125)
- Eastern Mediterranean University (160)

4.2.1 Demographic data of research participants

Table 4.1 shows the demographic data of research participants. 53.9% of the participants were male students and 46.1% were female students. The age group with most participants was the 23-27 age group which constituted 44.5% of the total population, followed by the 17-22 age group which constituted 37.6% and lastly the 28 and above age group which constituted 17.9% of the total population. Most students were undergraduates, followed by master students and the lowest group was PhD students which constituted 10.9% of the total population. Demographic data based on departments have shown that most participants fell under the STEM category which comprised of 59.2% of the total population and students from other non-scientific departments was comprised of 40.8% of the total population.

Table 4.1: Demographic data of research participants

Demographic Variable		Number	Percentage (%)
Gender	Male	355	53.9
	Female	304	46.1
	Total	659	100.0
Age group	17-22	248	37.6
	23-27	293	44.5
	28+	118	17.9
	Total	659	100.0
Level of Study	Undergraduate	379	57.5
	Masters	208	31.6
	PhD	72	10.9
	Total	659	100.0
Department	STEM	390	59.2
	Other	269	40.8
	Total	659	100.0

4.3 Data Collection Tool

A paper-based questionnaire with 8 dimensions was used to collect data from research participants. The dimensions of the questionnaire are as follows: demographic data, subjective norms, perceived usefulness and perceived ease of use, attitude, intention, usage and perceived behaviour control. Each dimension had four questions except for demographic data which had 7 questions and was meant to gain a better understanding of the cloud services that the participant used. TAM questions were adapted from the original study by Davis (1989).

4.3.1 Reliability tests of questionnaire dimensions

In order to assess the reliability of dimensions, Cronbach alpha test was carried out using SPSS in order to check the reliability and internal consistency of survey dimensions. This refers to the extent to which a given set of scales are a consistent measure of a concept. As shown on Table 4.2 below. The total Cronbach alpha of all dimensions was .867 which is acceptable. TAM model had a higher Cronbach alpha of .839 compared to TPB model which had a total of .831. Various dimensions were ranked from the highest Cronbach alpha to the lowest as follows, Usage, Perceived Behavioral Control, Perceived Ease of Use, Perceived Usefulness, Intention, Attitude and Subjective Norms. The reliability coefficient at least 0.60 are acceptable (Sekaran, 2000). The reliability coefficient for Subjective Norms is considered as poor. The reason behind this might be the English related complexity of the questions that might have led

to the confusion in comprehension of questions which affected the responses of the participants. Subjective norm dimension will not be considered in further statistical analysis.

Table 4.2: Questionnaire constructs and reliability tests

Constructs:	Number of Items	Cronbach Alpha
Subjective Norms	4	.48
Perceived Usefulness	4	.64
Perceived Ease of Use	4	.66
Attitude	4	.60
Intention	4	.63
Perceived Behavioural Control	4	.77
Usage	4	.75
TPB MODEL	20	.83
TAM MODEL	20	.84
TOTAL	28	.87

4.4 Data Analysis

A paper based questionnaire was distributed to 4 universities. A total of 705 questionnaires were printed and distributed. The researcher managed to collect 668 questionnaires, 37 questionnaires went missing. Of the 668 returned questionnaires, 9 of them were not completely filled and were not entered into SPSS. The total number of questionnaire responses that were entered into SPSS was 659. Due to the nature of the questionnaire the following data analysis methods will be used to analyze the data in SPSS:

- Descriptive analysis
- Pearson Correlation

4.5 Research Procedure

The following steps were followed by the researcher during conducting the research:

I. A literature review was conducted in order to fully understand what was researched before regarding the field of mobile cloud computing and to understand the missing gaps in the literature.

II. A paper based questionnaire was drafted and distributed to a few students that were randomly selected from Near East University and responses were analyzed to check if the questionnaire was well understood by participants.

III. A new draft version of the questionnaire was re-structured taking into consideration feedback obtained from the test sample.

IV. The final questionnaire was printed and distributed to the universities. To collect data, the researcher targeted at central common places such as cafeterias and libraries at the universities.

V. Responses from the questionnaires were collected and data was entered into SPSS ready for analysis.

VI. Data was analyzed using the most appropriate statistical analysis tools.

VII. During each stage feedback and current status quo updates were communicated to the supervisor.

VIII. Corrections were done and the final thesis was presented to a panel of Jury members.

IX. Table 4.3 below shows the timeframe it took for each task on the schedule to be completed.

Table 4.3: Thesis research schedule

TASK	DURATION (WEEKS)
Literature review	On-going process during thesis writing
Research proposal	3 weeks
Questionnaire design	1 week
Data collection	8 weeks
Data capturing into SPSS	4 weeks
Data analysis	4 weeks
Writing final thesis chapters	2 weeks
Thesis review by supervisor	2 weeks (on-going process during thesis writing)
Thesis corrections and final submission	2 weeks
Total	26 weeks

CHAPTER 5

RESULTS AND DISCUSSIONS

In this section, the researcher explains the statistical tool that was used to analyze the data, the results that were found after analyzing the data, how these findings are similar or contrary to what other researchers found and the overall meaning of the results.

5.1 Mobile Cloud Based Services Used for Educational Purposes

A multiple response question was computed and analyzed in SPSS to find out the cloud based services which students are using for educational purposes. Participants were asked to select all options applicable from five given options (Facebook, Academia.edu, Research Gate, Edmodo.com and Gmail groups). As shown on Table 5.1, it can be seen that the highest percentage of students used research platforms mainly Academis.edu (27%) and Research Gate (22.5%) this could be because most participants fell in the age group 23-27 years and that age group is mainly dominated by master students. In addition, results also showed that email related platforms such as Edmodo and Gmail groups had the least number of users, 12.1% and 15.6% respectively. This could be due to the nature of the platforms, users prefer to use services such as Facebook (22.8%) where they can get instant replies and they are able to see if the other person has read their messages compared to email platforms where such services are not available unless institutions upgrade student accounts to allow read-receipt features.

Similar findings were also found by Ananthanara et al. (2014) who conducted a study in Tunisia and found out that the most common cloud based research platforms used by postgraduate students were Academia.edu and Research Gate. The researchers explained that these cloud based platforms provide free resources and tend to be used a lot by students contrary to other databases which require monthly or annual subscriptions. In addition, Sarrab et al. (2016) also found out that Facebook was one of the widely used cloud based social network site among students to collaborate with peers and the researchers pointed out that Facebook has been widely used in education among all levels of study. Li and Chan (2012) also found out that the rise in cloud based platforms is causing a shift from email communications between teacher and student to cloud based social and educational platforms were instant feedback can be obtained. This greatly supports our results as evidenced by a low percentage usage for Gmail services.

Table 5.1: Cloud based services used for educational purposes

		Responses		Percent of
		N	Percent	Cases
Educational cloud based services	Facebook	384	22.8%	58.4%
	Academia.edu	454	27.0%	69.0%
	Research Gate	379	22.5%	57.6%
	Edmodo.com	204	12.1%	31.0%
	Gmail groups	263	15.6%	40.0%
Total		1684	100.0%	255.9%

a. Dichotomy group tabulated at value 1.

5.2 Social Network Sites Used for Communication Purposes

A multiple response question was computed and analyzed in SPSS to find out the cloud based social network sites used for communication purposes by students. Participants were asked to select all options applicable from five given options (Facebook Messenger, Skype, WhatsApp, Viber and Instagram). As shown on table 5.2 below, the majority of the students use WhatsApp and Facebook messenger to communicate as evidenced by a higher percentage of 30.5% and 25.7% respectively. The third highest is Instagram followed by Skype and lastly Viber and these three has 17.2%, 13.8% and 12.8% respectively.

Nan et al. (2015) also found out that WhatsApp and Facebook are among the popular mobile cloud based social network sites used by students. This supports our results as evidenced by higher number of users for those social network sites. Chaka and Govender (2017) alluded that the integration of Facebook, Instagram and WhatsApp has made these three the top used social network sites. This supports our findings as results show that these three were the top 3 most used social network sites. Furthermore, Wang et al. (2016) pointed out that social network sites like Skype and Viber were introduced as virtual platforms mainly for video calling, however, the integration of video services on platforms like WhatsApp and Facebook has caused a shift to many users as they prefer to do virtual calls on most popular social network sites leaving Skype more of a business platform now. This greatly supports our results as evidenced by lower number of users for Skype and Viber.

Table 4.2: Cloud based social network sites used for communication purposes

		Responses		Percent of
		N	Percent	Cases
Cloud based social network sites used for communication	Facebook Messenger	383	25.7%	58.7%
	Skype	205	13.8%	31.4%
	WhatsApp	455	30.5%	69.7%
	Viber	191	12.8%	29.2%
	Instagram	256	17.2%	39.2%
Total		1490	100.0%	228.2%

a. Dichotomy group tabulated at value 1.

5.3 Cloud Based Storage vs Local Storage

A multiple response question was computed and analyzed in SPSS to find out students' storage preference between local storage options and cloud based storage options. Participants were asked to select all options applicable from five given options (ICloud, Drobox, Google Drive, USB/ Flash and External Hard Drive). As shown on table 5.3 below, most students prefer to use local storage services as seen by higher percentages for USB/ Flash and external hard drive which had 36.4% and 21.5 respectively. Among the students who use cloud storage, the highest percentage was found in Google drive, followed by Drobox and lastly ICloud.

Similar findings were found by Baek et al. (2017) who conducted a study at three government owned educational institutions in South Korea and found out that students prefer local storage to cloud storage. The researchers explained that the reason for this could be because most of the students came from non IT departments and for that reason most of them were not much acquainted with technology. However, contrary results were found by Wang et al. (2016) who found out that students prefer to use cloud storage especially to share memories such as pictures with family and friends compared to local storage. These findings contradict with our results however differences could be due to the nature of the environment used. Wang et al. (2016) conducted the study in America at a private university, given such information, students at such a university are more likely to be wealthy and obviously acquainted to technology and would prefer cloud storage.

Table 5.3: Cloud based storage services versus local storage

		Responses		Percent of
		N	Percent	Cases
Cloud based storage vs local storage	ICloud	110	8.0%	17.2%
	Drobox	225	16.4%	35.1%
	Google Drive	240	17.5%	37.4%
	USB/ Flash	499	36.4%	77.8%
	External Hard Drive	295	21.5%	46.0%
Total		1369	100.0%	213.6%

a. Dichotomy group tabulated at value 1.

5.4 The Relationship between Perceived Usefulness (PU) and Attitude towards Using Mobile Cloud Computing

H1: Perceived Usefulness (PU) has a positive effect on attitude towards using mobile cloud computing.

A Pearson correlation was computed to find out the nature of the relationship that exist between Perceived Usefulness and Attitude towards using mobile cloud computing. As depicted on Table 5. 4 it can be seen that there was a moderate positive correlation between the two variables with r= .442, n= 659 and p= .000. Since the p value is less than 0.05, we therefore accept the hypothesis and conclude that there is a positive effect between Perceived Usefulness and attitude towards using mobile cloud computing. In addition, as shown on Figure 5.1, a scatterplot graph was computed showing a moderate and positive correlation between the two variables.

Van der Schyff and Krauss (2016) used the TAM model to find out the relationship between Perceived usefulness and attitude towards using cloud based services in South Africa at Limpopo University. Findings revealed that there was a significant correlation between the two variables. In addition, a study by Preeti and Vineet (2015) also showed a positive correlation between the two aforementioned variables. This suggests that when students perceive that the technology will be of use in their academics their attitude and views towards the technology changes. These results support our study as similar settings were used since all the studies were conducted at universities.

Table 5.4: Showing the Pearson Correlation between Perceived Usefulness and Attitude

		Perceived Usefulness	Attitude
Perceived Usefulness	Pearson Correlation	1	.442**
	Sig. (2-tailed)		.000
	N	659	659
Attitude	Pearson Correlation	.442**	1
	Sig. (2-tailed)	.000	
	N	659	659

**. Correlation is significant at the 0.01 level (2-tailed).

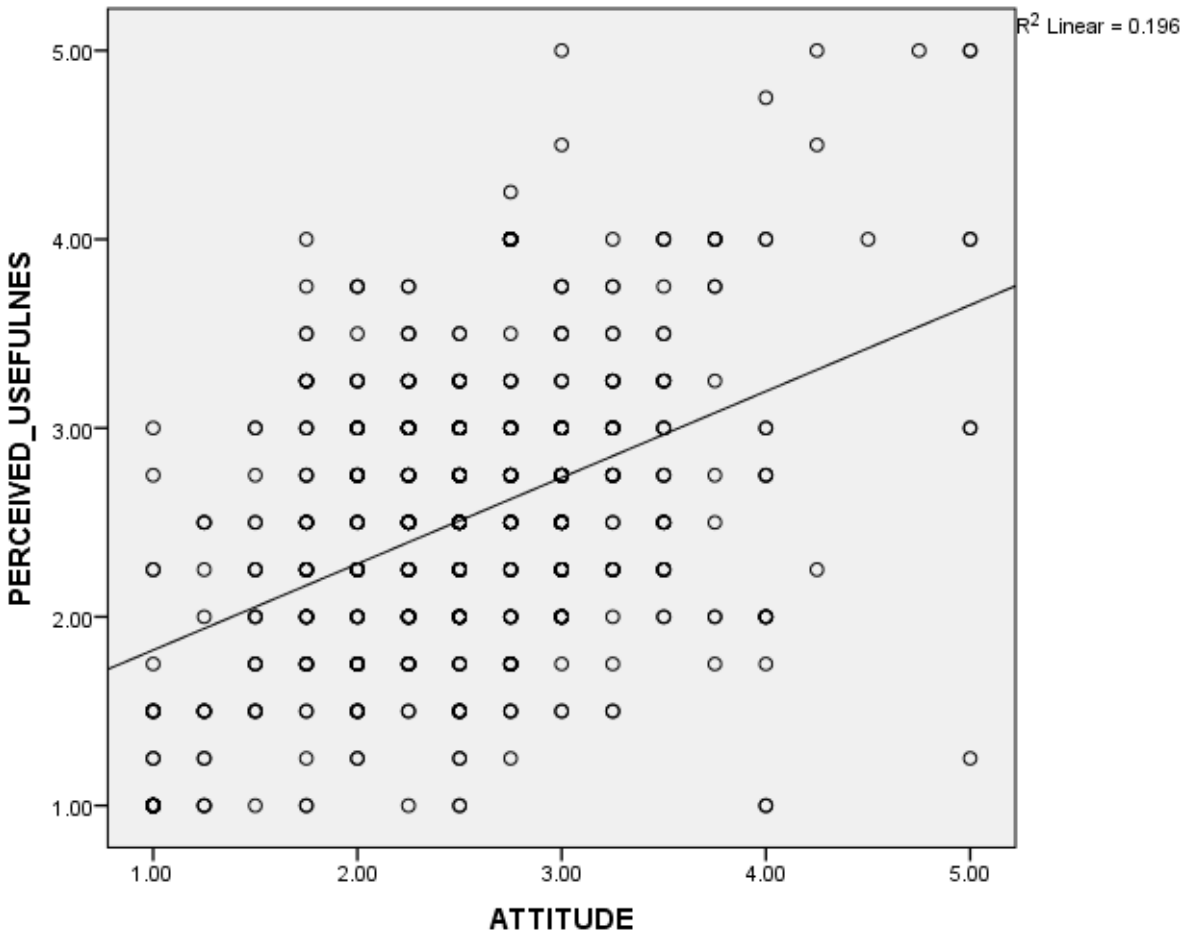

Figure 5.1: Scatter graph showing the relationship between Perceived Usefulness and Attitude

5.5 The Relationship between Perceived Ease of Use (PEU) and Attitude towards Using Mobile Cloud Computing

H2: Perceived Ease of Use (PEU) has a positive effect on attitude towards using mobile cloud computing.

A Pearson correlation was computed to find out the nature of the relationship that exist between Perceived Ease of Use and Attitude towards using mobile cloud computing. As depicted on Table 5. 5 it can be seen that there was a moderate positive correlation between the two variables with r= .649, n= 659 and p= .000. Since the p value is less than 0.05, we therefore accept the hypothesis and conclude that there is a positive effect between Perceived Ease of Use and attitude towards using mobile cloud computing. In addition, as shown on Figure 5.2, a scatterplot graph was computed showing a moderate and positive correlation between the two variables.

Similar findings were found by many researchers (Preeti & Vineet, 2015; Horrigan, 2017; Wang et al., 2016; Chaka & Govender, 2017) who also concluded that Perceived Ease of use had a positive effect on attitude. This implies that students prefer to use technology that free from effort and easy to use. However, contrary results were also found out by Li and Chan (2012) who found pout that there was no significant relationship between the two variables. Differences in results could be due to different settings used, the researchers conducted a study among government employees and also the time the study was published in 2012, cloud based services had not yet gained a momentum in several sectors.

Table 5.5: Showing the Pearson Correlation between Perceived Ease of Use and Attitude

		Perceived Ease of Use	Attitude
Perceived Ease of Use	Pearson Correlation	1	.649**
	Sig. (2-tailed)		.000
	N	659	659
Attitude	Pearson Correlation	.649**	1
	Sig. (2-tailed)	.000	
	N	659	659

**. Correlation is significant at the 0.01 level (2-tailed).

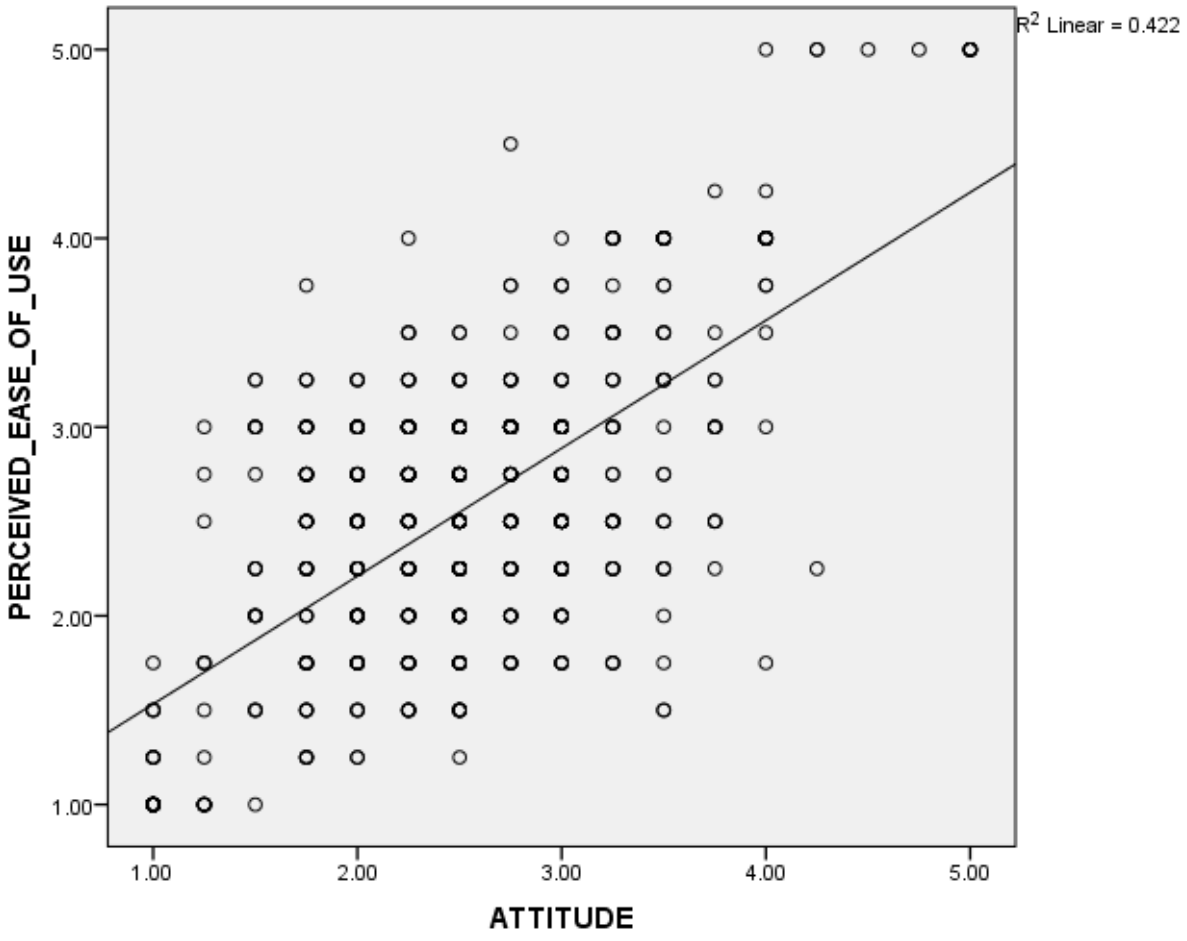

Figure 5.2: Scatter graph showing the relationship between Perceived Ease of Use and Attitude

5.6 The Relationship between Attitude towards Using Mobile Cloud Computing and Intention

H3: Attitude towards using mobile cloud computing will have a positive influence on behavioral intention.

A Pearson correlation was computed to find out the nature of the relationship that exist between Attitude towards using mobile cloud computing and behavioural intention. As depicted on Table 5. 6 it can be seen that there was a moderate positive correlation between the two variables with r= .426, n= 659 and p= .000. Since the p value is less than 0.05, we therefore accept the hypothesis and conclude that there is a positive effect between attitude towards using mobile cloud computing and behavioral intention. In addition, as shown on Figure 5.3, a scatterplot graph was computed showing a moderate and positive correlation between the two variables.

Baek et al. (2017) found similar results in a study the researchers conducted in South Korea. Attitude had a positive effect on intention to use cloud based services. In addition, Chien et al. (2014) also found the same results in a study conducted at three colleges in Ghana among students in their final year at high school level. Such findings support our study and this suggests that when students have a positive attitude towards mobile cloud computing they are more than willing to adopt to the new technology therefore emphasis must be on stimulating a positive attitude among students.

Table 5.6: Showing the Pearson Correlation between Attitude and Intention to use mobile cloud computing

		Attitude	Intention
Attitude	Pearson Correlation	1	.426**
	Sig. (2-Tailed)		.000
	N	659	659
Intention	Pearson Correlation	.426**	1
	Sig. (2-Tailed)	.000	
	N	659	659

**. Correlation is significant at the 0.01 level (2-tailed).

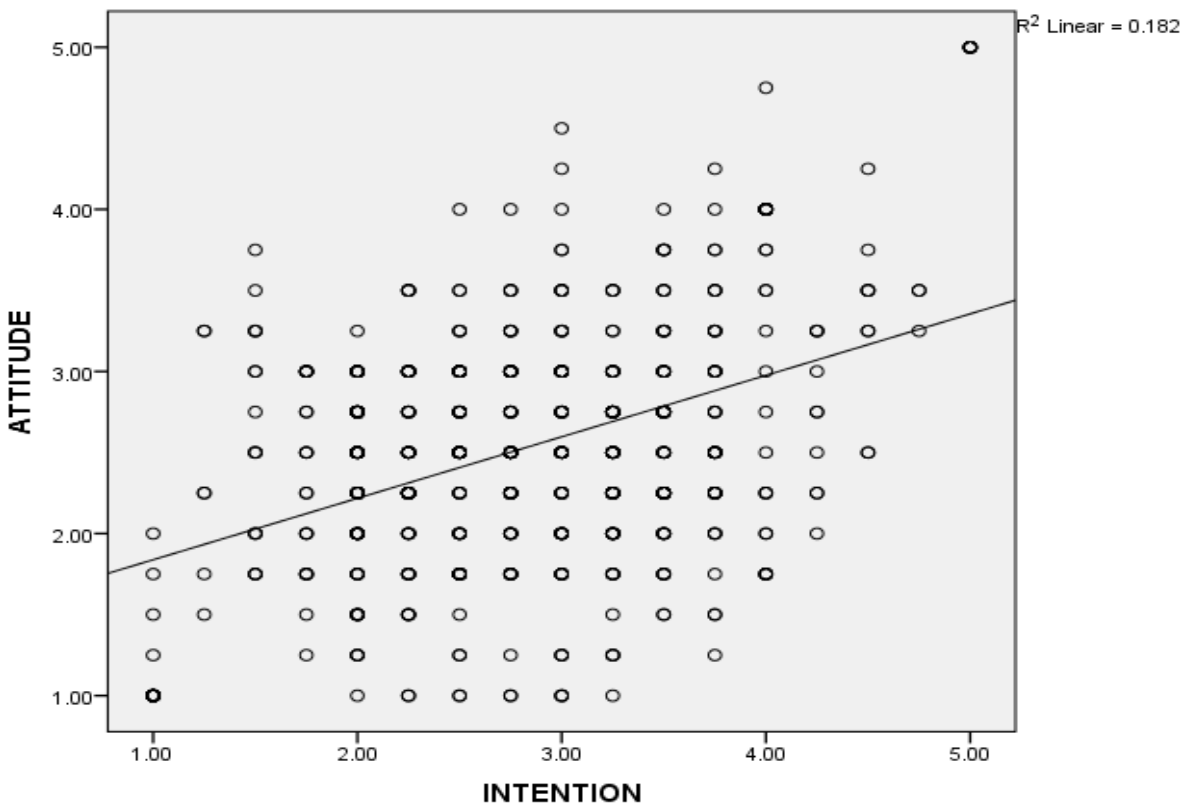

Figure 5.3: Scatter graph showing the relationship between Attitude and Intention of using mobile cloud computing

5.7 The Relationship between Behavioral Control and Intention towards Using Mobile Cloud Computing

H5: Perceived behavior control has a positive effect on intention to use mobile cloud computing.

A Pearson correlation was computed to find out the nature of the relationship that exist between behavioural control and intention towards using mobile cloud computing. As depicted on Table 5. 7 it can be seen that there was a moderate positive correlation between the two variables with r= .364, n= 659 and p= .000. Since the p value is less than 0.05, we therefore accept the hypothesis and conclude that there is a positive effect between Perceived behavioral control and intention towards using mobile cloud computing. In addition, as shown on Figure 5.4, a scatterplot graph was computed showing a moderate and positive correlation between the two variables.

Khan et al. (2014) conducted a study to investigate users' acceptance of mobile cloud computing at Uzuru Technology Institution in Tanzania and found out that there is a positive relationship between perceived behavioral control and intention towards using mobile cloud services. This implies that it is easy to alter a person's behavior towards using mobile cloud computing. Institutions should then focus more on encouraging students to adopt the new technology as this will lead to a positive behavior towards using the technology. Similar findings were also found out by Sarrab et al. (2016) who concluded that with technology it is possible to influence ones behavior during the early stages of adoption.

Table 5.7: Showing the Pearson Correlation between Perceived behavior control and Intention to use mobile cloud computing

		Perceived Behaviour Control	Intention
Perceived Behaviour Control	Pearson Correlation	1	.364**
	Sig. (2-tailed)		.000
	N	659	659
Intention	Pearson Correlation	.364**	1
	Sig. (2-tailed)	.000	
	N	659	659

**. Correlation is significant at the 0.01 level (2-tailed).

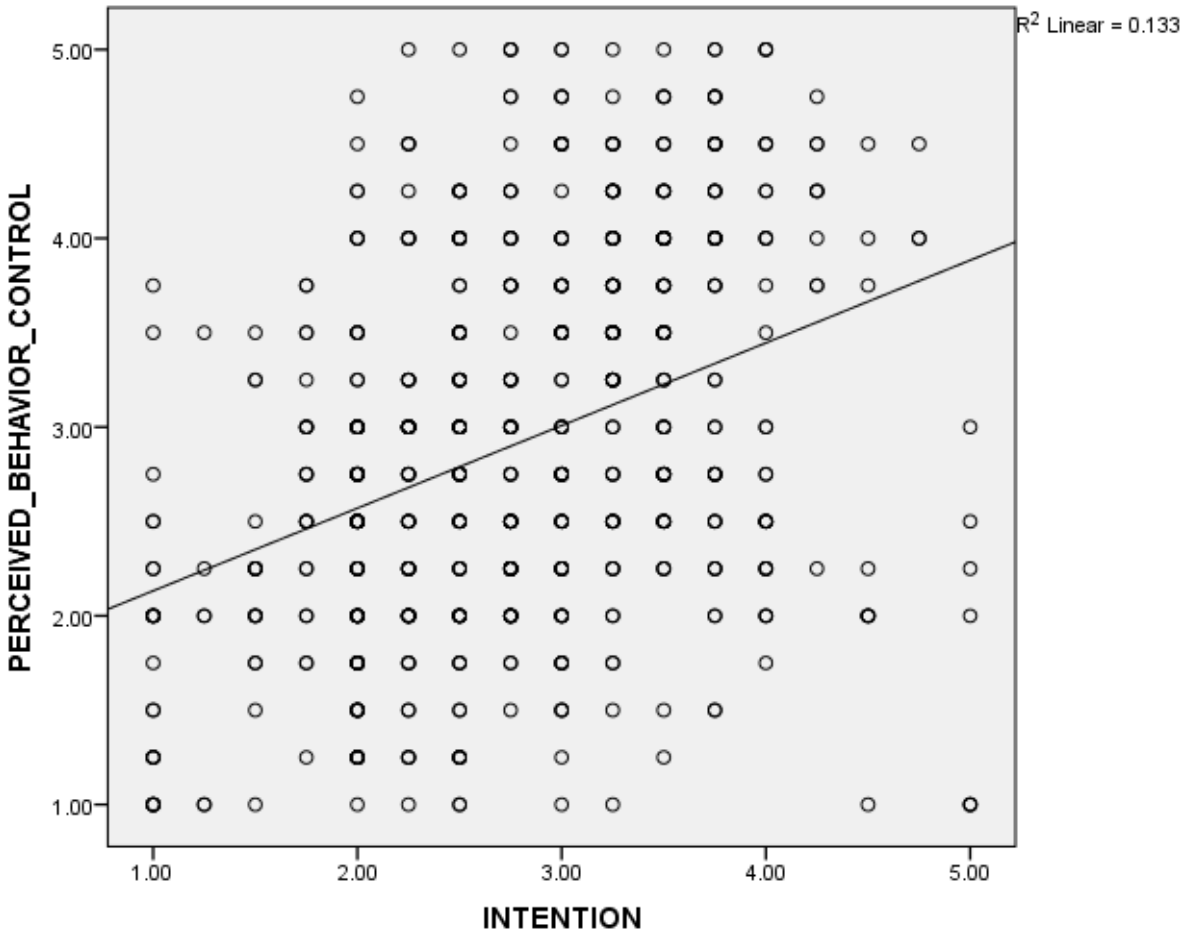

Figure 5.4: Scatter graph showing the relationship between Perceived behavior control and intention to use mobile cloud computing

5.8 The Relationship between Intention towards Using Mobile Cloud Computing and Usage

H6: Intention will have a positive influence on usage of mobile cloud computing

A Pearson correlation was computed to find out the nature of the relationship that exist between intention towards using mobile cloud computing and usage. As depicted on Table 5. 8 it can be seen that there was a moderate positive correlation between the two variables with r= .497, n= 659 and p= .000. Since the p value is less than 0.05, we therefore accept the hypothesis and conclude that there is a positive effect between intention towards using mobile cloud computing and usage. In addition, as shown on Figure 5.5, a scatterplot graph was computed showing a moderate and positive correlation between the two variables.

Similar findings were also found by Preeti and Vineet (2015) who also concluded that there was a positive relationship between intention to use cloud computing and usage. The researchers investigated cloud computing adoption at lawsuits and these results show that when students' intent to use mobile cloud computing, the usage of the technology keeps on

increasing. Chien et al. (2014) was concerned with technology acceptance among university students in Namibia and the researchers concluded that intention to use technology affects usage, the higher the intention levels among potential users or technology adopters the higher the usage levels hence institutions should focus more on motivating students to enhance their intention levels when it comes to using mobile cloud computing.

Table 5.8: Showing the Pearson Correlation between Intention and Usage of mobile cloud computing

		Intention	Usage
Intention	Pearson Correlation	1	.497**
	Sig. (2-tailed)		.000
	N	659	659
Usage	Pearson Correlation	.497**	1
	Sig. (2-tailed)	.000	
	N	659	659

**. Correlation is significant at the 0.01 level (2-tailed).

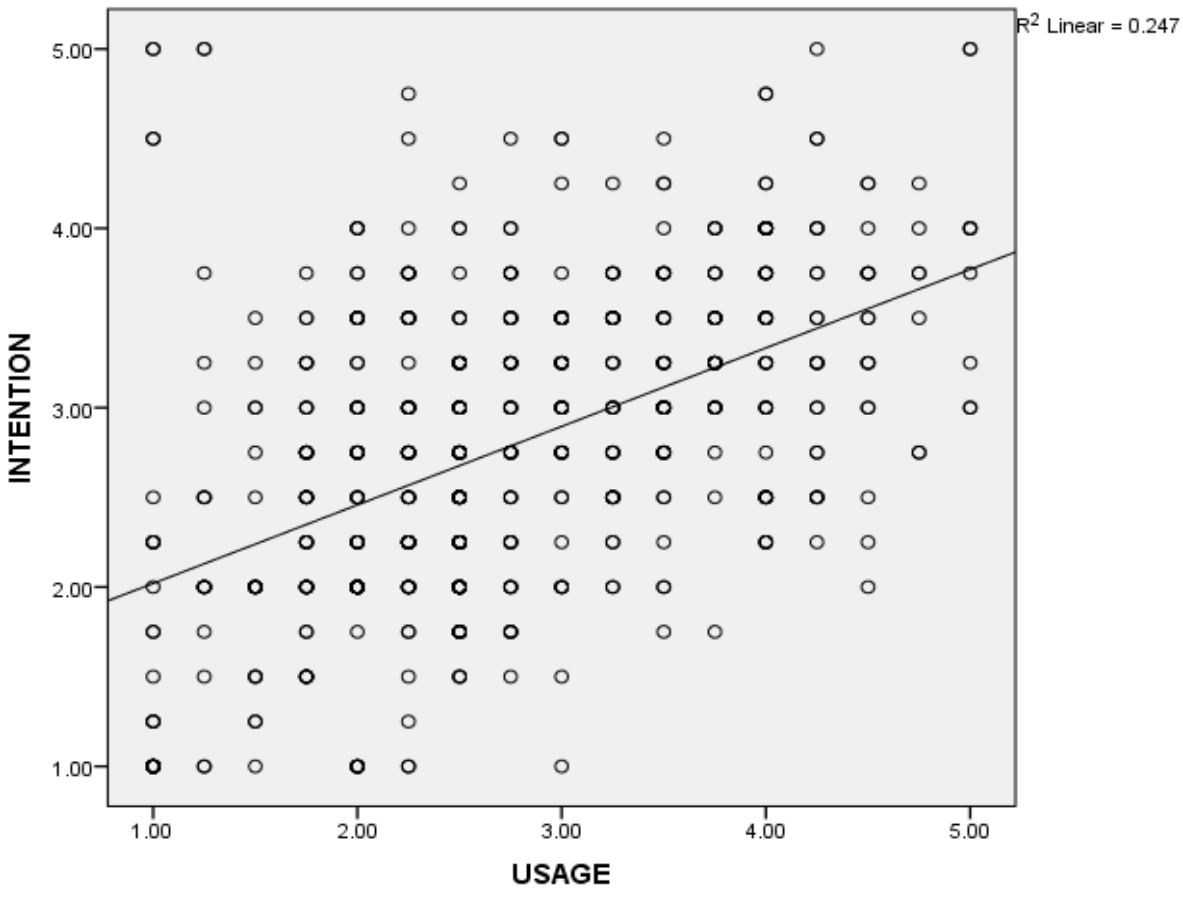

Figure 5.5: Scatter graph showing the relationship between intention to use mobile cloud computing and usage

5.9 Summary of Findings

To conclude the findings of this study, Table 5.9 describes a summary of all the hypothesis tested and the results obtained. Figure 5.6 also gives a detailed visual description of the research model used together with the r values from the studies. It is important to note that relationship between subjective norms and intention could not be calculated due to poor reliability.

Table 5.9: Summary of findings

Hypothesis	IV	DV	Supported	Correlation coefficient (+/-Positive/Negative)	R value
H1	PU	ATT	Yes	Moderate +	.442
H2	PEU	ATT	Yes	Moderate +	.649
H3	ATT	INT	Yes	Moderate +	.426
H5	PBC	INT	Yes	Moderate +	.364
H6	INT	USAGE	Yes	Moderate +	.497

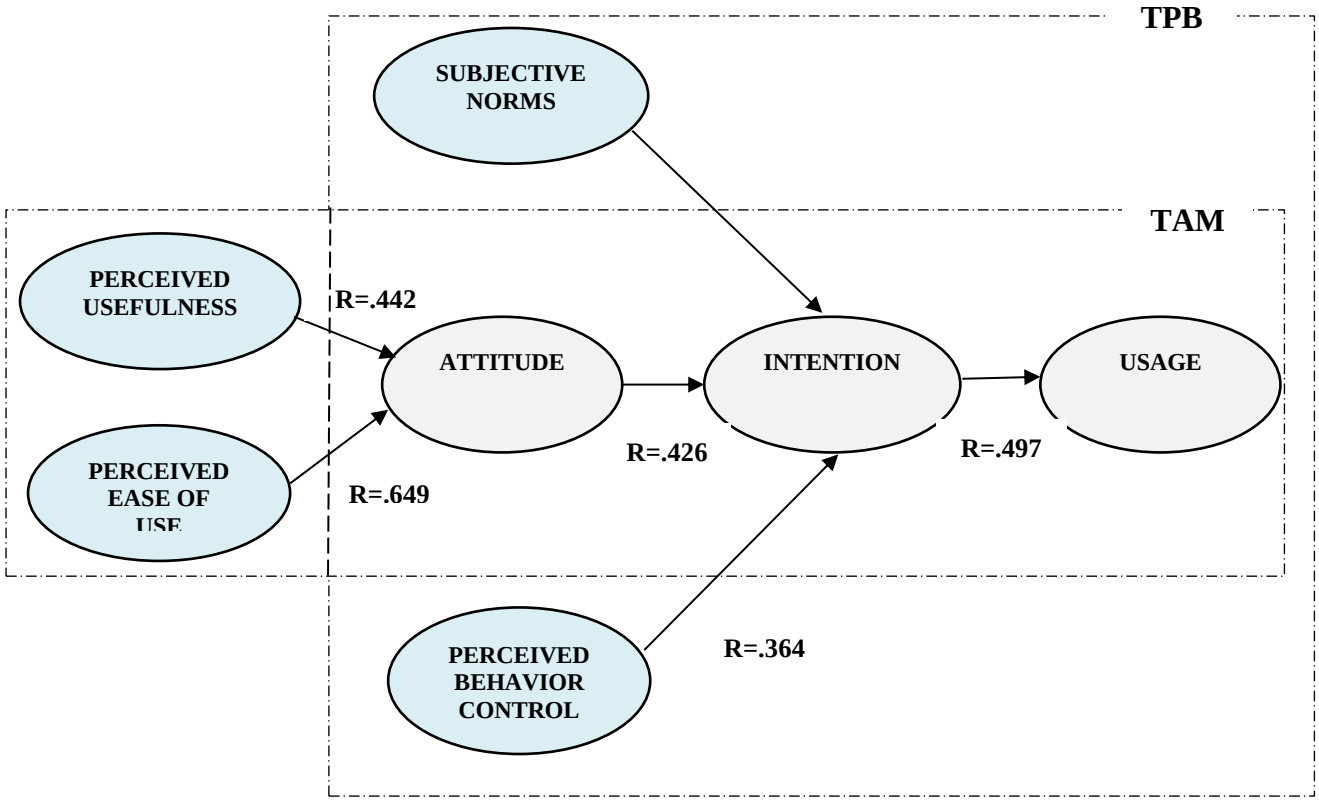

Figure 5.6 Summary of findings and correlations

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

This section gives a summary of the entire study, the researcher gives a brief narration of what the study was all about, the research findings and their meaning as well as recommendations for future research.

6.1 Conclusion

This study focused on investigating students' acceptance of mobile cloud computing at four universities in North Cyprus namely, Cyprus International University, Near East University, Girne American University and Eastern Mediterranean University. In order to achieve the main aim of the study, two research models were used namely; Technology Acceptance Model (TAM) and the Theory of Planned Behavior Model (TPB). Findings from the study are explained in detail below:

- The TAM model showed a moderate, positive and significant correlation between its independent and dependent variables. There was a significant correlation between Perceived Usefulness and Attitude towards using mobile cloud computing suggesting that when students perceive that the technology will be of use in their academics their attitude and views towards the technology changes. In addition, there was also a significant correlation between Perceived Ease of Use and attitude towards using mobile cloud computing implying that students prefer to use technology that free from effort and easy to use. There was also a significant correlation between attitude and intention to use mobile cloud computing suggesting that when students have a positive attitude towards mobile cloud computing they are more than willing to adopt to the new technology. Furthermore there was significant correlation between intention and usage meaning that when students' intent to use mobile cloud computing, the usage of the technology keeps on increasing.

- The TPB model also showed a moderate, positive and significant correlation between the independent and dependent variables. Relationship between subjective norms and intention was not considered in the study due to poor reliability. However, there was a significant correlation between Perceived Behavioral control and intention to use mobile cloud computing implying that it is easy to alter a person's behavior towards using mobile cloud computing. Furthermore, there was a significant correlation

between intention and usage of mobile cloud computing suggesting that usage tends to increase when intention levels of using mobile cloud computing are also high.

- Results have also shown that although there are a lot of cloud storage services online and most of them provide free storage students in North Cyprus still prefer to use local storage mainly USB/ Flash as well as external hard drives to store information and assignments.

- Students mainly use Academia.edu, research gate and Facebook cloud services for educational purposes. This is most likely to be the case for master and PhD students who are mainly doing research and such platforms are enriched with good quality articles and journals which they can easily access.

- WhatsApp and Facebook are the two mainly used cloud based social network sites for communicating with family and friends.

- The researcher also observed a high number of mobile devices among university students which makes mobile cloud computing a good technology to adopt among universities in North Cyprus.

6.2 Recommendations

The researcher did not fully exhaust the subject under study as a result of the limitations discussed in chapter 1. In order to fully understand the subject and enrich the literature database on cloud computing, it is important for the following recommendations to be taken into account for future research:

- Further research is strongly recommended targeting at a larger geographical area in North Cyprus for researchers to gain a better insight on acceptance levels of adopting mobile cloud computing in higher education.

- It is also recommended to focus on adoption of mobile cloud services in other industrial sectors of the economy apart from education. Researchers are encouraged to research acceptance of this technology in other sectors such as health and tourism.

- This study mainly focused at investigating acceptance of mobile cloud computing among students, further research is also recommended to investigate instructor's perceptions towards the adoption of this technology in higher education.

- Awareness programs on the benefits of adopting to cloud based technology should be implemented at universities. This will aid in increasing the adoption levels among students.

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APPENDICES

APPENDIX 1

THE QUESTIONNAIRE

ACCEPTANCE OF MOBILE CLOUD COMPUTING IN NORTH CYPRUS UNIVERSITIES QUESTIONNAIRE

The questionnaire is a part of MS thesis study and its aim is to investigate students' acceptance of mobile cloud computing in North Cyprus universities. Responses to this questionnaire are anonymous and information obtained from the questionnaire will solely be used for educational purposes only and will not be submitted to any institution. Read each question carefully and choose the answer that you feel is the most appropriate. You are required to answer all questions. Your participation is greatly appreciated.

Contact: Safa Fadel (Safafadel55@gmail.com) T: 05488731320
Thesis Supervisor: Assist. Prof. Dr. Seren Başaran (seren.basaran@neu.edu.tr)
Near East University – Department of Computer Information Systems. Nicosia, North Cyprus.

Mobile cloud computing: refers to a technique in which internet-based mobile applications, data and services are accessed through smartphones, laptops, tablets and other portable devices. A mobile cloud approach enables developers to build applications designed specifically for mobile users without being bound by the mobile operating system or memory capacity of the smartphone (Khan et al., 2014)

Section I: Demographic information of participant (Please select only one option for each question)

1. Gender:

◯ Male ◯ Female

2. In what age group are you?

◯ 17-22 ◯ 23-27 ◯ 28 and above

3. Level of Study

◯ Undergraduate ◯ Master Student ◯ PhD student

4. **Department Type** :

◯ STEM (Science, Technology, Engineering, Mathematics) ◯ Other

5. **Which of the following cloud based services do you use <u>for educational purposes</u>? (*You can select many options*)**

◯ Facebook

◯ Academia.edu

◯ Research Gate

◯ Edmodo.com

◯ Gmail groups

6. **Which of the following cloud based social network sites do you use <u>for communication purposes</u>? (*You can select many options*)**

◯ Facebook Messenger

◯ Skype

◯ WhatsApp

◯ Viber

◯ Instagram

7. **Which of the following <u>storage services</u> do you use? (*You can select many options*)**

◯ ICloud

◯ Drobox

◯ Google Drive

◯ USB/ Flash

◯ External Hard Drive

SECTION II: SUBJECTIVE NORM	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8. People who influence my behaviour think that I should use mobile cloud computing.					
9. Experts that are important in my life think I should use mobile cloud computing.					
10. People who are important in my career life think that I should use mobile cloud computing.					
11. I am expected to use mobile cloud computing.					
SECTION III: PERCEIVED USEFULNESS	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
12. I expect to gain additional benefits in my education by using mobile cloud computing					
13. Mobile Cloud computing improves my performance at school					
14. Using mobile cloud applications (such as Google Docs) in my education increases my productivity.					
15. Using the mobile cloud applications (such as Google Docs) enhances my effectiveness when doing school work.					
SECTION IV: PERCEIVED EASE OF USE	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
16. I find mobile cloud computing easy to use.					
17. I find it easy to get the cloud applications (such as Google Docs) to do what I want them to do.					
18. Interacting with the cloud applications does not require a lot of my mental effort.					
19. My interaction with the mobile cloud applications is so clear and understandable.					

SECTION V: ATTITUDE	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
20. Using mobile cloud applications is beneficial.					
21. Using mobile cloud applications is an advantage					
22. Using mobile cloud applications (such as Google Docs) is wise.					
23. Using mobile cloud applications (such as Google Docs) is a good idea.					
SECTION VI: INTENTION	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
24. I intend to use mobile cloud computing services in the next 3 months					
25. I plan to use mobile cloud computing services in the next 6 months					
26. Given that I have access to mobile cloud computing, I predict that I would use it.					
27. I am willing to perform some of my current computer tasks using mobile based cloud computing services.					
SECTION VII: USAGE	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
28. I am currently using mobile cloud based applications and services in my educational studies.					
29. The skills I learned from desktop applications (such as Microsoft Office) can be reused in mobile cloud applications (such as Google Docs).					
30. I feel unsafe when saving personal information in cloud based applications.					
31. Microsoft office skills are helpful in using cloud based applications and services.					

SECTION VIII: PERCEIVED BEHAVIOR CONTROL	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
32. When using cloud based applications (such as Google Docs), I have control over who can access to my information.					
33. When using cloud based services I have control over what information about me is released by the websites					
34. When using cloud based applications I have control over how my information is used by the websites.					
35. I have overall control over my information when using cloud based applications.					

Thank you for your participation

APPENDIX 2

ETHICAL APPROVAL LETTER

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

09.10.2017

Dear Safa Fadel,

Your application titled **"Acceptance of Mobıle Cloud Computıng in Hıgher Educatıon: Case of North Cyprus Unıversıtıes"** with the application number YDÜ/FB/2017/10 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Assist. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

Direnc Kanol

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document.

APPENDIX 3

SIMILARITY REPORT

Submit File

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AUTHOR	TITLE	SIMILARITY	FILE	PAPER ID	DATE
Safa Fadel	Abstract	0%		899268923	24-Dec-2017
Safa Fadel	Chapter1	10%		899268926	24-Dec-2017
Safa Fadel	Chapter2	3%		899268928	24-Dec-2017
Safa Fadel	Chapter3	13%		899268930	24-Dec-2017
Safa Fadel	Chapter4	6%		899268933	24-Dec-2017
Safa Fadel	Chapter5	12%		899268935	24-Dec-2017
Safa Fadel	Chapter6	6%		899268937	24-Dec-2017
Safa Fadel	Thesis	19%		899268939	24-Dec-2017