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Citation: Ameen, Nisreen, Willis, Robert, Abdullah, Media Noori and Shah, Mahmood (2019) Towards the successful integration of e-learning systems in higher education in Iraq: A student perspective. British Journal of Educational Technology, 50 (3). pp. 1434-1446. ISSN 0007-1013

Published by: Wiley-Blackwell

URL: <https://doi.org/10.1111/bjet.12651> <<https://doi.org/10.1111/bjet.12651>>

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Towards the successful integration of e-learning systems in higher education in Iraq: a students' perspective

Nisreen Ameen, Robert Willis, Media Noori Abdullah and Mahmood Shah

Dr Nisreen Ameen is a researcher at Lord Ashcroft International Business School, Anglia Ruskin University, Cambridge, UK. Her research interests include human-computer interaction and information and communication technology (ICT) in education. Dr Robert Willis is a researcher and the director of research students at Lord Ashcroft International Business School, Anglia Ruskin University, Cambridge, UK. His research interests include emerging higher-education models and sustainability. Dr Media Noori Abdullah is a researcher at Salahaddin University, Erbil, Kurdistan, Iraq. Her research interests include the adoption of ICT. Dr Mahmood Hussain Shah is a Senior Lecturer in e-Business at the School of Strategy and Leadership. His research interests include e-learning, Cyber Security and Information Systems.

Address for correspondence: Nisreen Ameen, Lord Ashcroft International Business School, Anglia Ruskin University, Cambridge, UK, CBI 1PT. Email: nisreen.ameen@pgr.anglia.ac.uk.

Abstract

This study aims to analyse the factors that can explain the adoption and effective use of a new e-learning system in Iraq by using a selection of factors that were present in the technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT) models with three additional factors, and hypothesising new relationships between these factors. Questionnaires were distributed to 300 university students in Iraq. Partial least squares-structural equation modelling (PLS-SEM) was used to analyse the data received. The findings suggest that although e-learning can be used successfully in universities in Iraq, training on using the systems needs to be improved. In addition, the findings suggest that perceived usefulness (PU), perceived ease of use (PEOU), subjective norms (SNs), information quality (IQ), system quality (SQ), technical support (TS) and self-efficacy (SE) have significant effects on behavioural intention (BI). In turn, BI and technical support (TS) have significant direct effects on actual use (AU) of e-learning systems. The factors age, gender and experience significantly moderated some of the relationships in the model. The research has several implications for policy makers, universities and the management of e-learning systems.

Keywords: e-learning adoption, TAM, UTAUT, Iraqi universities, Salahaddin University-Erbil, partial least squares

Practitioner notes

What is already known about the topic:

- In developing countries, e-learning is still in the early stages.
- The success of the e-learning system depends on design, availability of the system and students' willingness to use it to obtain full advantage of the system.
- Only 42% of students in Iraq are satisfied with their educational experience.

What this paper adds:

- Provides a cohesive investigation of the key factors that influence students' behavioural intention (BI) and actual use (AU) of e-learning in Iraq.

- Analyses the factors specific to the successful use of e-learning systems in Iraq. These include technical support (TS), information quality (IQ), system quality (SQ), self-efficacy (SE) and subjective norms (SNs).
- Hypothesises new relationships between these factors and students' BI and AU of the e-learning system.
- Provides a case-study investigation of the use of e-learning systems in Iraqi higher-education institutions; this is necessary as there is a lack of research of e-learning adoption from the students' perspective in this country.
- Delivers validated results which confirm that the factors (PU, PEOU, SE, SQ, IQ and TS) have significant effects on students' BI and use of the e-learning system.

Implications for practice and/or policy

- To ensure the success of the e-learning system, a strong technical support team and robust and effective training is needed to build students' confidence. Instead of training instructors and relying mainly on them to teach students, the training should concentrate on the students themselves.
- Policy makers and universities should provide high-quality materials that are relevant to students' study modules and easy to access through the system.
- The presence of a strong technical support team that can target and address the students' needs and preferences is crucial to improve the system quality, information quality and the ease of use of the system which increases the use of the e-learning system.

Introduction

e-Learning has been defined as “learning facilitated and supported through the utilization of information and communication technology (ICT)” (Masrom, 2007, p.1). Previous studies explained the difficulties in operating successful e-learning systems in developing countries (e.g. Al-Azawei, Parslow, & Lundqvist, 2016; Kundi, & Nawaz, 2014). In particular, the existing body of literature on e-learning adoption in higher education in Arab countries is limited in comparison to other regions in the world (Mirza & Al-Abdulkareem, 2011; Al-Azawei et al., 2016). Within the context of using e-learning in higher education, Iraq represents a unique case. The country is considered behind in comparison to both developed and developing countries, due to several challenges as a result of lack of facilities, lack of financial support, limitations of accessibility to digital research and political unrest (Mako & Sullivan, 2014). According to the United Nations Development Programme (UNDP) 2016 report, only 42% of students in Iraq are satisfied with their educational experience. Previous research found that e-learning can be an effective tool to raise the standards and quality of education (Mirza & Al-Abdulkareem, 2011). Mako and Sullivan (2014) stated that academics and scholars in Iraq appreciate the role of e-learning systems in improving the experience of both students and academics. The authors stressed the need for a such a system.

Although some universities in Iraq have started using the e-learning system, they are still in the early stages (Elameer & Idrus, 2010a; Elameer & Idrus, 2010b; Thabit & Harjan, 2015). In 2010, the United Nations Educational Scientific and Cultural Organisation (UNESCO) launched the Avicenna Virtual Campus to improve the quality of learning by integrating online learning into higher education (an online virtual learning environment) (UNESCO, 2017). This project has been implemented in many European and Arab countries (Salahaddin University-Erbil, 2016). Iraqi universities joined when the project was launched in 2015 and the training of instructors and some students began, although the training was mainly focusing on the

instructors. The project has great potential but also presents challenges, which need to be investigated.

To the best of our knowledge, the vast majority of the existing studies on the successful use of e-learning systems in Iraq have focused on the infrastructure side or the perspective of IT staff, lecturers or instructors and collected data from them (including; Al-Din & Al-Radhi, 2008; Elameer & Idrus, 2010a; Elameer & Idrus, 2011; Anter, Abualkishik & Mashhadany, 2014; Thabit & Hajran, 2015; Fahad, Hassan, Sulaiman & Rahman, 2015; Radif, 2016; Sabr & Naemah, 2017). Only a few studies were concerned with the students' perspective. For example, Jamil (2017) conducted research to analyse the factors that can affect Iraqi students' behavioural intention towards the use of e-learning systems using the basic technology acceptance model (TAM) (Davis, 1989) factors. Al-Azawei, Parslow and Lundqvist (2017) conducted a study with the same purpose and used the same model. Keong, Hakoush and Dhulfiqar's (2014) research had the same purpose and used the basic unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) model factors. However, there is a gap in the literature in terms of conducting in-depth research analysing the factors that can affect Iraqi students' behavioural intentions, preferences and opinions on the successful use of the e-learning platform available to them by including factors that can explain the adoption and use of the e-learning system rather than using the basic factors from previous technology acceptance models.

This study aims to address the gap stated above by analysing the factors that can explain the adoption and effective use of the new e-learning system in Iraq by using a selection of factors that were present in the TAM (Davis, 1989) and UTAUT (Venkatesh et al., 2003) models with three additional factors and hypothesising new relationships between these factors. Therefore, it enhances our understanding of the factors that may influence e-learning adoption in Iraq in order to enhance the quality of education in the country.

Background on the use of e-learning in Iraqi universities

Previous studies showed that Iraqi universities are interested in integrating e-learning systems (Fahad et al., 2015). However, there is a lack of experience and effective planning of e-learning systems in most Iraqi universities (Elameer & Idrus, 2010a; Sabr & Neamah, 2017). Some universities in Iraq have started using the e-learning system but they are at the early stages (Elameer & Idrus, 2010a; Sabr & Neamah, 2017). Unlike other Arab countries, online learning has not been adopted in Iraq and the certificates obtained by students cannot be certified and accredited by the Iraqi Ministry of Higher Education (Elameer & Idrus, 2010b). Therefore, the use of e-learning is limited to the hybrid approach.

Andersson and Grönlund (2009) categorised the challenges facing e-learning use into four main categories namely; course challenges, challenges related to characteristics of the individual (student or teacher), technological challenges and contextual challenges (organisational, cultural and societal challenges). In general, the culture in Iraq is high in power distance (Greet-Hofstede, 2016). Within this culture, students view lecturers as the main source of information for their learning and they rely heavily on them in their learning progress (Andersson & Grönlund, 2009). This situation offers both challenges and advantages. When students have high reliance on lectures, they may not prefer to move away from the traditional ways of teaching (i.e. face-to-face). However, in high power distance and collectivistic societies such as the society in Iraq (Greet Hofstede, 2016), younger people (i.e. students) tend to respect and listen to the elderly (i.e. lecturers) and follow their advice and guidance. In addition, the lack

of electricity, computers and the Internet was found a major challenge facing the successful implementation of e-learning in developing countries (Rajesh, 2003; Eke, 2011).

Within the context of e-learning in Iraq, previous studies emphasised the importance of the overall e-learning system infrastructure (Elameer & Idrus, 2011; Sabr & Neamah, 2017) and usability aspects, for example, page and site design, context design, navigation, accessibility and usability which were highlighted in Elmeer and Idrus' (2011) study. The reason behind the high attention allocated to the technical aspect of the e-learning system is the low ICT infrastructure in Iraq (Heshmati, Al-Hammadany & Bany-Mohammed, 2013). This makes it unrealistic to investigate and analyse the factors that can encourage students to adopt the e-learning system without investigating system quality and infrastructure.

Research model and hypotheses development

The acceptance and use of technologies has been widely investigated in previous studies. One of the first theories used in technology acceptance was the theory of reasoned action (TRA) (Fishbein & Ajzen, 1980), which was primarily developed to understand and predict human social behaviour (decision making). This was followed by the TAM which is one of the most well-known models of technology acceptance (Park, 2009). The two main constructs in TAM were perceived ease of use (how easy the system is to use) and perceived usefulness (the outcomes gained from using the system).

Venkatesh and Davis (2000) further developed TAM to create TAM2, which was also purely developed for an organisational setting (for employees). The authors added subjective norm as one of the main constructs of the model. Later on, Venkatesh et al. (2003) developed the UTAUT. The model was built from an organisational point of view using organisational settings based on the TRA (Ajzen & Fishbein, 1980), the TAM (Davis, 1989), the motivational model (Davis, Bagozzi & Warshaw, 1992), the TPB (Ajzen, 1991), the combined TAM and TPB, known as the A-TAM (Taylor & Todd, 1995), the model of PC utilisation (Thompson, Higgins & Howell, 1994), the diffusion of innovation theory (Rogers, 2003) and the social cognitive theory (Bandura, 1986). The model included four main predictors, namely; performance expectancy (usefulness), effort expectancy (ease of use), social influence (subjective norm) and facilitating conditions referred to as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003, p.453). The model was then extended by Venkatesh, Thong & Xu, (2012) who developed the extended UTAUT (UTAUT2) to study the technology adoption in the consumer context. In both the UTAUT (Venkatesh et al., 2003) and the UTAUT2 (Venkatesh et al., 2012), age, gender and experience were included as moderators that can affect the relationships between the independent and the dependent factors. These moderating factors were found significant in previous studies on technology adoption outside and within Arab countries (Venkatesh & Davis, 2000; Ameen, 2017).

Previous studies have emphasised the importance of the overall infrastructure and usability of the system (Elameer & Idrus, 2011). For example, page and site design, context design, navigation, accessibility and usability were part of a framework created by Elameer & Idrus (2011). Anter, Abdulkishik & Mashhadany (2014) proposed a new e-learning model for students in Iraq. The model was holistic, as it covered all the elements of an efficient e-learning system: student activities, teacher activities and the administration team. It was based on three main technical factors: the availability and accessibility of services and information; flexibility in updating system components (i.e. services and materials); and the management of services and infrastructure from a central web server. Considerable attention was paid to the technical

aspects of the e-learning system because the level of ICT infrastructure in Iraq is considered to be low (Heshmati et al., 2013). This makes it unrealistic to investigate and analyse the factors that may encourage students to adopt an e-learning system without investigating the quality of the system and the ICT infrastructure in the country as a whole. Therefore, the conceptual model proposed in this research integrates three additional factors which are anticipated to have strong effects in the model including; technical support, system quality and information quality.

The model proposed in the present study uses four independent variables, many of them were present in TAM (Davis, 1989) and UTAUT (Venkatesh et al., 2003) including perceived usefulness (PU), perceived ease of use (PEOU), subjective norms (SN) and self-efficacy (SE). We integrated three additional independent factors including; technical support (TS), system quality (SQ) and information quality (IQ). The proposed model includes behavioural intention (BI) and actual usage of the e-learning system (USE) as the dependent factors. In addition, the model integrates three moderators namely; age, gender and experience.

Venkatesh et al. (2003) found that attitude does not have a significant effect on intention. They stated that attitude can be found within the effects of performance expectancy (usefulness) and effort expectancy (ease of use). Thus, this study did not include attitude. Instead, following Venkatesh et al.'s (2003) findings, the research framework included BI to mediate between the independent variables in the model and USE. We also hypothesise new relationships between these factors which have not been explored in previous studies (as shown in figure 1 below).

Figure 1 shows the main constructs of the proposed model.

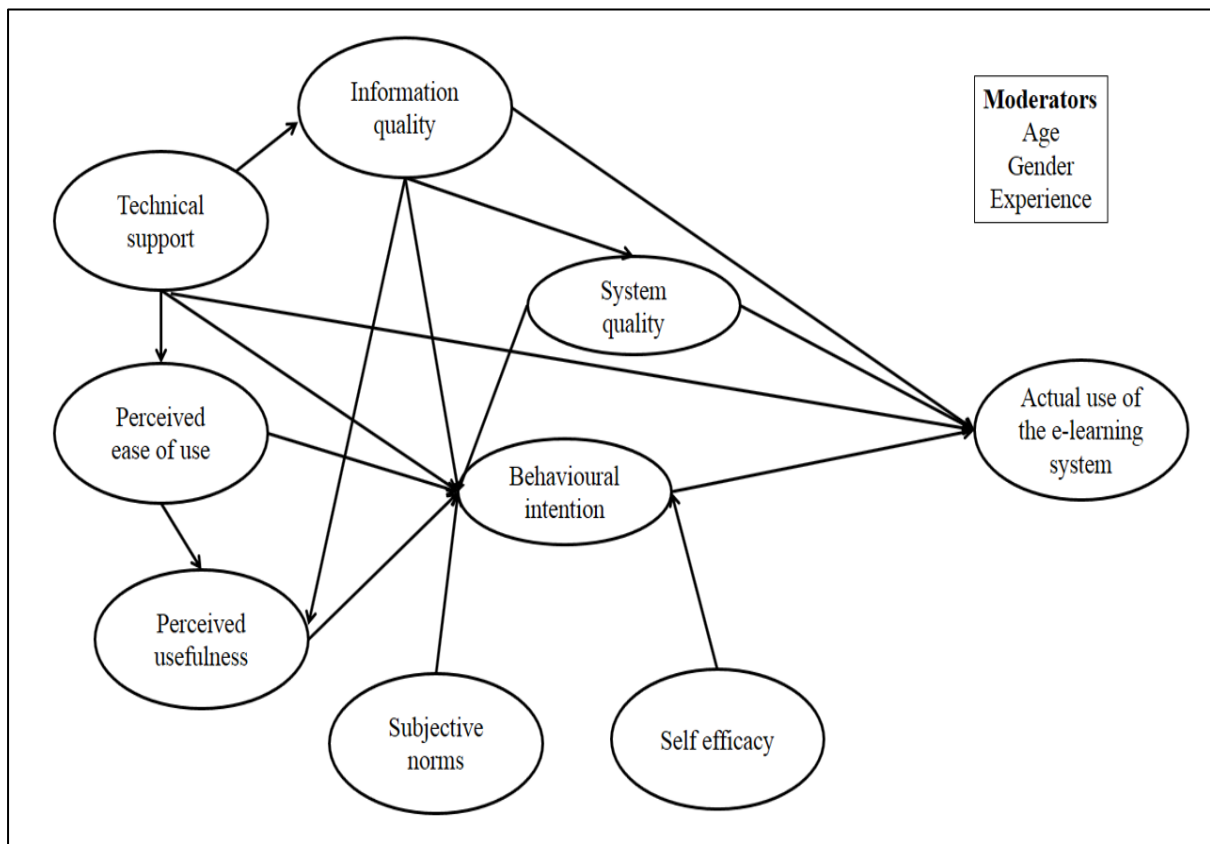


Figure 1: Proposed research model

The following sub-sections illustrate the main constructs of the model developed in this study.

PU

PU has been defined as the degree to which a person believes that using a particular system would enhance his or her performance (Davis, 1989; Davis, Bagozzi & Warshaw, 1989; Venkatesh et al., 2003). From a student's perspective, integrating e-learning into the learning process in higher education may be useful because they can access various resources and lecture slides at any time, it saves time, it is more flexible and it gives them greater control over their work, which enhances productivity in learning. Therefore, we propose the following hypothesis:

H1: PU will have a significant effect on students' BI to use the e-learning system in the Iraqi context.

PEOU

PEOU has been defined as the degree to which a person believes that using a particular system would be free of effort (Davis, 1989; Davis *et al.*, 1989; Venkatesh et al., 2003). Previous studies have found that PEOU is important in the context of e-learning adoption (e.g. Abbad, Morris & Nahlik, 2009). Moreover, it was found to have a significant effect on PU (Davis et al., 1989; Moreno, Cavazotte & Alves, 2017). If the e-learning system is easy to use, students will realise its benefits further. Thus, we propose the following hypotheses:

H2a: PEOU will have a significant effect on students' BI to use the e-learning system in the Iraqi context.

H2b: PEOU will have a significant effect on students' PU to use the e-learning system in the Iraqi context.

SNs

SNs are defined as "the person's beliefs that specific individuals or groups think he/she should or should not perform the behaviour and his/her motivation to comply with the specific referents" (Fishbein & Ajzen, 1980, p.8). This construct was also found to be significant in other studies (e.g. Venkatesh et al., 2003; Tarhini, Hone & Liu, 2013). Students can be influenced by their instructors or their peers towards the use of e-learning. Therefore, we propose the following hypothesis:

H3: SNs will have a significant effect on students' BI to use the e-learning system in the Iraqi context.

SE

SE is an important concept in the social cognitive theory (Bandura, 1986). It has been defined as "an individual's self-confidence in his or her ability to perform tasks across multiple computer applications domains" (Monsuwe, Dellaert & Ruyter, 2004, p.105). Previous studies have found that SE is a significant factor in the adoption of e-learning in specific Arab countries (Abbad *et al.*, 2009; Sharma & Chandel, 2013). Individuals with low e-learning SE cannot cope with the system if it is complex and will not persist with their efforts. As a result, they are less likely to overcome any challenges they may face when using a system. Thus, we propose the following hypothesis:

H4: SE will have a significant effect on students' BI to use the e-learning system in the Iraqi context.

TS

The presence of TS was found to be important in encouraging users to adopt technology (Venkatesh, 1999). The TS provided by a university to students using an e-learning system has a significant effect on whether the system is adopted (Ngai, Poon & Chan, 2007). Making an efficient support and advice team available may increase students' BI to use the e-learning system, and increase their perceptions on the ease of using the system and AU of the system. In addition, the presence of an effective technical support provision can help to explain the information available in the e-learning platform which increases information quality. Thus, we propose the following hypotheses:

H5a: TS will have a significant effect on students' BI to use the e-learning system in the Iraqi context.

H5b: TS will have a significant effect on students' AU of the e-learning system in the Iraqi context.

H5c: TS will have a significant effect on IQ of the e-learning system in the Iraqi context.

H5d: TS will have a significant effect on the PEOU of the e-learning system in the Iraqi context.

IQ

IQ refers to the quality of the content and information provided on the e-learning system (Aparicio, Bacaó & Oliveira, 2017). IQ is measured by five main dimensions namely; completeness, timelessness, accuracy, relevance and steadiness of the system output (Delone & Mclean, 2003; Aparicio et al., 2017). If students do not find the information on their university's e-learning platform important, up to date, relevant to the modules they are studying and of a high quality, they are unlikely to use the e-learning system. Lwoga (2014) found that IQ is an important determinant of e-learning adoption. Delone and Mclean (2003) explained that IQ is proven when the e-learning platform provides students with useful content. Previous studies explained that the evaluation of the quality of e-learning systems through measuring the level of quality of the information and materials that can be accessed has become increasingly important (Alla & Faryadi, 2013). Although the factors IQ and SQ are distinct, the main dimensions of IQ including accuracy, relevance and accessibility have a direct effect on the quality of the e-learning system (Alla & Faryadi, 2013). To be able to use the e-learning system, the content should not distract learners. For example, in order for the e-learning system to provide means for taking tests and submitting assignments, the information and instructions provided have to be clear, readable and well-formatted. Also, the layout and structure of the e-learning system depends on the quality of the information and how well acceptable, available and relevant they are to the students. Hence, we hypothesise that IQ will have a significant effect on SQ. In addition, quality of the information provided on the e-learning system is a significant determinant of how the students perceive the system to be useful (Alsabawy, Cater-Steel & Soar, 2016). Thus, we propose the following hypotheses:

H6a: IQ will have a significant effect on students' BI to use the e-learning system in an Iraqi context.

H6b: IQ will have a significant effect on students' AU of the e-learning system in an Iraqi context.

H6c: IQ will have a significant effect on SQ of the e-learning system in an Iraqi context.

H6d: IQ will have a significant effect on PU of the e-learning system in Iraqi context.

SQ

SQ is a significant predictor of e-learning system adoption (Lwoga, 2014). Furthermore, because the concept of using e-learning is still new to universities in Iraq, it is important to investigate SQ and its effect on BI in the case of university students. According to Lwoga (2014), there are five main sub-factors of SQ: responsiveness, usability, availability, reliability and adaptability. SQ can be thought of as the facilitating conditions (Venkatesh et al., 2003) available for the e-learning system to be used effectively. Following the study conducted by Xu and He (2013), in this study, the quality of the e-learning system is hypothesised to have a significant effect on BI. In addition, we propose that SQ has a significant direct effect on AU. This is because even if students have a strong intention to use the e-learning system, a low-quality interface with a long response time can affect how it is used. Therefore, we propose the following hypotheses:

H7a: SQ will have a significant effect on students' BI to use the e-learning system in an Iraqi context.

H7b: SQ will have a significant effect on students' AU of the e-learning system in an Iraqi context.

BI

BI is an indication that a person is ready to behave in a certain way (Ajzen, 1991). It has been found to be a significant predictor of the AU of a technology system (Venkatesh & Davis, 2000). Thus, we propose the following hypothesis:

H8: BI has a significant effect on students' AU of the e-learning system in the Iraqi context.

In addition to the direct relationships, we hypothesise that age, gender and experience moderate the relationships between the independent and the dependent factors in our proposed model. Within the context of e-learning adoption, the moderating factors age, gender and experience were found important to identify the context within which the relationship between the independent and the dependent factors becomes significant. The study conducted by Al-Gahtani (2016) on e-learning adoption highlighted the importance of accounting for individual differences such as age, gender and experience. Age differences have been shown to exist in technology adoption context (Venkatesh & Morris, 2000). For example, Venkatesh et al. (2003) found that age moderates the effects of the usefulness of the system, how easy it is to use, social influence and the conditions that facilitate its use on behavioural intention. In addition, gender and experience are important moderators. Within the context of e-learning, age can be a significant moderating factor as an older student can have a lower level of self-efficacy (Tarhini, Hone & Liu, 2014). Gender can also be a significant moderator as unlike male students, female students can find subjective norms an important factor for their adoption of the e-learning system (Tarhini et al., 2014). This can be the case for Iraqi female students due to the restrictive nature of the culture of the country (Geert Hofstede, 2016) which makes females there more aware of the opinions of others and the society (Ameen, 2017). Therefore, we propose that the three moderators age, gender and experience have significant moderating effects on the relationships in our proposed model, using the following hypotheses:

H9: Age will moderate all relationships in the proposed model.

H10: Gender will moderate all relationships in the proposed model.

H11: Experience will moderate all relationships in the proposed model.

Research methods

The quantitative approach has been widely used in previous studies of technology acceptance and use (e.g. Davis, 1989; Davis *et al.*, 1989; Tarhini, Hone & Liu, 2015). In this research, questionnaires were distributed to 300 students at Salahaddin University-Erbil using convenience sampling. The rationale for this is that Salahaddin University was the first in the Kurdistan region of Iraq and the only one to use the e-learning system in collaboration with UNESCO and the Iraqi Ministry of Higher Education. The use of convenience sampling is justified in the case of this research because it allowed us to collect data from students based on whether they were available or not. The data was collected from undergraduate and postgraduate students in different departments. All the students had undertaken the e-learning system training programme provided by the university. Collecting data from these students allowed us to understand how the e-learning system can be used effectively and find new ways to improve it. In addition, it allowed us to measure the AU of the system. The questionnaire was distributed in Arabic and in English. It was written in both English and Arabic as some of the students at the university could read and write English but not Arabic while others could only read and write in Arabic. The use of both languages was advised by a number of academics at the university too.

The questionnaire included a section on students' demographic profiles to gather information about their age and gender. It also included questions about using the e-learning system from the students' perspective and a question on the challenges facing the use of e-learning in higher education in Iraq, as an open-ended question. In addition, the questionnaire included the constructs of the model proposed in this research and their measurement items. These items and their sources are provided in Table S1 (Online Supplementary File). The items were measured using a 7-point Likert scale, 1=strongly disagree to 7=strongly agree.

The analysis of the data was conducted using partial least squares-structural equation modelling (PLS-SEM) with SmartPLS V3.0 software. PLS-SEM makes it possible to analyse data with small sample sizes (Hair, Hult, Ringle & Sarstedt, 2014). It is a non-parametric approach, which means that it is not necessary for the data to be normally distributed (Henseler, Ringle & Sinkovics, 2009). Furthermore, this method of analysis makes it possible to test the effect of constructs with only one or two items (Ringle, Sarstedt & Straub, 2012), which is the case for the construct AU in this research. We analysed the quantitative data in two stages: first, testing the measurement model and second, testing the structural model.

Partial least squares – multi-group analysis (PLS-MGA) was also used to analyse the differences in how the model fitted. The PLS-MGA is a non-parametric approach that was introduced by Henseler (2007) and Henseler *et al.* (2009). It was adopted in this research using the partial least squares (PLS) path analysis for each subsample (group). The PLS-MGA results (bootstrapping procedure for 500 samples) were obtained from SmartPLS. The analysis in this approach relies on assessing the observed distribution of the bootstrap outcomes instead of making distributional assumptions (Henseler *et al.*, 2009). The centred bootstrap estimates of the groups are compared, then the difference between the groups is divided by the total number of bootstrap samples to indicate the probability that the second group is greater than the first group, and is evaluated using the p value (Henseler *et al.*, 2009). *P* values of 0.05 or lower or 0.95 or higher indicate significant differences between the paths in the groups (Henseler *et al.*, 2009).

Results

Descriptive statistics

The participants were students from the Science, Business and Computer Engineering faculties in Salahaddin University-Erbil. In total, 181 questionnaires were completed. Of those who responded, 43% were male and 56.9% were female. The respondents were between the ages of 18 to 37. The respondents indicated that the length of time they have been using the system for was between one and six months. Most of them were undergraduates (89.5%) and the rest were postgraduates (10.5%). In answer to the questions on training, 68% of the respondents stated that there is a need for more experienced trainers and higher-quality training. Furthermore, 12% said that sometimes the training needs to be provided during lectures in order for them to apply their knowledge of using the e-learning system to real-life situations. As recommended by 20% of the respondents, during the training sessions it is important to explain the benefits of using the system. Only 43.1% of the respondents thought that they were using the e-learning system effectively. When asked whether they think using e-learning systems is important, 79.6% of them agreed while the rest of them did not consider them important for their learning.

Many challenges facing the use of the e-learning systems were listed by the participants. Most of the participants (99%) stated that the major challenge facing the use of e-learning for distance learning courses is that the qualifications obtained from studying online courses cannot be certified by the Ministry of Higher Education. This was followed by the lack of electricity (96%), the slow speed of the Internet connection (94%), lack of access to the Internet (91%), lack of facilities provided by the university (90%), high cost of the Internet (90%), lack of culture that promotes the use of technology for learning (86%) and a small number of them (22%) stated that the lack of knowledge on how to use the system is also an issue.

Analysis of the measurement model – examination of reliability and validity

The first stage of the PLS-SEM analysis was to assess the measurement model by testing the validity, reliability and loadings of its items and constructs. According to Hair *et al.* (2014), CR should be 0.70 or greater. CR was greater than 0.70 in all cases, suggesting good reliability. The convergent validity was assessed using the AVE, which should be 0.5 or greater (Hair *et al.*, 2014). The AVE values of all the constructs were higher than 0.5; therefore, they have convergent validity. Discriminant validity was assessed by examining the cross-loadings of each construct. The constructs should load higher on their own indicators than they load on the indicators of the other constructs (Chin, 1998). This was the case in this sample. The Fornell-Larcker criterion was assessed to examine discriminant validity. This showed that the constructs shared more variance with their own indicators than they shared with the other indicators. The AVE was greater than 0.5 in all cases and greater than the square of the correlations, which suggests that there is discriminant validity. We also assessed factor loadings. The minimum value for factor loadings should be 0.70 (Hair *et al.*, 2014). Some items were removed due to their low loadings; these were SE6, SQ4, SQ6, IQ1. When we analysed the responses to SQ6 using descriptive statistics, we found that most of the students responded negatively to the item. The mean value for this item was 3.41 and the mode was 1. This indicates that there is a problem with the speed of the internet. The remaining items in the model were well above the threshold value of 0.70.

Analysis of the structural model and hypotheses testing

The structural model was assessed by examining the explanatory power of the model and the significance of the paths between the constructs. The relationships between the latent variables were assessed and evaluated based on their magnitude and significance, using the path coefficients, the *t* values and the significance level (*p* value). The bootstrapping procedure (500 samples) was used, as mentioned by Hair *et al.* (2014).

We tested the hypotheses represented in the model (as shown in figure 2) by examining the magnitude and significance of path loads between the latent variables. The values generated by the bootstrapping method indicate that the loads corresponding to 12 of the 16 tested hypotheses (H1, H2a, H2b, H4, H5b, H5c, H5d, H6a, H6c, H6d, H7a and H8) are statistically significant and positive ($p < 0.001$ to 0.05), which suggests that the collected data provides empirical support for those propositions. Loads related to hypotheses H3, H5a, H6b, H7b and are not statistically significant, thereby indicating that these hypotheses should be rejected. The model was able to explain 53% of the variance in BI and 45% in the AU of the e-learning system. Figure 2 synthesise these findings.

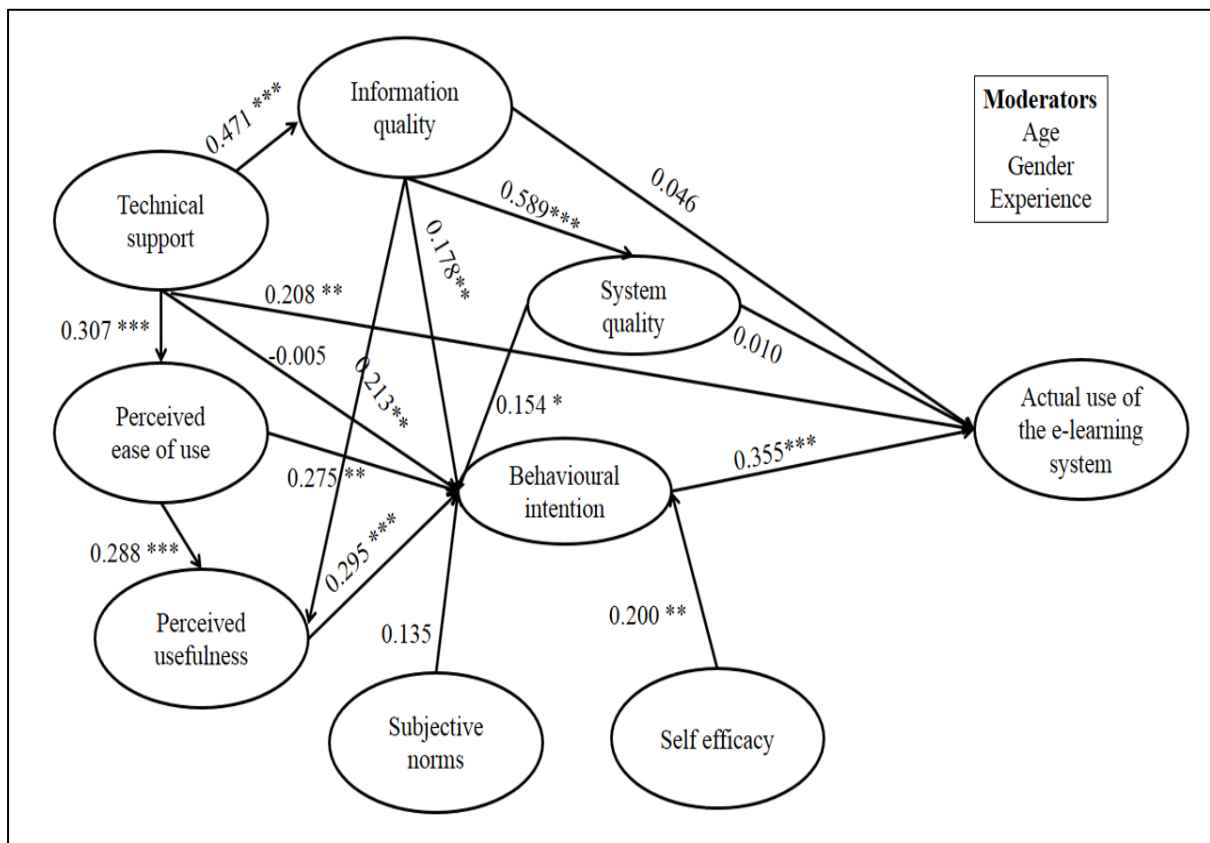


Figure 2: Results of the structural model

Multi-group analysis

In terms of age, the sample was split into two groups, younger students (less than 22 years old: 57 respondents) and older students (22 years or older: 79 respondents). Also, the sample was split according to gender (males: 78 respondents and females: 103 respondents). Experience was measured according to the length of time of using the system, following the approach used by Venkatesh *et al.*, (2003) and Venkatesh *et al.*, (2012). Hence, the sample was split into two groups, lower experience users (less than three months: 93 respondents) and higher experience students (three months to six months: 88 respondents). The results of the multi-group analysis

showed that age moderated one relationship only in the model (TS and IQ: p value= 0.010). The effect of TS on IQ was more significant among the older group students. Gender moderated three relationships in the model namely; the relationships between BI and AU (p value= 0.041, PU and BI (p value= 0.997) and SQ and AU (p value= 0.979). Experience moderated one relationship only in the model (TS and IQ: p value= 0.035). Therefore, H9, H10 and H11 were only partially supported as the moderators did not moderate all relationships in the model.

The R^2 value of the model among the younger students was ($R^2= 0.51$) for BI and ($R^2= 0.40$) for AU, meaning that the model can explain 51% of the variance in BI and 40% of the variance in AU among the younger students. The R^2 value of the model among the older students was ($R^2= 0.36$) for BI and ($R^2= 0.35$) for AU, meaning that the model can explain 36% of the variance in BI and 35% of the variance in AU among the older students. The R^2 value of the model among the male students was ($R^2= 0.71$) for BI and ($R^2= 0.34$) for AU, meaning that the model can explain 71% of the variance in BI and 34% of the variance in AU among the male students. The R^2 value of the model among the female students was ($R^2= 0.41$) for BI and ($R^2= 0.40$) for AU, meaning that the model can explain 41% of the variance in BI and 40% of the variance in AU among the female students. The R^2 value of the model among the students with lower experience level was ($R^2= 0.54$) for BI and ($R^2= 0.38$) for AU, meaning that the model can explain 54% of the variance in BI and 38% of the variance in AU among the students with lower experience level. The R^2 value of the model among the students with higher experience level was ($R^2= 0.49$) for BI and ($R^2= 0.28$) for AU, meaning that the model can explain 49% of the variance in BI and 28% of the variance in AU among the students with higher experience level.

Table 1: Summary of the moderating effect of age

	Path Coefficients (Younger group)	Path Coefficients (Older group)	t-Values (Younger group)	t-Values (Older group)	p-Values (Younger group)	p-Values (Older group)	P- Value(Younger vs Older group)
BI -> AU	0.163	0.468	1.035	2.361	0.301	0.019	0.098
IQ -> AU	0.035	0.056	0.205	0.376	0.838	0.707	0.457
IQ -> BI	-0.007	-0.305	0.055	1.836	0.956	0.067	0.927
IQ -> PU	0.188	0.290	1.314	1.475	0.189	0.141	0.329
IQ -> SQ	0.479	0.554	4.654	5.000	0.000	0.000	0.298
PEOU -> BI	0.183	0.475	1.192	1.829	0.234	0.068	0.155
PEOU -> PU	0.360	0.031	2.558	0.150	0.011	0.881	0.906
PU -> BI	0.277	0.133	1.910	0.901	0.057	0.368	0.760
SE -> BI	0.148	0.059	1.107	0.227	0.269	0.821	0.620
SN -> BI	0.104	0.339	0.831	2.052	0.406	0.048	0.128
SQ -> AU	0.093	-0.238	0.524	1.099	0.601	0.272	0.878
SQ -> BI	0.106	0.143	0.820	0.782	0.412	0.435	0.432
TS -> AU	0.302	0.338	2.135	2.300	0.033	0.022	0.431
TS -> BI	0.057	-0.048	0.444	0.379	0.657	0.705	0.724
TS -> IQ	0.187	0.554	1.223	6.841	0.222	0.000	0.010
TS -> PEOU	0.287	0.341	2.854	2.274	0.004	0.023	0.361

Table 2: Summary of the moderating effect of gender

	Path Coefficients (Males group)	Path Coefficients (Females group)	t-Values (Males group)	t-Values (Females group)	p-Values (Males group)	p-Values (Females group)	p-Value(Males vs Females group)
BI -> AU	0.551	0.224	3.970	1.800	0.000	0.073	0.041
IQ -> AU	-0.007	0.051	0.048	0.484	0.962	0.628	0.625
IQ -> BI	0.040	-0.218	0.344	1.816	0.731	0.070	0.061
IQ -> PU	0.266	0.189	1.903	1.322	0.058	0.187	0.344
IQ -> SQ	0.579	0.644	6.663	9.432	0.000	0.000	0.723
PEOU -> BI	0.439	0.211	2.974	1.939	0.003	0.053	0.104
PEOU -> PU	0.445	0.191	3.386	1.415	0.001	0.158	0.089
PU -> BI	0.006	0.410	0.054	4.149	0.957	0.000	0.997
SE -> BI	0.312	0.181	2.438	1.339	0.015	0.181	0.239
SN -> BI	0.175	0.031	1.867	0.308	0.062	0.758	0.145
SQ -> AU	-0.212	0.176	1.482	1.975	0.139	0.041	0.979
SQ -> BI	0.042	0.191	0.341	1.614	0.733	0.107	0.808
TS -> AU	0.187	0.241	1.350	2.478	0.178	0.014	0.620
TS -> BI	-0.062	-0.028	0.625	0.319	0.532	0.750	0.604
TS -> IQ	0.524	0.429	6.147	5.148	0.000	0.000	0.209
TS -> PEOU	0.326	0.274	3.484	2.444	0.001	0.015	0.359

Table 3: Summary of the moderating effect of experience

	Path Coefficients (Low experience group)	Path Coefficients (High experience group)	t-Values (Low experience group)	t-Values (High experience group)	p-Values (Low experience group)	p-Values (High experience group)	p-Value(Low experience vs High experience group)
BI -> AU	0.430	0.261	2.962	2.108	0.003	0.036	0.820
IQ -> AU	-0.053	0.065	0.387	0.524	0.699	0.601	0.261
IQ -> BI	-0.147	-0.250	1.267	2.130	0.206	0.034	0.737
IQ -> PU	0.032	0.314	0.206	2.345	0.837	0.019	0.087
IQ -> SQ	0.592	0.624	7.880	7.781	0.000	0.000	0.379
PEOU -> BI	0.306	0.247	2.252	1.699	0.025	0.090	0.617
PEOU -> PU	0.343	0.282	2.168	1.989	0.031	0.047	0.633
PU -> BI	0.177	0.349	1.280	3.058	0.201	0.002	0.167
SE -> BI	0.165	0.227	1.415	1.593	0.158	0.112	0.370
SN -> BI	0.260	0.057	1.913	0.620	0.056	0.536	0.891
SQ -> AU	0.045	0.035	0.254	0.272	0.800	0.786	0.505
SQ -> BI	0.049	0.255	0.361	2.146	0.718	0.032	0.128
TS -> AU	0.192	0.236	1.299	2.012	0.195	0.045	0.414
TS -> BI	-0.043	0.034	0.442	0.347	0.659	0.729	0.284
TS -> IQ	0.346	0.573	3.287	7.699	0.001	0.000	0.035
TS -> PEOU	0.238	0.367	2.245	3.529	0.025	0.000	0.190

Discussion and conclusion

In this research, we analyse the factors that can explain the adoption and use of e-learning in Iraqi higher education. To the best of our knowledge, this is the first study to consider the factors that can explain e-learning adoption in Iraq from the students' perspective, addressing the lack of studies that consider the Iraqi students' perspective on the use of e-learning. This is particularly important since e-learning was found to be important in improving the educational experience of students (Mirza & Al-Abdulkareem, 2011) and recent reports found that only 42% of Iraqi students are satisfied with their experience (UNDP, 2016). The results of this study have a number of implications for universities and policy makers.

Less than half of the participants thought that they were using the e-learning system effectively, so the system must be improved further to increase effective use. Importantly, the descriptive statistics show that most of the participants thought that the speed of their internet connection was not adequate for using the e-learning system. This is a major issue that needs further investigation, as fast internet connectivity is crucial for students to access and use the e-learning system. A number of other major challenge facing the use of e-learning in Iraq were identified by the students; the qualifications obtained from studying online courses (for distance learning courses) cannot be certified by the Ministry of Higher Education, the lack of electricity, the slow speed of the Internet connection, lack of access to the Internet, lack of facilities provided by the university, high cost of the Internet, lack of culture that promotes the use of technology for learning and a lack of knowledge on how to use the system is also an issue. Hence, there is a need for collaboration between the Iraqi Ministry of Higher Education, staff members including lecturers and instructors, policy makers and service providers to address these challenges.

Similar to previous studies (Davis *et al.*, 1992; Venkatesh & Davis, 2000), the results support the importance of PU for the acceptance of e-learning technology. PU is followed by PEOU. This result is consistent with the findings of Davis *et al.* (1989), who stated that PEOU is especially important in the early stages of a system's use. The results of this research showed that IQ, SQ, PEOU, PU and SE had a significant effect on BI while BI and TS had a significant effect on USE. PEOU had a significant effect on PU, confirming the findings of Davis *et al.* (1989). Some interesting findings emerged from the analysis with regards to the relationships between IQ, SQ and TS. TS had a significant effect on IQ and USE, indicating that the presence of a strong technical support team is important to guide students to the relevant information, make the system easier to use and increase their use of the system. The quality of the information provided in the e-learning system has a strong effect on how students view the quality of the system as a whole and the usefulness of the use of the system.

This study found that SE had a significant effect on students' BI to use the e-learning system and that TS had a significant direct effect on their AU of the system. Therefore, it is vital to build students' confidence in using the system by providing training of an outstanding quality and a technical support team that includes a number of experts in using the system. It was also found that IQ had a significant direct effect on BI. Therefore, e-learning centre managers should ensure that the system provides high-quality materials that are relevant to the students' modules and easy to access through the system. Future training for students should provide guidance on how they can obtain high-quality information through online journals, articles and books.

The moderators; age, gender and experience did not significantly moderate the majority of the relationships in the model. Age only moderated the relationship between TS and IQ. While younger students do not think that technical support affects how they evaluate the quality of the information provided on the e-learning system, older students find it the most important factor affecting their adoption and use of the system. This is possibly because older individuals do not use technology as extensively as younger individuals (Ameen, 2017). Thus, they need guidance to locate the relevant information on the platform. Hence, both the service providers and curriculum designers should ensure the presence of a strong technical support team that can assist older students in finding the relevant information. The results show that SNs had an insignificant effect on Iraqi students' BI to use the e-learning system. However, the results showed that this effect is significant among older students. Therefore, it is vital to emphasise the significant role of instructors in convincing older students to adopt the e-learning system.

Surprisingly, despite that only female students find PU and SQ as significant factors to adopt and use e-learning, the findings showed that male students are more prepared to use the e-learning platform than females. This can be related to the large gender gap in the use of technology in Iraq (Ameen, 2017). Hence, lecturers, service providers should specifically target females to enhance their use of e-learning systems, for example, providing training sessions that are specifically tailored for female students.

In terms of the moderating effect of experience, students with a higher experience level think that the presence of a technical support team can improve how they perceive the quality of the information provided on the platform. However, there was no major difference between the lower experience and the higher experience students in terms of the length of time they have been using the system for and the relationship was significant in both groups.

Instead of training instructors and relying heavily on them to teach students, the students should be trained directly. To improve the training for students, universities should provide sessions run by experts in using the e-learning system who can fully explain the different features and what they can help students to achieve. As the usefulness of the system is significant, trainers need to emphasise the importance and benefits of using the e-learning system. Furthermore, up-to-date, high-quality information that can be translated into Arabic should be provided which can also enhance the usefulness of the system. It is important to assess the quality of the information provided through the e-learning system and how it complements students' face-to-face learning and provide the required level of technical support to the students. Thus, policy makers in Iraq should carefully develop strategies for the content that students can access through the system.

This study has some limitations. Convenience sampling was used to collect data from the students. Therefore, the data may not be representative of the entire population. In addition, this research was conducted when students were in the early stages of adopting the system. Future studies could collect data in the later stages of the adoption of the system, using a larger sample size, and compare the results with the findings of this research to investigate whether the significance of the factors changes.

Acknowledgements

This research was made possible through the help and support provided by Salahaddin University-Erbil, in which the primary data for this research was collected.

Statements on open data, ethics and conflict of interest

- a. The data collected in this research can be accessed freely.
- b. A full ethical approval procedure claim took place and ethical approval was obtained from the Anglia Ruskin University Ethics Committee. The authors of this research strictly followed all ethical guidelines provided by Anglia Ruskin University.
- c. We confirm that there is no conflict of interest in the work produced here.

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