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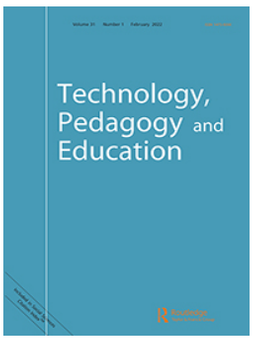

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RESEARCH ARTICLE

Exploring the factors influencing mobile technology integration in higher education

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ABSTRACT

This study proposed and tested an empirical model to examine the relationships between the factors influencing mobile technology integration in higher education from the students' and faculty points of view. A sequential mixed method was used to meet the aim of the study. The findings of the qualitative phase were used to develop the quantitative instrument. The participants in the qualitative data collection were 39 students and faculty members. In addition, the participants were 300 graduate students from two large universities in northern Palestine. The findings of the study revealed that the proposed model helps in explaining factors affecting students' mobile technology integration and exploring relationships between the factors. Furthermore, students' attitudes and beliefs, the quality of service, patronisation, the cost of service and the instructors had a significant impact on students' mobile technology integration in higher education.

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Mobile technology; mobile devices; higher education; path analysis; mobile technology integration

1. Introduction

With the development of advanced technology, many higher education institutions (hereafter HEIs) worldwide are working to develop and enhance their learning systems and provide the best educational experiences for students and staff. Many universities have adopted different initiatives to achieve these goals in using mobile technology. Criollo-C et al. (2018) pointed out various advantages of using mobile technology in teaching, such as ensuring accessibility in education, availability of education and resources anywhere and anytime, motivational and flexible. Zhai (2021) reflected on the value of mobile technology, as it significantly extended the dimension of time and space of learning. The findings of previous studies have revealed that mobile technology can be an effective tool for learning activities in both public and higher education (Chang et al., 2020; Criollo-C et al., 2018; Crompton & Burke, 2018). In a systematic review by Crompton and Burke (2018), it was suggested that HEIs could use mobile technology to assist both instructors and students. HEIs invest a large percentage of their budget to enhance mobile technology infrastructure through strengthening the Wi-Fi network, training faculty to use mobile technology for academic purposes and implementing various mobile services (Pimmer et al., 2016). Investment in mobile technology integration in HEIs for learning requires the understanding of both students and staff to adopt and accept mobile technology for learning. Mobile technology integration in HEIs for academic purposes requires assessing students' and instructors' readiness to use mobile technology in their practice. As mobile technology proliferates and there are different types of devices, it can be conceived that it has potential to be suitable for teaching and learning in HEIs (Eppard et al., 2016; Khaddage et al., 2016). Traxler (2009) pointed out

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that students in HEIs may be ready to use mobile technology faster than K–12 students because they already have these devices. Moreover, acceptance of mobile technology among HEIs students is crucial to ensuring the successful implementation of mobile technology in HEIs.

Many countries in the Middle East region have adopted mobile technology integration initiatives in both K–12 and HE (Khlaif, 2018a; Mussa, 2020). For example, in Palestine, most of the universities have a specialisation centre for e-learning and offer different electronic services, such as registering, sending and receiving grades, communicating with instructors and accessing learning resources (Shraim & Crompton, 2015). Previous studies conducted in Palestine mentioned that Palestinian universities have initiatives to use mobile technology such as 'bring your own device' and competitions for the best mobile application in the institution owing to the availability of infrastructure to use mobile technology (Atallah & Abu Ghosh, 2015; Shraim & Crompton, 2015). However, as mentioned in previous studies, the accessibility of mobile technology does not guarantee that it will be used for learning, and there is a lack of technology use for educational purposes (Balliammanda, 2021; Khlaif, 2018).

Readiness is defined as the quality of being willing and ready to use something new (*Oxford Advanced Dictionary*, n.d.). For the current study, readiness is the ability of students and instructors in HEIs to adopt and use mobile technologies for academic purposes. Nikolopoulou et al. (2020) examined teachers' readiness to adopt mobile learning, and they found that teachers expressed positive perceptions of mobile learning readiness, such as the possibilities of mobile learning, ICT training and attendance ICT conferences. However, Hu et al. (2020) believed there was little research regarding using mobile technology within HE from a teaching perspective.

Studies have revealed different definitions for mobile technology. For example, Khlaif (2018) defined mobile technology 'as any small devices with an Internet connection and edit functionality' (p. 51). In addition, Wang et al. (2013) defined it as any small device such as a smartphone, personal digital assistant (PDA), digital audio player and use of wireless internet. For the aim of the present study, mobile technology is defined as 'any small device such as a smartphone, and a tablet that can be used for academic purposes as well as using Wi-Fi Internet' (Khlaif, 2018).

There is a shortage of studies to understand the relationship between factors impacting mobile technology integration in HE from the students' perspectives. Therefore, it is important to identify and understand the important factors that influence students to accept mobile technology from the students' perspectives (Almaiah et al., 2019). Furthermore, many of the systematic reviews that have been conducted by researchers have not provided evidence about the actual state of the factors influencing the use of technology in HE in the Middle East, particularly in the Arab world (Crompton & Burke, 2018; Khan et al., 2015; Pollara & Broussard, 2011). Within the Palestinian context, little is known about mobile technology adoption and acceptance among students in HE institutions as it is still an under-developed area of research in the Arab region, which was the motivation to conduct this study. With this identified gap in academic understanding, the current study seeks to propose and examine a model to explain the relationships between the factors that influence students' use of mobile technology in HE, providing some insights into the different factors that could influence the use of mobile technology in HE as seen from the students' point of view. The present study is predicted to help the decision-makers in HE institutions change and adopt new policies to enhance the infrastructure for their institutions to adopt mobile technology in the learning process (Al-Hunaiyyan et al., 2018).

2. Literature review

2.1 Mobile technologies in HE

Mobile technologies in HEIs include all devices and applications that are portable, handheld, lightweight and equipped with internet that can be accessed from anywhere and at any time (Lee et al., 2020). The popularity of mobile technology and its affordability in HE has encouraged institutions to consider using it as a new medium of instruction (Al-Adwan et al., 2018). However, in many cases, the

outcomes of using mobile technology do not meet the expectations of HE institutions. Many researchers believe that the factors that influence mobile technology use in HE and the relationships between these factors have not been explored (Briz-Ponce et al., 2017; Lijanporn & Khlaisang, 2015; Siyam & Abdallah, 2021). Moreover, Ahmed et al. (2017) extracted seven factors that best represent the acceptance of mobile technology for university education. These factors were facilitating condition, hedonic motivation, price, social influence, effort expectancy, habit and behaviour intention.

Furthermore, Pimmer et al. (2016) mentioned that there is little knowledge available about the use of mobile technology for learning in HE settings from the students' perspective. In addition, Venkatesh et al. (2003) recommended future research including developing a deeper understanding of the factors associated with new technology use in higher education based on his model.

2.2 Factors influencing mobile technology integration in HE

In a recent study, Bernacki et al. (2020) emphasised that mobile technology is appropriate for enhancing a student-centred approach and supporting education since students and faculties can use it at any time and anywhere. Various factors and challenges exist for mobile technology in education, for example, individual factors (Karaca et al., 2013), perceived usefulness (Zhai & Shi, 2020) and contextual factors (Bernacki et al., 2020). In addition, the lack of self-efficacy to integrate technology is considered crucial because it can affect the educators' characteristics in the use of mobile technology (Kwon et al. 2019). Meta et al. (2021) indicated that mobile technologies are used more as instructional tools in HE, especially in teacher training courses. Integration of mobile technology in the learning process provides instructors with the chance to reimagine education (Heflin et al., 2017; Nakra, 2021).

Other studies have explored the relationship between the factors that influence mobile technology in HE settings. For example, Aburub and Alnawas (2019) developed a structural equation model by using AMOS 26 to investigate the factors that impact the use of mobile technology in HE. The findings revealed that the perceived use had the highest influence on the attitude towards integration of mobile technology. Furthermore, Abu-Al-Aish and Love (2013) constructed a model to explore the relationships between the factors by using the Unified Theory of Acceptance and Use of Technology (UTAUT). The authors pointed out that quality of service, individual innovativeness, ease of use and influence of instructors were significant factors impacting mobile technology integration.

Qteishat et al. (2013) found that patronisation, which is support from the university to use mobile technology, and attitudes had a significant positive influence on students' use of mobile technology. Kim et al. (2017) developed a model to explore the relationship between the relative advantage of mobile technology, the complexity of mobile technology and resistance to the use of mobile technology. The findings demonstrated that relative advantage increased students' adoption of mobile technology. Conversely, where there was more complexity in mobile technology, this produced more resistance to use it (Kim et al., 2017).

Moreover, Hu et al. (2020) used the UTAUT2 model to explore instructors' acceptance, preparedness and adoption of mobile technologies in HE institutions in China. The findings of their study emphasised existing findings in terms of the factors that affected technology use in HE, including performance expectancy and facilitating conditions such as infrastructure and availability of support from colleagues.

Based on the findings of previous studies, many factors influenced readiness to use mobile technology in HE, and they can be categorised on the individual and institutional level. However, these studies did not focus thoroughly on the complex relationships between the factors (direct, indirect and total effects), and most of these studies used existing instruments for data collection which differs from the present study, which developed an instrument based on students' views. Moreover, the findings of the previous studies were based on instructors' perspectives rather than students' perspectives in HE.

2.3 Justification of the need for a new model

Many studies have proved UTAUT to be a valid and robust model for predicting users' acceptance and adoption of new technologies, and it has received a high level of attention among researchers compared with other models; however, it has deficiencies, as reported by different researchers. For example, Dwivedi et al. (2019) argued that the moderating variables in the UTAUT model may not be applicable in all contexts, and ignoring the effect of moderating variables might be distorting the actual performance of the model. Furthermore, Hoi (2020) suggested conducting empirical studies on instructional approaches in HE institutions to improve mobile learning in the context of developing countries. Moreover, Chao (2019) reported that doubts exist over UTAUT's capability to explain technology acceptance among individuals and mentioned that much research has been conducted to extend the original UTAUT to include new variables to improve the model.

A study conducted by Doleck et al. (2017) confirmed that UTAUT does not have much more explanatory power than the Technology Acceptance Model (TAM). This is consistent with Venkatesh et al. (2003), who mentioned that the existing eight models were able to explain up to 70% of the variance of usage behaviour and recommended future research including developing a deeper understanding of the factors associated with new technology use in different contexts. Ooi and Tan (2016) discussed the limitations of UTAUT in describing mobile services adoption because potential users are mobile consumers and react differently in a mobile environment compared to the electronic environment. For example, mobile users are more heavily influenced by factors such as screen size, storage and battery life, access speed and text input compared to desktop users. Therefore, the UTAUT constructs are not suited for use in mobile studies (Ooi & Tan, 2016). Estriegana et al. (2019) reported that the approaches of using technology voluntarily or obligatorily can produce different results. Whilst a number of studies have been conducted to explore acceptance and adoption of mobile technology, little consideration has been paid to investigating influencing factors that affect the acceptance of mobile technology from the students' viewpoint (Almaiah et al., 2019). In addition, existing studies do not have a comprehensive model regarding important factors for accepting technology among HE students (Almaiah et al., 2019).

Based on the findings of the studies mentioned in the previous paragraphs, there is a lack of consistency in the literature about the role of the UTAUT model in the acceptance of mobile technology. Most of these studies could not be applied in the Palestinian context because of differences in mobile technology use and restrictions on mobility. However, despite the inconsistency among the findings of previous studies, the researchers selected UTAUT to develop a proposed model for the current study in order to achieve a solid base to explain why students accept or reject mobile technology in HE institutions in Palestine. Based on that, the UTAUT forms the theoretical foundation of the proposed research model for this study.

2.4 Research model

In response to the findings of previous studies investigating the factors affecting mobile technology integration, this study developed a research model and hypothesised the relationships between these factors as illustrated in Figure 1.

2.5 Research questions

The current research aims to introduce and test a proposed model of mobile technology integration in HE from the perspectives of students and faculty members. The proposed model contains the most crucial factors influencing students' integration of mobile technology in HE. The research questions that drove the study were:

- What are the important factors impacting use of mobile technology as perceived by higher education students in Palestine?

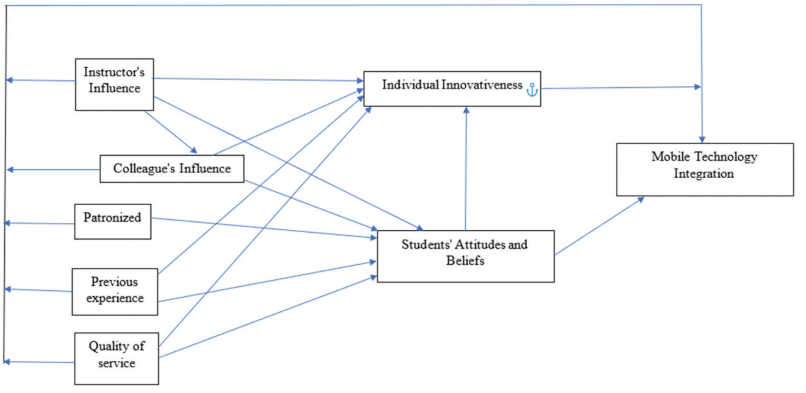

Figure 1. Hypothesised model.

- What is the best model to explain the relationships between instructors' influence, colleagues' influence, patronisation, previous experience, quality of service, individual innovativeness, students' attitudes and beliefs, and mobile technology integration by students in higher education settings in Palestine?

3. Research methods and design

To achieve the aims of the present study, a mixed-methods approach was used. Creswell et al. (2007) called it sequential mixed methods; the result of one phase is used to develop the other phases of the study. In the qualitative phase, we conducted interviews with 10 faculty members from different backgrounds and fields and 18 students. In addition, we led a focus group composed of five graduate students and six faculty members for one hour. Therefore, there was a total of 39 participants in the qualitative stage. The purpose of the interviews and the focus group session was to explore the important factors impacting use of mobile technology in HE at a deeper level and to develop the items of the quantitative data collection tool. Therefore, the findings of the qualitative phase assisted the researchers to develop the items of the survey. Finally, the survey was used for data collection to construct the path model and test it.

3.1 First phase: semi-structured interviews with faculty members and students and focus group session

The researchers developed an interview protocol (Appendix A) to guide the process of collecting qualitative data. The protocol consisted of data about the research, its title and purpose as well as why the researchers chose the participants for the interview. The interview protocol informed the participants of the confidentiality and anonymity of the study and the length of the interview. In addition, it comprised the interview questions, which were developed based on the framework of the UTAUT model (Venkatesh et al., 2003) and previous studies such as Chao (2019), and Abu-Al-Aish and Love (2014). The qualitative data were collected from two large universities in northern Palestine. A criterion sampling method was used to select the universities based on predefined criteria. The aim of this phase was to explore the most important factors influencing use of mobile technology in HE. The main criteria for selecting the universities were the availability of different electronic services on campus, the university having a clear vision to use mobile technology on campus, and free Wi-Fi available everywhere and at any time on campus.

Students and faculty members were chosen to participate in the study based on voluntary participation, and there was at least one student from each department in the School of Social Sciences and Natural Sciences, as participants in different areas have different perspectives on technology integration (Creswell et al., 2007). The criteria for choosing the faculty members were using mobile technology in their courses and being willing to participate in the study. The researchers conducted interviews with one student from each department. Students were selected based on voluntary participation and use of mobile technology in their studies on and off campus. The researchers continued interviewing participants until they reached a saturation point in getting new themes. The final sample of participants was 18 students from different departments and schools. There were 12 females (60%) and six males (40%). Semi-structured interviews were one-to-one for 20–30 minutes. Interviews were scheduled based on time the students had available, and some were conducted on Skype and others at the university. Interviews focused on the utilisation of mobile technology on campus for academic purposes. Participants signed a consent form to record the interviews. Table 1 presents demographic information about the participants in the qualitative data collection process (semi-structured interviews and focus group discussion).

In terms of faculty member participants, six (60%) were male and four (40%) female. All the interviews lasted for 30 minutes and were conducted on campus in their offices. The focus group was composed of five graduate students and six faculty members and lasted for one hour at An Najah National University. The participants of the focus group were from the two universities. We used the suggestions of Braun and Clarke (2006) to analyse the qualitative data. The procedures we used were transcribing the audio files, analysing line-by-line looking for ideas and concepts related to the factors impacting students' use of mobile technology and then grouping these into themes and subthemes.

The findings of the qualitative data analysis revealed two themes: mobile technology use and factors influencing mobile technology integration. The first theme describes the ways students use mobile technology for academic purposes and the type of mobile technology they usually use. Most of them mentioned that they use a smartphone to access the internet to check their emails and to view the information from their department. This category helped the

Table 1. Participants in the qualitative data collection phase ($N = 39$).

Variable	Category	Frequency	Percentage (%)
Gender	Male	17	43.6
	Female	22	56.4
Age	> 20	6	15.4
	21–25	14	35.9
	26–30	3	7.7
	31–35	5	12.8
	36–40	4	10.3
	< 40	7	17.9
Education Level	PhD	13	33.3
	Master's	3	7.7
	PhD student	2	5.1
	Master's student	3	7.7
	Undergraduate	18	46.2
Do you have mobile technology?	<1 year	4	10.3
	1–3 years	6	15.4
	3–5 years	8	20.5
	5–7 years	10	25.6
	< 7 years	11	28.2
Mobile internet usage	< 1 h	12	30.8
	1–3 h	13	33.3
	3–5 h	6	15.4
	5–7 h	5	12.8
	<7 h	3	7.7

Table 2. Frequencies of factors affecting mobile technology use in HE.

Factor	*F*
Attitudes and Beliefs	87
Quality of Service	69
Previous Experience	63
Patronised	55
Individual Innovativeness	40
Instructor's Influence	39
Colleagues' Influence	30
Study Field	10
Lack of Time	8

researchers identify the type of mobile devices students use on campus. The second theme helped the researchers develop and design the instrument in phase two. To recognise the factors that make important contributions to students' use of mobile technology in HE settings, the frequency of each factor was counted, which helped the researchers determine the most common factor mentioned by the participants. Table 2 shows the frequency of the most influencing factors.

3.2 Second phase: instrument design and development

Development of the constructs of the survey and its 29 items was based on the findings of the literature review, the findings of the qualitative data analysis and the UTAUT model, which was the framework of the study. The constructs were attitudes and beliefs, colleagues' influence, instructors' influence, quality of service, individual innovativeness, patronisation, previous experience and readiness to use mobile technology. Nine out of the 29 items were adopted from the UTAUT constructs. Therefore, the researchers created a pool of items and chose the items to be in the survey based on the constructs of the UTAUT model and the findings of previous studies, including Venkatesh et al. (2003), Cimperman et al. (2016), Hoque and Sorwar (2017), and Šumak et al. (2017). The three items of the individual innovativeness construct were adapted from the individual innovativeness scale developed by Hurt et al. (1977) with slight modifications to meet the purpose of the study. The four items of the quality-of-service construct were adapted from the study conducted by Abu-Al-Aish and Love (2013), which focused on using mobile technology in HE.

The rest of the items of the constructs were developed based on the findings of the qualitative phase. The researchers created a pool of items from participants' voices in a series of steps. In the first step, the researchers agreed to include the factors of highest frequency, which were students' attitudes and beliefs, quality of service, previous experience with mobile technology, patronisation, individual innovativeness, instructors' influence and colleagues' influence. The researchers then started to develop items for each factor based on the qualitative data. The next step was to revise the items based on previous studies and to word the items to make them understandable. Finally, five specialists in HE and educational technology revised the final draft of the survey to assess and validate the content.

The first part of the survey was related to the characteristics of the participants, including gender, age, education level, having mobile technology and using Wi-Fi. A 5-point Likert scale was used to score the survey responses. It consisted of five answer options ranging from *strongly agree* to *strongly disagree*.

We conducted the pilot study with a sample of 80 graduate students. The validity, reliability and poorly worded items had been checked. Exploratory factor analysis (EFA) was conducted to identify the main factors, and different procedures were used to check the loading factors for each item, such as the varimax rotation method. Items loading on more than one factor and having a coefficient

Table 3. Participants in the survey characteristics (N = 300).

Variable	Category	Frequency	Percentage (%)
Gender	Male	75	25
	Female	225	75
College	Social Sciences	202	67
	Science	98	33
Year Level	Graduate	131	44
	Fourth year	87	29
	Third year	35	12
	Second year	29	10
	First year	18	6

loading lower than 0.5 were removed from the list of items. To find out the number of factors, we used eigenvalue greater than 1 and scree plot. The final survey consisted of 29 items measuring eight constructs (see Appendix B).

3.3 Third phase: model building and testing

In this phase, we tested the proposed model (see Figure 1) to explain the casual relationships between the impacting factors and students' use of mobile technology. An online survey developed and designed using Google Forms was used to collect data from the participants. Graduate students in the Faculty of Education and Faculty of Science at two large universities in northern Palestine were invited to participate by sending secure emails, including the link to the online survey, to the participants with a short description of the research aims, the definition of mobile technology, the definition of mobile technology integration as well as examples of different types of mobile technology such as smartphones, tablets, mini-laptops, Wi-Fi and USB. The researchers obtained the students' emails from the learning systems at the universities. A total of 315 responses out of 350 emails were obtained. Fifteen surveys were excluded from data analysis because more than 5% of the data were missing. Therefore, the researchers reported data from 300 participants. Table 3 introduces demographic information about the participants.

To explore the complex relationships between the factors, AMOS 26 was used for path analysis between the factors. Different estimations were calculated, including the direct, indirect and total effects of each factor on mobile technology use.

3.4 Data analysis

An initial analysis was conducted to ensure the estimations of the model met the assumptions of multiple regression, including multicollinearity and normality of the residual of data and its linearity (Inan & Lowther, 2010a). SPSS (25) was used for descriptive analysis of the respondents, testing the validity and reliability of the measurement scores and to check the normality of the data. EFA was conducted on the data resulting from the survey. The findings of the analysis provided identification and verification of whether the proposed items on the survey were categorised into suitable groups for the factors. Of 33 items proposed on the survey, four items were removed because the loading factor was less than 0.5 and the item loaded on two factors (see Appendix B). After removing the four items, a second factorial analysis was conducted with the remaining items. The Kayser-Meyer-Olkin (KMO) measure of adequacy was 0.885.

4. Results

The correlation between the variables in the model was conducted by using bivariate correlations in SPSS and is presented in Table 4. The criteria to meet the multicollinearity is that the bivariate correlations between two variables should be less than 0.9 (Field, 2000).

Table 4. Pearson product-moment correlations between measures of use of mobile technology.

Measures	1	2	3	4	5	6	7	8
(1) Mobile Technology Integration	1							
(2) Quality of Service	.553**	1						
(3) Individual Innovativeness	.230**	.468**	1					
(4) Attitudes and Beliefs	.326**	.305**	.168**	1				
(5) Colleagues' Influence	.276**	.397**	.075*	.397**	1			
(6) Instructor's Influence	.368**	.198**	.080*	.696**	.434**	1		
(7) Previous Experience	−.002-	−.112-**	−.108-**	.014	.088*	−.021-	1	
(8) Patronised	.249**	.082*	.144	.104**	−.031-	.082*	−.030-	1

4.1. Estimations of the model

Cronbach's alpha values were estimated to check the reliability of the factors and their items (see Table 5). The researchers followed the criteria suggested by Fornell and Larcker (1981) to evaluate convergent validity. The criteria were that factor loading should be significant, equal or greater than 0.5, compound reliability should be greater than 0.7 and the average variance extracted (AVE) should be greater than 0.5. The estimations of the model show a strong fit between the model and the data (Chi-Square ($\chi 2$) = 33.568, $df = 13$, $\chi 2/df = 2.582$, $p < 0.05$). The reliability of the factors was acceptable and had values ranging from 0.73 to 0.87 (Abu-Al-Aish & Love, 2013).

4.2. Path modelling

Figure 1 shows the exogenous variables in the model, including instructors' influence, quality of service, patronisation and previous experience. In addition, colleagues' influence, individual innovativeness, attitudes and mobile technology integration were dependent variables in the model.

Table 5. Results for the measurement model.

Construct	Items	Factor extracted	Cronbach's alpha	Squared multiple correlations	CR	AVE
Attitudes and Beliefs	AB3	0.856	0.82	0.776	0.897	0.502
	AB5	0.845		0.658		
	AB2	0.821		0.793		
	AB1	0.798		0.581		
Colleagues' Influence	CI1	0.835	0.87	0.658	0.932	0.548
	CI4	0.811		0.457		
	CI2	0.793		0.354		
	CI3	0.754		0.458		
Instructor's Influence	II3	0.895	0.83	0.765	0.865	0.721
	II1	0.863		0.786		
	II2	0.811		0.423		
Quality of Service	QoS2	0.791	0.73	0.568	0.821	0.658
	QoS4	0.768		0.485		
	QoS6	0.742		0.389		
	QoS1	0.717		0.523		
Individual Innovativeness	INI3	0.953	0.88	0.874	0.931	0.5
	INI1	0.879		0.768		
	INI2	0.813		0.657		
Patronised	P1	0.865		0.798		
	P2	0.974	0.87	0.874	0.889	0.678
	P3	0.578		0.657		
Previous Experience	PE1	0.782		0.786		
	PE2	0.658	0.85	0.842	0.836	0.742
	PE3	0.864		0.687		
Mobile technology Integration	RU2	0.876	0.78	0.653	0.831	0.509
	RU3	0.832		0.458		
	RU1	0.784		0.354		
	RU5	0.732		0.578		
	RU4	0.698		0.481		

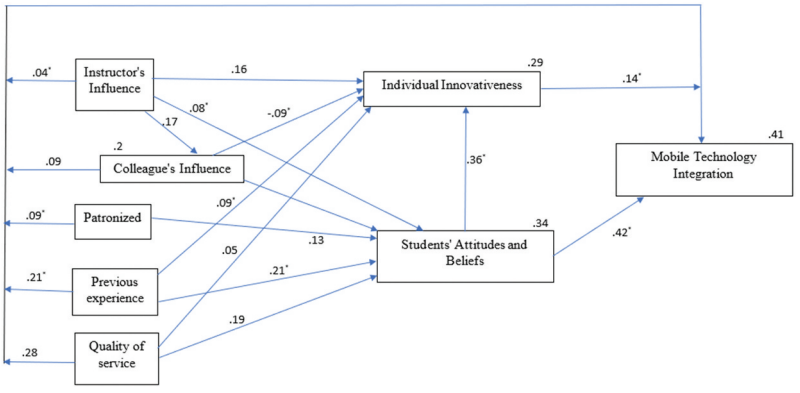

Figure 2. The estimated path coefficients of the model *$p < .05$, two-tailed.

Figure 2 presents the estimations of the path coefficients. The expected relationship between the factors was based on the UTAUT model and the findings of previous studies that clarified the relationship between these factors. Furthermore, model fit was examined using different fit statistics. These estimations are presented in Table 6.

The findings in Tables 5 and 6 show that the model is a good fit and explains the hypothesised model. Other estimations were calculated such as total, direct and indirect effects and are presented in Table 7.

4.2.1 Mobile technology integration

According to Table 6 and Figure 2, eight variables predicted 41% of the variance of use of mobile technology in HE. Students' attitudes and beliefs regarding mobile technology had the strongest direct effect (Beta = .422), followed by previous experience (Beta = .213) and individual innovativeness (Beta = .143). Instructors' influence did not have a significant direct effect on mobile technology use (Beta = .042); however, it was the highest factor influencing students' use of mobile technology owing to its high indirect effect. This was followed by quality of service (Beta = .104) and the partial mediation of endogenous factors through students' attitudes and beliefs, individual innovativeness and colleagues' influence.

The variables show significant total impact on students' use of mobile technology. Based on Figure 2, the following variables: students' attitudes and beliefs, previous experience, instructors' influence, individual innovativeness, quality of service and patronisation have influence on mobile technology integration in HE.

4.2.2 Individual innovativeness

In general, all the hypothesised paths were significant to describe the individual innovativeness construct, explaining 29% of its variance (see Table 6). Students' attitudes and beliefs (Beta = .357) had a significant direct effect on individual innovativeness, followed by instructors' influence (Beta = .16). Quality of service (Beta = .148) and previous experience had low positive direct effects on students' readiness to use mobile technology. Colleagues' influence (Beta = −.09) had a low negative direct effect on readiness to use mobile technology. Patronisation (Beta = .081) also had a low positive effect.

Table 6. The fit indices of the model.

Chi-square ($\chi 2$)	33.568, $df = 13$
Root Mean Square Error of Approximation (RMSEA)	037
Normed Fit Index (NFI)	933
Comparative Fit Index (CFI)	.927
Tucker–Lewis Index (TLI)	.984

Table 7. Direct, indirect and total effects of various factors on mobile technology integration.

Variables			
Endogenous (Dependent) Variable Mobile technology integration			
Exogenous (Independent) Variables	Direct Effects	Indirect Effects	Total Effects
Individual Innovativeness	.143*	-	.150
Students' Attitudes and Beliefs	.422*	.073	.495
Instructor's Influence	.042*	.186	.229
Colleagues' Influence	-	.024	.024
Quality of Service	.038	.104	.143
Patronised	.093	.025	.121
Previous Experience	.213	.018	.231
Endogenous (Dependent) Variable Individual Innovativeness			
Exogenous (Independent) Variables			
Students' Attitudes and Beliefs	.357	-	.357
Instructor's Influence	.16	.194	.354
Colleague's Influence	−.09	.037	−.053
Quality of Service	.05	.098	.148
Patronised	-	.081	.081
Previous Experience	.09	.013	.022
Endogenous (Dependent) Variable Students' Attitudes and Beliefs			
Exogenous (Independent) Variables			
Instructor's Influence	.488	.024	.512
Colleagues' Influence	.05	.049	.099
Quality of Service	.191	.071	.262
Patronised	.13	.096	.226
Previous Experience	.26	.065	.325

Instructors' influence (Beta = .186) had a strong indirect effect on readiness to use mobile technology, followed by quality of service (Beta = .104). The strongest total effects on readiness to use mobile technology were students' attitudes and beliefs (Beta = .357), instructors' influence (Beta = .354) and quality of service (Beta = .148). The only factor that had a negative low effect on mobile technology integration was colleagues' influence.

4.2.3 Students' attitudes and beliefs

According to Table 6, 34% of variance in students' attitudes and beliefs regarding using mobile technology was clarified by the present model. Instructors' influence (Beta = .488) had the strongest direct effect, followed by previous experience (Beta = .26) and quality of service (Beta = .191). Patronisation (Beta = .13) had a significant positive direct effect on mobile technology readiness. All the variables had low positive effects on use of mobile technology in HE. The highest total effect was instructors' influence (Beta = .512) through mediating factors, including colleagues' influence (Beta = .05); this was followed by previous experience (Beta = .325).

4.2.4 Colleagues' influence

Instructors' influence had a high effect (Beta = .17) on colleagues' influence, and 20% of variance in colleagues' influence was explained by the instructors' influence.

5. Discussion

By using a path analysis approach, a model of readiness to use mobile technology was developed based on the data collected in the present study. The path analysis approach enabled us to assess the relationships between the factors influencing students' use of mobile technology in HE in Palestine. The factors in the present model explained 41% of various significant amount of variance in use of mobile technology in the Palestinian context. The results of the present study indicated that

most of the hypothesised factors have a significant influence on students' use of mobile technology. The present study explained the complexity of mobile technology integration in HE and suggested new strategies to integrate mobile technology from practitioners in different countries, and future research into mobile technology integration in HE is necessary in Palestine and other countries in the Middle East region.

The most influential factor in students' readiness to use mobile technology in HE was students' attitudes and beliefs. This finding is consistent with the findings of existing studies (e.g., Briz-Ponce et al., 2017; Cheon et al., 2012; Qteishat et al., 2013).

Moreover, the current study found various factors that influence students' attitudes and beliefs and factors that influence individual innovativeness in HE settings. Many factors play a crucial role in students' attitudes and beliefs towards using mobile technology, such as instructors' influence and colleagues' influence, patronisation, previous experience and quality of service, which is congruent with previous studies (Abu-Al-Aish & Love, 2014; Qteishat et al., 2013). Furthermore, the findings of the present study reveal the factors that influence individual innovativeness, including instructors' influence, colleagues' influence, professional seniority and quality of service. These findings are important in giving clues as to how to change students' attitudes and enhance individual innovativeness through designing different strategies to foster these factors.

In addition, quality of service is a significant variable that affects students' use of mobile technology, which is in line with previous studies. One of the important findings in this study was that quality of service influences all the endogenous variables, which is also consistent with the findings of other studies. Abu-Al-Aish and Love (2013) found that quality of service has an important influence on behavioural intention to use mobile learning. Students will be eager to accept mobile technology for learning when the quality of service is seen as good and related to the students' field of study (Abu Aish & Love, 2013). Mobile devices such as smartphones and some tablets are not specifically designed for academic purposes, but instead as communication tools (Cheon et al., 2012; Hao et al., 2016) for listening to music, playing games, communicating over social media, surfing the Web and watching videos (Hao et al., 2016; Wang et al., 2013). Therefore, learning by using these devices requires concentration, willingness and readiness, and with the complexity of services, students' reluctance to use them is likely to increase (Kim et al., 2017).

Individual innovativeness, which is related to willingness to adopt new technology, had a significant influence on students' readiness to use mobile technology. This finding is consistent with existing studies (Kim et al., 2017; Milosevic et al., 2015) which point out that individual innovativeness affects the adoption and acceptance of new technology. Furthermore, the study revealed that the factors that influence individual innovativeness include instructors' influence, previous experience, quality of experience and students' attitudes and beliefs. In addition, the present study found that colleagues had a negative impact on individual innovativeness, which was inconsistent with and Inan and Lowther (2010a). Therefore, decision-makers could develop a strategy to enhance and foster innovation among students in HE. Patronisation, which is the degree of support from the institution, had a significant influence on all the endogenous factors.

5.1 Theoretical implications

Most mobile technology integration studies have been based on models such as the TAM and UTAUT models (Almaiah et al., 2019; Hu et al., 2020). Other studies have modified these theories to suit the context of the study (Cacciamani et al., 2018; Inan & Lowther, 2010a Khlaif, 2018), but the current study introduced a comprehensive model based on sequential mixed methods and found new factors from students' perspectives, as they are the practitioners who influence readiness to use mobile technology, and it examined the relationships between these factors. We argue that studies

on mobile technology integration in HE should take into consideration individual innovativeness, quality of service, as well as the cost of services as a new construct, and the instructors' influence on students to use mobile technology.

5.2 Managerial implications

The hypothesised model presented in the current study describes different variables influencing students' readiness to use mobile technology in HE. Consequently, decision-makers in universities could use these factors to enhance students' use of mobile technology. Our findings regarding the importance of quality of service, patronisation and instructors' influence are consistent with previous studies such as Abu-Al-Aish and Love (2013) and Aburub and Alnawas (2019). Improving students' attitudes and beliefs through working on the factors affecting their beliefs towards mobile technology integration in HE through training could increase mobile technology integration among students. Future research on the impact of individual innovativeness and instructors' influence should be conducted to have a clear picture about their influence on the use of mobile technology. Future research should also be conducted to check the validity of the model in different schools and universities as well as different contexts.

5.3 Limitations

The study has several limitations that create opportunities for future research. The current study focused on two large universities in northern Palestine; future research should cover a random sample of students from different universities and schools to include participants from different backgrounds and fields of study. The current study focuses only on students' readiness. Future research should focus on both students' and instructors' use of technology and compare their integration with students' use of mobile technology for academic purposes.

6. Conclusion

This study explored the variables affecting university students' mobile technology integration and indicated the relationships between these factors. The results show that 41% of the use of mobile technology in HE was predicted by our model. The direct, indirect and total effects of the exogenous variables and endogenous variables were estimated. Decision-makers in higher education institutions can develop their strategies and plans for enhancing mobile technology integration in HE settings.

Availability of data and material

The survey used for data collection was provided as supplementary material

The data is not available because of the privacy of the participants, and it is in the Arabic language.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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