International Journal of Instruction *July 2024 ● Vol.17, No.3*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 695-714

Article submission code: 20231204 063743
Received: 04/12/2023 Revision: 13/03/2024
Accepted: 20/03/2024 OnlineFirst: 07/04/2024

Exploring Key Factors Influencing the Adoption of Mobile Cloud Computing in Higher Education: Case study at An-Najah University

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The integration of mobile learning applications has emerged as indispensable in higher education, yet the widespread adoption of mobile cloud computing technology within university settings remains limited in developing countries. This research seeks to bridge this gap by elucidating the primary factors influencing the decision to adopt mobile cloud computing in universities. To attain this objective, a comprehensive model is proposed, encompassing seven established technological factors along with novel considerations such as quality of service and social influence. The study involves data collection from 210 students and academic staff An-Najah National University in Palestine. The investigation underscores the paramount influence of quality of service, perceived usefulness, perceived ease of use, facilitating conditions, social influence, management support, and privacy on mobile cloud adoption. Furthermore, the research brings to light the persistent concerns surrounding security and privacy, serving as significant impediments to mobile cloud adoption in Palestinian Universities. The implications of these findings extend to higher educational institutions, mobile cloud service providers, and decision-makers. The identified factors serve as critical considerations for successful implementation of mobile cloud computing technology. Moreover, the research sheds light on the societal and scientific significance by addressing the motivation behind the title—exploring the utility of Mobile Computing Technology in enhancing educational processes.

Keywords: mobile cloud computing, adoption, quality of service, TAM, social influence

INTRODUCTION

Educational institutions are consistently exploring innovative and state-of-the-art technologies to facilitate the exchange of knowledge online among researchers, educators, and students. In recent times, the significance of mobile learning applications has risen as indispensable tools for students in higher education (Almaiah et al., 2019b). The rapid advancement of mobile technology, coupled with the widespread use of

Citation: Abdallah, N., Abdallah, O., & Kielani, J. Z. (2024). Exploring key factors influencing the adoption of mobile cloud computing in higher education: Case study at An-Najah university. *International Journal of Instruction*, *17*(3), 695-714.

smartphones among students and progress in information and communication technology (ICT), has spurred researchers' interest in integrating mobile learning (ML) into educational environments (Alqaralleh et al., 2019). As per Alqaralleh et al. (2019), ML has revolutionized the educational landscape by enabling instructors and learners to organize and synchronize interactions, as well as access online learning resources at any time and from any location. However, challenges such as limited learning resources, security concerns, and resource constraints still exist for mobile learning. One potential solution is the incorporation of Mobile Cloud Computing (MCC) into mobile learning, which has garnered attention from many researchers due to its potential to address these challenges effectively (Park & Kim, 2014).

Cloud computing is broadly used in education, with learners relying on free or low-cost cloud-based services on a daily basis. This allows educational institutions to focus on providing students, teachers, and professors with the essential tools they need for success by sharing files, documents, and IT services in the cloud (Abdulfattah, 2021). Mobile Cloud Computing (MCC) stands as an innovative platform that integrates mobile devices with cloud computing to establish a novel infrastructure, empowering the cloud to manage extensive computing-intensive tasks and store vast data volumes (Aliyu et al., 2020; Jararweh et al., 2016). For higher education institutions, MCC presents a multitude of benefits, including heightened computing performance, improved learning accessibility, expanded storage capacity, and economic advantages (Almaiah & Al-Khasawneh, 2020). It is recognized as a potent solution for addressing challenges encountered in implementing mobile learning in higher education, such as environmental factors (e.g., heterogeneity, scalability, and availability), performance-related issues (e.g., bandwidth, battery life, and storage), and security considerations (e.g., reliability and privacy) (AlAhmad et al., 2021). A noteworthy aspect of MCC is its capacity to store educational resources in the cloud, facilitating students' convenient access, backup, and sharing of files via their mobile devices (Christensen & Knezek, 2017). Widely-used MCC storage applications in academic settings encompass Google Drive, Dropbox, and iCloud, compatible with diverse mobile platforms like iOS, Windows, Android, and Blackberry, enabling the synchronization and sharing of educational materials such as documents, files, videos, and images (Almaiah, 2018).

The rising favorability of portable handheld gadgets among youthful learners is anticipated to yield favorable consequences for the prospective trajectory of mobile cloud technology (MCC) within the realm of higher education, with potential for exciting developments. However, MCC adoption in higher education is still in its early stages, mainly in underdeveloped nations (Burhan et al., 2022; Sultana, 2020), as supported by limited studies in the area of cloud-based mobile learning (Ahmad et al., 2020; Aydin, 2021). Additionally, each country has its unique context and conditions. This study is one of the first to investigate MCC adoption in Palestine, providing valuable insights for academics on the factors that influence mobile cloud technology acceptance. According to Abu Naser et al., (2015), the majority of services offered by Palestinian Higher Education Institutions are web-based applications. Although these services can be accessed from computers, the availability of these devices is not constant. This limitation hinders Academic Staff and students from accessing the University Services consistently. There is a need for periodic, anytime, and anywhere

access to these services. Palestine, being both a developing country and an occupied nation, faces a unique set of circumstances. Given its financial constraints and resource shortages, the researcher recommends Cloud Computing as a primary solution for the Palestinian IT sector. This is aimed at cost savings and enhancing overall efficiency. Tthe adoption of Mobile Cloud Computing in Palestine offers a strategic and practical solution to overcome challenges, improve efficiency, and create a technologically advanced and accessible educational environment in the face of unique socio-political and economic circumstances (Younis, 2017). Palestinians view Information and Communication Technology (ICT) as a vital tool for navigating challenges, maintaining livelihoods, and fostering the development of more closely-knit communities. The internet and access to information play a crucial role in strengthening the social fabric. Consequently, there is a compelling need for institutions to embrace and incorporate emerging technologies into their teaching and learning methods, leading to the establishment of numerous e-learning hubs in various institutes and universities (N Abdallah et al., 2023). The study aims to identify the elements that affect MCC adoption in educational institutions, advancing the current state of knowledge and addressing the challenges that hinder the integration of computing resources into the education system. The findings of this research can enhance the capabilities of future computing devices and benefit stakeholders in addressing the issues related to MCC implementation in developing nations' education sectors. The paper is structured into sections that offer a summary of the MCC literature and its possibilities, the theoretical framework, the research model, the research methodology, the findings and hypothesis testing, as well as the discussion, conclusion, implications, and limitations of the study.

Literature Review

Cloud Computing

Cloud computing emerges as a new concept in the context of developing countries, where its adoption is gaining prominence. This technology introduces the concept of information sharing, hardware and software consolidation, and standardization of infrastructure resources in a centralized facility (Hussein Alghushami et al., 2020(Chimmalee & Anupan, 2022)). In conducting this research, literature pertaining to the adoption of cloud computing in educational institutions, as well as literature on E-Learning, mobile learning, and mobile learning facilitated by cloud technology was reviewed. HEIs are migrating to the cloud for a multitude of reasons, the most important of which is economic (Klug & Bai, 2015). Furthermore, the cloud environment offers a lower cost of ownership model. In contrast, cloud computing services are becoming more popular in HEIs that are connected with the use of e-learning systems (Al Ajmi et al., 2017). In their study, Jawad et al., (2017), e-learning based on Cloud computing services is now feasible for HEI, resulting in increased educational and management effectiveness. Cloud services are the greatest solution for researchers and students that require low-cost services at academic institutions. As cloud computing grew in popularity, it became more sophisticated, and additional development was made available not only to corporations but also to people. A thorough literature review was conducted to investigate MCC utilization in HEIs. The literature search found that several studies in this field had been published and that the rate of publication had been growing in recent years (Qasem et al., 2020).

Mobile cloud computing (MCC) in higher education

The combination and combination of cloud computing with mobile-based technologies has resulted in the emergence of a new technical format known as mobile cloud computing (MCC) (Jaradat et al., 2020). According to Abdul Fattah (2021), MCC was established in 2009 and has since been a widespread applied solution among information technology scholars. The study conducted by Arpaci (2016), defines MCC as "an infrastructure in which different mobile devices (i.e. smartphones, tablets, and laptops) can access various computing resources anytime and anywhere". One of MCC's primary functions is to provide customers with cloud data storage services so that they can back up, update, access, or share information from their mobile devices. (Alonso-Monsalve et al., 2018). Gurung et al., (2016) mentioned that the innovative new approach of MCC is going to be a leading learning approach in the future. In a nutshell, MCC has been considered a prevailing innovation for addressing most of the challenges encountered when applying mobile learning in higher education in terms of scalability, availability, performance, and security (Almaiah & Al-Khasawneh, 2020).

The deployment of MCC helps content suppliers, such as educational institutions and faculty personnel, in addition to students (Gurung et al., 2016). Because MCC is learner-centered, it offers great flexibility in learning concerning time, place, and learning pace. It encourages active connection self-learning and self-understanding. Likewise, it enables professors to manage learning content more easily, design learning activities, track student progress, distribute academic learning information, and exchange views with other academics or professionals. According to Almaiah and Al-Khasawneh (2020), MCC plays a critical role in minimizing and overcoming various problems associated with mobile learning such as high smartphone costs, low network transmission rate, battery life, and low storage capacity. Furthermore, mobile MCC allows students to access their academic resources, videos, libraries, and assignments or tests via their mobile devices via the cloud (Kamaludin et al., 2022).

Research Model and Hypothes

The study has investigated determinants of the intention to use MCC by academics is solely conceptualized by following the theories of acceptance at the organizational level, this research model is based on TAM II developed by Venkatesh et al., (2003), Technology–Organization–Environment (TOE) Theory developed by Tornatzky et al., (1990) and Diffusion of Innovation (DOI) Theory invented by Everett Roger (2014). TAM II consists of two important variables; perceived ease of use and perceived usefulness, which influence intention to use and actual usage indirectly. The model demonstrated that there were other variables out of the main constructs known as antecedents (external) variables believed to be predictors of both perceived ease of use and perceived usefulness. Accordingly, Davis (1989) and Davis (1993) implied that external variables are theorized to indirectly influence the intention to use the system through perceived ease of use and perceived usefulness. Recently, in IS studies, many researchers were attempting to extend the TAM by associating it with external variables such as individual, organizational, and task characteristics. In the past ten years, researchers were more interested in examining external variables influencing perceived ease of use and perceived usefulness instead of TAM itself. The factors such as

individual, systems, and organizational characteristics have long been identified as external variables of TAM in past researches.

This study attempts to extend the antecedents' variable on TAM, TOE, and DOI within the MCC context. The external variables are hypothesized to be related to three constructs of TAM; perceived ease of use perceived usefulness and intention to use. Although TAM was applied in various IS studies, only a few have applied and combined TAM with other predictor variables, especially in the MCC context. In line with previous studies, this study also tried to examine factors that were believed to be antecedents of TAM within the online learning context. TOE Theory incorporates technology-organization, environment, and sociocultural elements to provide a comprehensive explanation of the possibility of a specific corporation adopting new technology. These three traits are shared by both the restrictions that operate as barriers and the opportunities that act as accelerators for technological growth, according to the TOE paradigm (Aldahwan & Ramzan, 2022). Conversely, DOI theory, which focuses on how people embrace new ideas, has made substantial use of this technique. The major purpose of the DOI theory is to assist all organizations and individuals, whether they accept or reject the advancements (Kaminski, 2011). Although numerous studies focus on the structural perspective of cloud computing adoption, very few of them delve into the actual impact of adopting this technology. As a result, this study takes a comprehensive approach by utilizing a cause-effect-based model to thoroughly examine the effects of cloud computing adoption. The factors identified in this research are perceived usefulness, perceived ease of use, social influence, facilitating conditions, management support, perceived security and privacy, and service quality. Figure 1 illustrates the research model of this study.

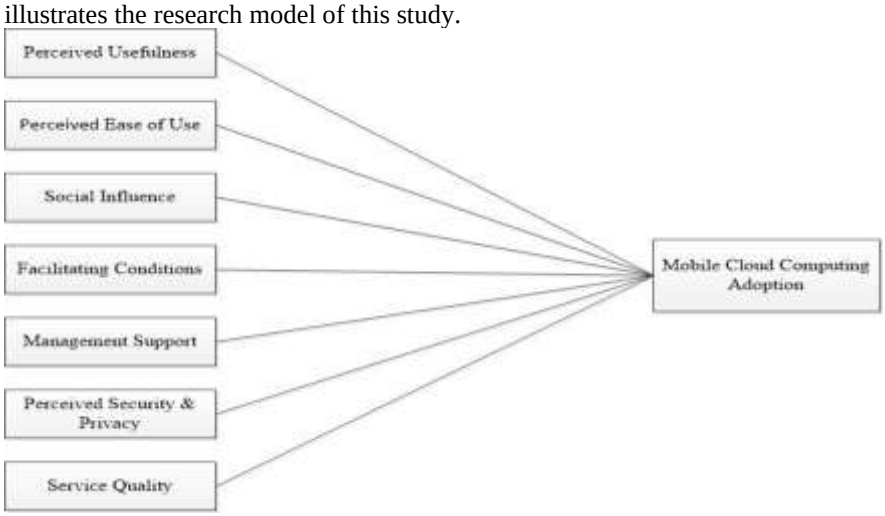

Figure 1
Research framework

TAM suggests that users' perceptions of usefulness and ease of use directly impact their intentions and actual behavior when it comes to using computers. According to Davis

(1989), perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance". Meanwhile, the perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort". Originally, TAM consisted of four major constructs; perceived ease of use perceived usefulness, intention to use, and usage. As described in the research model, the study prefers to use the new TAM consisting of perceived ease of use, perceived usefulness, and intention to use (adoption). The adoption is determined by two specific beliefs perceived usefulness (PU) and perceived ease of use (PEOU). Prior studies have evaluated TAM by incorporating external variables in the different settings of the cloud computing learning context (Ahmad et al., 2020; Isa et al., 2019; Nordin et al., 2017). The complexity of MCC is mostly determined by how simple it is to accomplish critical functions such as file sharing, file access, and file storage. The less difficult it is to complete these tasks, the lower the level of complexity, and the easier and faster perception of the benefits supplied by this technology (Arpaci, 2015; Jaradat et al., 2020).

The concept of perceived usefulness posits that if users believe a system will provide them with benefits, it will directly influence their intention to use the system, as they will be more inclined to use it. Perceived usefulness in this study refers to the extent to which a higher educational institution considers that implementing MCC services for learners increases their academic achievement. Mobile cloud computing encompasses diverse features applicable in educational contexts, such as the storage of learning materials, sharing of saved files, and synchronization of data across devices. These functionalities enable students to efficiently organize and manage their files and documents on mobile devices (Almaiah & Al Mulhem, 2019). In contrast, extensive research conducted in the past decade has revealed that perceived ease of use plays a substantial role in influencing the intention to use a system, either directly or indirectly through its impact on perceived usefulness (Aldahwan & Ramzan, 2022). When a system is easy for users to interact with, they are more likely to perceive it as useful and express an intention to use it (Jaradat et al., 2020). In the context of mobile cloud technology (MCC), the proposed model suggests that higher levels of perceived usefulness and ease of use of MCC will positively impact learners' performance.

In addition, Individuals' perceptions and attitudes toward behavior often undergo subconscious shifts based on the expectations of a public setting or the way others perceive the behavior. According to Jaradat et al. (2020), the likelihood of users accepting new technology increases when important individuals in their social circle, such as family, friends, peers, and close acquaintances, view the technology as useful and beneficial. Social influence, as defined in this study, refers to an individual's perception that significant others believe they should or should not adopt Mobile Cloud Computing (MCC). Generally, people are inclined to adopt a behavior if they hold a positive attitude towards it and believe that influential individuals support the adoption. Empirical studies conducted across various perspectives, contexts, and social environments consistently demonstrate that the social dimension significantly influences individuals' purposeful behaviors in the technology adoption process. Existing literature underscores the crucial role of social influence as a determinant that positively shapes individuals' decisions to adopt or utilize technology (Yaokumah &

Amponsah, 2019). Additionally, empirical evidence establishes that social influence significantly affects people's beliefs, perceptions, behavior, actions, and commitment to using information systems.

Cloud computing technologies have instigated significant technological shifts across various industries, with education being a notable beneficiary. Empirical investigations into the adoption of cloud computing underscore the crucial role of social impact in elucidating and determining intentional behaviors toward embracing new technologies (Juma & Tjahyanto, 2019). For instance, Sabi et al.'s (2018) study revealed through analysis results that social influence profoundly affects respondents' inclination to adopt cloud computing. Similarly, Abdul Fattah's (2021) research indicated that a substantial number of students perceived social influence as a major factor influencing their intention to utilize Mobile Cloud Computing (MCC). Further scrutiny uncovered social influence as a primary impediment to the adoption of MCC technologies within the context of developing countries (Yaokumah & Amponsah, 2019). Syed's (2018) investigation documented the direct impact of the social influence dimension on the willingness to embrace MCC. Arpaci (2016) observed that students experiencing heightened social pressure are more likely to harbor positive attitudes and intentions toward utilizing these services. This suggests that more favorable subjective norms regarding mobile cloud storage services correlate with more positive attitudes and intentions to use such services. Consequently, it becomes evident that social influence stands out as the chief determinant of MCC acceptability, exerting a profound impact on shaping and altering individuals' behaviors, particularly in developing countries. Thus, the ensuing hypothesis is posited:

Facilitating conditions - on the other hand- when considered as an organizational factor, refer to an individual's perception of the existence of organizational and technical support to enable the use of a system. This includes external resources such as time, money, and effort, as well as technological resources like personal computers and broadband access, which are necessary to facilitate the performance of a specific behavior. When an individual perceives the existence of conducive conditions, encompassing organizational and technical infrastructure, there is a heightened likelihood of them intensifying their utilization of a system (Sabi et al., 2018). The assimilation of novel technology hinges on the presence of facilitating conditions and the accessibility of the technology. Environmental factors wield influence over an individual's inclination to undertake a task. Numerous hindrances impeding learners from embracing technology in their learning have been identified by researchers. These obstacles encompass insufficient infrastructure, a dearth of personal technical proficiency, and inadequate support (Jaradat et al., 2020).

Numerous researches have demonstrated that the existence of relevant FC can assist as a helpful motivator for people to implement technology, as it fosters enthusiasm and willingness towards adopting the technology. In the research conducted by Jaradat et al. (2020), learners identified various forms of support, such as skills, availability of information or materials, and administrative support, as highly significant factors that influenced their utilization of information technology in the educational context. Research conducted by Rodrigues et al. (2016) confirmed the significance of having

adequate support for the acceptance of ICT in education. These studies collectively highlight the importance of facilitating conditions for both teachers and learners in the adoption of technology. It appears that when users receive increased support, their likelihood of adopting e-learning technology also increases.

The backing of top-level management stands out as a critical factor crucial for the accomplishment of any IT initiative, including e-learning. The management can help employees learn and support the acceptance of the new system implementation (Isa et al., 2019). In the case of cloud computing, top-management support is critical because it requires the provision and integration of numerous resources as well as the reengineering of procedures. This factor could be neither an enabler nor a barrier to cloud computing adoption. As per the findings by Ahmed et al. (2017), facilitating the execution of such a project necessitates top management's comprehension of the business advantages, efficiency, and effectiveness of cloud computing. The significance and influence of top management support have been extensively examined across various implementations of IT and information systems (Jawad et al., 2017). The support provided by the organization, particularly from senior managers, plays a crucial role in students' acceptance and adoption of e-learning systems for their learning. When end-users receive adequate support from management, it significantly enhances their computer usage.

Numerous investigations have indicated that the support of top management plays a pivotal role in influencing the uptake of technological innovations (Nahil Abdallah et al., 2021b; Al-Ammary, 2021). This influence is achieved by establishing a conducive environment, ensuring readiness of infrastructure, securing appropriate and ample resources, fostering knowledge development, and providing training, all underpinned by a clear vision and commitment (Hussein Alghushami et al., 2020). Studies have illustrated that a robust belief in the availability of organizational and managerial support significantly facilitates the adoption of the respective technology. Additionally, there is substantive evidence demonstrating a noteworthy correlation between management support and the intention to embrace a specific system or technology (Aydin, 2021; Odeh et al., 2017). Ahmad et al. (2020) showed that when users have a strong perception of organizational and managerial support, it positively influences the adoption of the technology under consideration. Previous research has also indicated a significant correlation between management support and the intention to accept a specific system or technology, as highlighted by Aydin (2021) and Odeh et al. (2017). It is important to highlight that institutions receiving substantial support from management are more inclined to embrace such services (Aldahwan & Ramzan, 2022). Consequently, managers are urged to promote the utilization of mobile cloud services to enhance collaboration among faculty and students. Universities should establish policies governing the utilization of such services and provide similar offerings through a secure-access intranet (Arpaci, 2016). Therefore, in the realm of e-learning, it is postulated that learners who perceive management support in the implementation of the e-learning system, potentially involving modifications in university structures, will encounter a positive influence on their acceptance and success with the e-learning system.

Likewise**,** perceived security and privacy encompass the extent to which students have confidence in the secure nature of mobile cloud storage services as platforms for storing and sharing personal data. Higher education institutions are facing numerous challenges in implementing cloud computing such as data privacy and security (Aldahwan & Ramzan, 2022). Previous research has revealed that security is a very high-risk element for an organization's acceptance of cloud computing and is the primary concern of the organization and individuals alike (Nahel Abdallah & Abdullah, 2019; Al-Ammary, 2021). The ability of a cloud computing provider's service to provide effective security protection for an organization's files and data is one indicator of success. On the other hand, privacy is recognized as a risk factor in cloud computing. The findings of Odeh et al., (2017) revealed that security and privacy are one of the main obstacles that negatively affect the acceptance of cloud computing in higher educational institutions.

The original purpose of developing cloud computing was to minimize hardware usage, while also enabling expert providers to securely access data and manage the computing environment to enhance privacy and security (Rahimah & Aziati, 2017). However, cloud computing continues to grapple with privacy and security challenges, particularly when the provider fails to guarantee comprehensive data protection for users. This arises from the potential risk that external providers hosting user data might misuse their access, bypassing user authorization or consent. As highlighted by Juma and Tjahyanto (2019), the integration of cloud computing into higher education institutions involves the transfer of highly critical and sensitive information, such as student records, researchers' patents, and intellectual property, beyond the campus boundaries, thereby elevating privacy and security to paramount concerns in the adoption of cloud computing. Service providers must prioritize confidentiality, integrity, and availability as their core security objectives. Students' trust in mobile cloud storage services will increase if they perceive a high level of security. When a student uses these services, his or her data may be recorded or monitored. As a result, students' trust in mobile cloud storage services may suffer as a result of privacy concerns (Arpaci, 2016). The higher the perceived privacy, however, the more likely mobile cloud storage services will be trusted. Accordingly, Almaiah and Al-Khasawneh (2020) highlighted that trust may be increased if cloud service providers adhere to strict security and privacy policies, which in turn influences students' attitudes toward using these services. This implies that cloud service users should take adequate risk mitigation measures to protect their institutional data from unauthorized access or use (Hussein Alghushami et al., 2020).

Finally, service quality pertains to the overall excellence of information system services, covering the complete support provided by the service provider, whether it be the ICT department or a specific unit within an organization (DeLone & McLean, 2002). This may also encompass outsourced services and the provision of diverse communication channels to promptly aid users in resolving issues related to information system usage. The evaluation of service quality in e-learning systems often centers around technical support services offered by online support technicians. Almaiah and Al-Khasawneh (2020) examined service quality using indicators such as responsiveness, reliability, and empathy, which were found to have a direct and significant impact on acceptance and adoption. This dimension encompasses support provided to learners, computer training, and program flexibility.

According to Abdallah et al., (2019), the level of quality of service provided to end users has a significant impact on the use of online services. Similarly, in their research, Tariq et al., (2017) concluded that Perceived benefits of quality of service have a significant positive effect on cloud computing adoption. Furthermore, DeLone and McLean (2002) observed that the quality of service influences users' intentions to use a particular information system.

In the context of this study, mobile cloud computing delivers services to end users through mobile devices, allowing access from any location and at any time (Qasem et al., 2020). Therefore, ensuring a high standard of service to students is crucial in increasing the likelihood of adoption of mobile cloud computing technology in higher education institutions. Based on the above discussion, the following hypotheses are proposed:

- H1: PEOU affects higher education institutions' intention to adopt MCC.
- H2: PU affects higher education institutions' intention to adopt MCC.
- H3: Social Influence affects higher education institutions' intention to adopt MCC.
- H4: Facilitating Conditions affect higher education institutions' intention to adopt MCC.
- H5: Management Support affects higher education institutions' intention to adopt MCC.
- H6: Perceived security and privacy affect higher education institutions' intention to adopt MCC.
- H7: Service quality affects higher education institutions' intention to adopt MCC.

METHOD

This study employs a quantitative research approach to examine the relationships between independent variables and the adoption of mobile cloud learning. To collect data for the study, a survey instrument with 27 items was created (See Appendix A) by the researchers to meet the requirements of the research. The survey has two sections, with Section 1 focusing on participant and university demographics, while Section 2 measures the adoption of mobile cloud computing using a five-point Likert scale. The researchers received feedback from three academic experts to ensure the survey's structure and questions were unambiguous before conducting the preliminary study.

The study targeted academic members who had at least two years of work experience and were knowledgeable about their university's current state and new information technology. The survey employed both electronic and paper distribution methods, utilizing the accidental sampling technique wherein participants responded based on their availability and willingness (Almaiah & Al-Khasawneh, 2020). This approach was chosen for its efficiency and promptness compared to other methods demanding more resources and time. A sample size of 210 participants (refer to Table 1) was determined to ensure a reliable and robust analysis employing Structural Equation Modelling (SEM). As suggested by Kline (2015), a sample size of around 200 is considered appropriate for conducting a dependable analysis like SEM. Hence, it was decided that the minimum sample size for this study would be 200 participants. The determination of the sample size is also influenced by the type of test applied in data analysis (Patten,

2017). Patten (2017) notes that with a larger sample size, the error rate in generalizing the results tends to be lower. In this study, the data were subjected to analysis using Structural Equation Modelling (SEM), which is employed to scrutinize the initial data, validate the measurement, and assess the structural components of the proposed model. The findings from the analysis were employed to estimate indicator weights, loadings, and path coefficients between the exogenous and endogenous variables. Furthermore, the study conducted tests for convergent and discriminant validity to affirm the survey instrument's validity. The reliability of the survey was evaluated using Cronbach's alpha and composite reliability tests, utilizing the SPSS statistical tool.

Table 1
Respondents demographic data

Measure	Item	Frequency	Percentage
Gender	Male	129	61.40%
	Female	81	38.50%
Age	<20	63	17.10%
	20-26	136	64.70%
	>26	11	05.20%
Education Level	Bachelor's Degree	184	87.61%
	Master’s Degree	26	12.38%

FINDINGS

This section describes the outcomes of examining the suggested model in this investigation. The SEM methodology was utilized in this study to evaluate the effectiveness of the model for adopting mobile cloud computing and to assess its performance. SEM was chosen as the most appropriate method for this study because it can examine multiple relationships at once, whereas other statistical methods, such as multiple regression or multivariate analysis of variance, are only capable of analyzing relationships between individual variables (Byrne, 2013). Additionally, SEM is a confirmatory approach, unlike most other multivariate techniques which are descriptive and cannot effectively test a theoretical model. The AMOS software was utilized to analyze data through SEM because it is readily available and meets the requirements of this study. The following subsections outline the findings of the proposed model analysis using two types of analysis: measurement analysis and structural model analysis.

Exploratory factor analysis (EFA)

To assess the reliability of the measurement model, this study utilized Exploratory Factor Analysis (EFA) combined with Principal Components Analysis (PCA) to ascertain factor loading and reliability through Cronbach's alpha (α) for each construct within the proposed model. EFA, a technique employed to pinpoint the most pertinent items for each construct, was instrumental in this evaluation. An overview of the results, including Cronbach's alpha (α) for reliability analysis and factor loading values for all constructs, is presented in Table 2. Initially, for reliability analysis, the Cronbach's alpha coefficient (α) was applied to assess internal consistency among items within the same construct. Following Field's (2013) recommendation, values of Cronbach's alpha (α)

above 0.7 were deemed acceptable. As depicted in Table 4, all latent constructs demonstrated satisfactory reliability, with Cronbach's alpha exceeding 0.7. Subsequently, Principal Components Analysis (PCA) with Varimax rotation was executed to unveil the underlying structure for each factor in the research model. The PCA relied on factor loading values, with each item displaying factor loadings surpassing 0.7, as per the suggestion by Campbell and Fiske (1998). Any item with a factor loading below 0.7 was considered for removal from the construct's structure. The outcomes presented in Table 4 affirmed that all items were appropriately loaded onto the factors, each exhibiting loadings above 0.7, confirming the identification of all constructs.

Table 2
Internal consistency analysis using Exploratory Factor Analysis

Constructs	Items	Factor loadings (>0.7)	Cronbach's Alpha ($\alpha \geqslant 0.70$)
Perceived Usefulness (PU)	PU1	0.812	0.903
	PU2	0.799	
	PU3	0.843	
	PU4	0.803	
Perceived ease of use (PEOU)	PEOU1	0.782	0.864
	PEOU2	0.793	
	PEOU3	0.801	
	PEOU4	0.854	
Social Influence (SI)	SI1	0.811	0.867
	SI2	0.834	
	SI3	0.719	
Facilitating Conditions (FC)	FC1	0.854	0.863
	FC2	0.883	
	FC3	0.892	
	FC4	0.842	
Management Support (MS)	MS1	0.864	0.896
	MS2	0.816	
	MS3	0.794	
	MS4	0.873	
Perceived Security & privacy (PSP)	PSP1	0.873	0.796
	PSP2	0.817	
	PSP3	0.805	
	PSP4	0.856	
Service Quality (SQ)	SQ1	0.812	0.753
	SQ2	0.869	
	SQ3	0.810	
	SQ4	0.807	

Measurement analysis

To ensure the accuracy of the research, it is crucial to check the dependability of the instrument and the quality of the measurements before the main analysis. This involves evaluating the relationships between the factors in the proposed model and the items used to measure them, through two types of analysis: reliability and validity analysis. Composite reliability measures the consistency between items in the same construct and

is considered highly reliable if above 0.7, and acceptable if between 0.6 and 0.7 (J. F. Hair et al., 2012). Results from Table 3 show that the composite reliability values for most constructs exceeded the minimum threshold, indicating high reliability overall. Convergent validity was assessed using Average Variance Extracted (AVE), According to Hair et al. (2010), the acceptable value of AVE should be 0.5 or higher. with an acceptable value of 0.5 or higher. Results from Table 3 demonstrate that the AVE values for the constructs are all 0.5 or higher. On the other hand, discriminant validity was assessed by comparing the square root of AVE with correlations between the constructs. To have discriminant validity, the square root of AVE for each latent construct should be greater than the correlation estimated between the constructs (Fornell & Larcker, 1981). Results from Table 4 indicate that the square root of AVE for all constructs was higher than the correlation between them, providing adequate evidence of the discriminant validity of the constructs. Overall, the study provides reliable and valid measurements for the proposed model.

Table 3
Results of composite reliability and convergent validity

Constructs	Composite reliability (CR > 0.7)	Average Variance Extracted (AVE > 0.5)
Perceived Usefulness (PU)	0.89	0.74
Perceived ease of use (PEOU)	0.90	0.67
Social Influence (SI)	0.85	0.72
Facilitating Conditions (FC)	0.82	0.69
Management Support (MS)	0.86	0.62
Perceived Security & privacy (PSP)	0.81	0.74
Service Quality (SQ)	0.84	0.61

Table 4
Rotated pattern matrix (factor loading)

Constructs	PU	PEOU	SI	FC	MS	PSP	SQ
PU	0.85						
PEOU	0.464	0.88					
SI	0.462	0.436	0.81				
FC	0.492	0.462	0.431	0.78			
MS	0.368	0.385	0.468	0.353	0.85		
PSP	0.501	0.514	0.316	0.396	0.431	0.84	
SQ	0.468	0.469	0.372	0.414	0.479	0.427	0.81

Structural model analysis

Within this part, an examination of the proposed model is conducted at a structural level, bifurcated into two segments. The initial segment gauges the compatibility of the proposed model with the gathered data, employing a Goodness of Fit (GoF) analysis. The subsequent section involves the testing of the hypotheses postulated in the research model.

Model fit

To assess the adequacy of fit between the measurement and the proposed research model, a Confirmatory Factor Analysis (CFA) was executed, scrutinizing various model-fit indices. These indices encompass Chi-square/degree of freedom (χ^2/df), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), and Incremental Fit Index (IFI). Within this study, the Goodness of Fit (GoF) analysis played a pivotal role in Structural Equation Modelling (SEM), serving as a crucial step to assess the congruence of the proposed model with the acquired data (Fidell et al., 2013). Looking at the findings presented in Table 5, all factors of the model fit the data, with model fit indices indicating that the proposed model is well-fitting with the collected data. Specifically, the values of the model fit indices, including x2/df, GFI, AGFI, RMSEA, SRMR, NFI, NNFI, IFI, and CFI, were found to be 3.54, 0.912, 0.915, 0.042, 0.053, 0.921, 0.936, 0.911, and 0.935 respectively. Therefore, the analysis confirms that the proposed model fits well with the collected data.

Table 5
Results of model fit indices

Fit indices	Measurement model	Research model	Criteria
X2/Df	3.54	3.87	<5.00
GFI	0.912	0.917	>0.90
AGFI	0.915	0.906	>0.80
RMSEA	0.042	0.041	<0.06
SRMR	0.053	0.064	<0.08
NFI	0.921	0.923	>0.90
NNFI	0.936	0.941	>0.90
IFI	0.911	0.904	>0.90
CFI	0.935	0.927	>0.90

Hypotheses testing

Upon confirming the congruence of the proposed model with the collected data, the hypotheses within the research model underwent examination through standardized path analysis. The investigation focused on scrutinizing the connections between the constructs outlined in the proposed model. The findings, succinctly presented in Table 6, substantiated all hypotheses within the research model, revealing statistically significant positive effects. Specifically, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) demonstrated significant positive effects on the intention to adopt mobile cloud computing (H1 and H2, respectively). Additionally, Social Influence (SI), Facilitating Conditions (FC), Mobile Services (MS), Perceived Security and Privacy (PSP), and Service Quality (SQ) exhibited significant positive effects on the intention to adopt mobile cloud computing (H3, H4, H5, H6, and H7, respectively). Concerning the variances of the constructs influencing the intention to adopt mobile cloud, PEOU, PU, SI, FC, MS, PSP, and SQ collectively accounted for 84.6% of the variance in MCC adoption (R^2 = 0.826). This underscores the statistical significance of the proposed model in elucidating the adoption of mobile cloud technology.

Table 6
Hypotheses test results

No.	Hypotheses	Stand. coefficient Weights (β)	SE (P)	C.R.	Supported
H1	PEOU→ MCC Adoption	0.513*	0.005	41.242	Yes
H2	PU→ MCC Adoption	0.367*	0.007	32.353	Yes
H3	SI→ MCC Adoption	0.445*	0.003	28.345	Yes
H4	FC→ MCC Adoption	0.483*	0.010	31.345	Yes
H5	MS→ MCC Adoption	0.512*	0.006	28.232	Yes
H6	PSP→ MCC Adoption	0.472*	0.015	29.234	Yes
H7	SQ→ MCC Adoption	0.372*	0.002	31.341	Yes

* $P < 0.001$

DISCUSSION

The current study goes beyond previous research in the field of e-learning adoption by incorporating a comprehensive set of critical factors from relevant literature and applying them to the local context. Most previous studies in developed countries have focused on access to technology and context, while those in developing countries have primarily focused on individuals. However, this study offers a multidimensional approach that combines variables not previously integrated into a single framework, allowing for a more comprehensive examination of their validation and relationship. Researchers are cautioned against using a linear methodology to assess individual attitudes toward e-learning and are encouraged to adopt a multidimensional approach (N. A. Abdallah, 2018). This present investigation scrutinized the elements linked to technological and social aspects that might influence the inclination to embrace mobile cloud computing within higher education institutions in Palestine. The emphasis was placed on seven factors, encompassing service quality, perceived usefulness, perceived ease of use, perceived security and privacy, management support, facilitating conditions, and social influence, all of which could potentially influence the adoption process.

The study's findings reveal a significant influence of service quality on the decision-making process regarding the adoption of mobile cloud computing technology. This finding aligns with a prior investigation conducted by Park and Kim (2014). Moreover, the study underscores that the quality of service plays a pivotal role in motivating Palestinian universities to embrace mobile cloud services, a trend observed in other countries that have already incorporated mobile cloud technology (Arpaci, 2016; Hussein Alghushami et al., 2020). In essence, these outcomes underscore the imperative for mobile cloud providers to prioritize and ensure the quality of service as a fundamental measure to stimulate universities to adopt mobile cloud technology. On a different note, the study identifies a significant impact of security and privacy on the adoption of mobile cloud computing technology by universities. The positive correlation between these factors and the adoption decision aligns with findings from prior studies (Abdulfattah, 2021; Arpaci, 2016) emphasizing the critical role of security in the adoption of mobile cloud services. This insight highlights that the success of mobile cloud technology hinges on its capacity to furnish enhanced security, prompting

mobile cloud providers to invest in the development of reliable and trustworthy platforms that safeguard universities' sensitive data from unauthorized tampering, deletion, or fabrication. To sum up, security and privacy emerge as pivotal considerations for the university in the adoption of mobile cloud technology. Therefore, ensuring robust security and privacy measures for university data on the mobile cloud platform is poised to enhance the likelihood of mobile cloud computing technology adoption.

Perceived usefulness (PU) is the user's perception of how a specific innovation, such as technology, service, or system, can improve the performance of students' work. This paper proposes Hypothesis 2, which suggests that perceived usefulness has a significant impact on the adoption of mobile cloud computing. The study's parameter estimates indicate a statistically significant and positive relationship (H2: PU → AU; $\beta = 0.367$, t-value = 32.353, $p = 0.005$). Therefore, the empirical evidence supports the argument that the intention to adopt mobile cloud computing is positively influenced by the users' beliefs regarding its usefulness. Similar studies and research in the field of IS/IT adoption have also found that perceived usefulness significantly affects cloud computing adoption (Al-Hajri et al., 2021; Almaiah & Al-Khasawneh, 2020; Hussein Alghushami et al., 2020). The results suggest that universities recognize the potential benefits of mobile cloud computing, such as enhancing students' academic performance and providing access to learning materials anytime and anywhere. At the same time, the anticipation of efforts required for embracing IT innovations among users is encapsulated by Perceived Ease of Use (PEOU). In this study, PEOU is posited to exert a direct positive influence on the adoption of mobile cloud computing, as articulated in hypothesis 1. The envisaged connection between PEOU and MCC adoption, scrutinized through H1 (i.e., PEOU → AU), is deemed significant. Accordingly, the results derived from the parameter estimate ($\beta = 0.513$, t-value = 41.242, $p = 0.007$) substantiate the proposed hypothesis. The statistical analysis of the study indicates that given PEOU's robust predictability of MCC adoption, it holds the potential to contribute significantly to advancements in higher education. Notably, in contrast to Perceived Usefulness (PU), the influence of PEOU ($\beta = 0.513$) emerges as more pronounced on MCC adoption. These findings align with expectations and corroborate with analogous empirical studies conducted in a comparable context (Al-Hajri et al., 2021; Oliveira et al., 2014).

The investigation revealed that social influence significantly influenced the decision to embrace mobile cloud technology, aligning with earlier research that underscored trust as a pivotal element in the acceptance of new technology and online services (Abdulfattah, 2021; Almaiah et al., 2019). Consequently, the study's results posit that social influence stands out as a driving factor behind the adoption of mobile cloud technology. Corroborated by the findings of Nahil Abdallah et al. (2021a), Al-Hajri et al. (2021), and Hussein Alghushami et al. (2020), the outcomes also suggest that top management support plays a substantial role as a catalyst for mobile cloud computing (MCC) adoption. The parameter estimate results ($\beta = 0.512$, t-value = 28.232) indicate the statistical significance of this hypothesis at the $p = 0.006$ level, affirming that staff members' inclination to adopt mobile cloud computing is directly influenced by the availability of management support. The provision of diverse connectivity channels to assist academic staff in addressing IT and IS-related challenges promptly is projected to

have a positive impact on MCC adoption. Additionally, Hypothesis 4, posited as "Facilitating Conditions affecting higher education institutions' intention to adopt MCC," anticipates a positive and direct impact on the acceptance and adoption of mobile cloud computing. The parameter estimate results from Structural Equation Modelling (SEM) ($\beta = 0.484$, t-value = 31.345) pertaining to this hypothesis are statistically significant at the $p = 0.010$ level, endorsing the acceptance of the hypothesis. These outcomes imply that the presence of facilitating conditions amplifies the adoption of MCC, aligning with earlier research studies (Al-Hajri et al., 2021; Hussein Alghushami et al., 2020).

IMPLICATIONS

This study carries several noteworthy implications for research. Firstly, it makes a valuable contribution to the realm of mobile cloud computing, particularly as a nascent technology, by scrutinizing its adoption within higher educational institutions in Palestine. Secondly, the proposed model for mobile cloud adoption integrates pivotal factors from the literature review while also assessing the impact of novel elements not explored in earlier studies on universities' adoption of mobile cloud services. Additionally, this research stands out as among the first to delve into the influence of both technological and social factors on university's decisions to adopt mobile cloud computing technology, a consideration often overlooked in prior studies. The study offers distinctive insights, identifying quality of service, security, top management support, social impacts, and privacy as paramount factors enhancing the likelihood of mobile cloud computing technology adoption. Finally, this research not only addresses research gaps but also conducts a thorough assessment of technological factors influencing mobile cloud computing adoption, encompassing perceived usefulness, perceived security, perceived privacy, trust, relative advantage, and perceived ease of use. Consequently, it enriches the understanding of the prevailing circumstances and success determinants in mobile cloud adoption, particularly within private and public universities in Palestine and analogous developing countries.

CONCLUSION

Despite the manifold advantages that mobile cloud computing technology brings to educational institutions, encompassing cost reductions in software, hardware, and data processing, along with extensive network access and flexibility, its integration within Palestinian universities remains constrained. In response, this study introduces an all-encompassing model designed to pinpoint the pivotal factors that could catalyze the adoption of mobile cloud computing technology in Palestinian universities. This model incorporates factors previously recognized in the literature, alongside novel elements not explored previously, aiming to scrutinize their impact on mobile cloud computing adoption. Empirical validation of the model was undertaken utilizing data gathered from 210 academic staff members. The outcomes underscore the significance of quality of service, privacy, security, usefulness, ease of use, management support, and social influence as the foremost factors amplifying the likelihood of mobile cloud computing adoption.

Subsequent research endeavors have the opportunity to enhance this model by integrating additional factors, notably exploring the influence of cultural elements on mobile cloud adoption. It is essential to note that this study exclusively focused on one private university in Palestine, leaving room for future investigations to delve into mobile cloud adoption within public and private universities, allowing for a comparative analysis between the adoption dynamics of public and private institutions. Furthermore, the current study primarily gauged mobile cloud adoption from a technological standpoint, suggesting a potential avenue for future research to extend its scope to behavioral and individual levels. This could be achieved by leveraging established theories in IT adoption, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). Lastly, while the present study engaged academic staff, future research could broaden its perspective by incorporating insights from IT staff, who possess an in-depth understanding of emerging information system technology, offering nuanced insights into critical adoption-related issues. In summary, the proposed model yields valuable insights into mobile cloud computing technology adoption, potentially informing the development of implementation guidelines for universities, mobile cloud providers, and decision-makers alike.

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Appendix A

Table A. Constructs and their Measurement Items.

Construct	Measurement Items
Perceived Usefulness	- Using MCC permits us to perform specific tasks more quickly - MCC can lessen IT expenses. - The use of MCC enables people to seize new educational and research opportunities. - The use of MCC services improves the quality of operations.
Perceived ease of use	- Cloud computing is compatible with our institution's current hardware and software infrastructure - Interacting with the system requires minimal effort and learning. - Learning to operate the system is straightforward and does not demand extensive training. - Customizing the system to suit individual needs is perceived as uncomplicated.
Social Influence	- The institution thinks that cloud computing has an influence on competition - The institution is under pressure from competitors to adopt cloud computing. - Authorities and colleagues think it's a must to use MCC
Facilitating Conditions	- MCC is suitable for our institution's IT infrastructure - The institution has the necessary technical, managerial and other skills to implement cloud computing. - The institution has sufficient technological resources to implement cloud computing, including high bandwidth connectivity to the Internet. - The institution hires highly specialized or knowledgeable personnel for cloud computing.
Management Support	- The institution's top management advocates the implementation of MCC - The institution's top management demonstrates strong leadership and gets involved in the process with respect to MCC - The institution's top management is aware of the benefits of MCC - The institution's top management provides resources for adopting MCC
Security	- Our institution is concerned about data security in MCC - The institution is concerned about privacy in cloud computing. - The institution is concerned that data cannot be manipulated by online criminals or hackers - The institution is concerned with no official data is used for commercial benefit by cloud providers
Service quality	- The mobile cloud computing service consistently performs without disruptions." - The system responds promptly to user commands and requests. - Users experience minimal delays when interacting with the mobile cloud computing service. - The mobile cloud computing service is consistently available when needed.