WHAT DRIVES SUCCESSFUL SOCIAL MEDIA IN EDUCATION AND E-LEARNING? A COMPARATIVE STUDY ON FACEBOOK AND MOODLE

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ABSTRACT

Aim/Purpose	This research investigates the success variables affecting the adoption of social networking sites (SNS), namely Facebook, and learning management systems (LMS), specifically Moodle, in developing countries.
Background	In contemporary education, universities invest heavily in the integration of LMS with traditional classrooms. Conversely, such technologies face a high rate of failure and not all learners are satisfied with LMS services. In turn, this leads to the exploitation of SNS interactive features and services, which are subsequently included in the process of teaching and learning. However, the success of both SNS and LMS has rarely been studied in the context of developing nations.
Methodology	In this study, a cross-sectional survey was used to collect the research data. It targeted a population sampled from amongst state-sector university undergraduates in Iraq (N=143). The study was based on an extension of DeLone and McLean's Information Systems Success (D&M ISS) model to include four antecedent variables: system quality, information quality, technology experience, and Internet experience as direct determinants of technology use and user satisfaction, both of which affect the net benefits of Facebook and Moodle. The collected data were analyzed with SmartPLS, using a partial least squares-structural equation model (PLS-SEM).
Contribution	This research extends previous literature on the critical success factors (CSF) of SNS and LMS in the case of developing countries. The study guides the way in which the acceptance of SNS and LMS

	in higher education can be organized in the developing world in general, especially in the Middle East, thereby bridging this research gap and extending previous literature.
Findings	The research results support the influence of quality and experience antecedents on technology use and learner satisfaction. The extended model also provides full support for the association between technology use and learner satisfaction, concerning the net benefits of Facebook and Moodle. The proposed model achieved a good fit and explained 61.4% and 68.1% of the variance of LMS and SNS success, respectively.
Recommendations for Practitioners	The significant influence of the constructs investigated in this research could shape strategies and approaches to be adopted for the enhancement of SNS and LMS implementation in educational institutions. More specifically, this study is aimed at guiding SNS and LMS acceptance in developing countries, especially in Middle Eastern higher education.
Recommendations for Researchers	This work offers a theoretical understanding of the body of knowledge on SNS and LMS application in institutes of higher education. It further supports the usefulness of the D&M ISS model for predicting the success of social networks and e-learning systems.
Future Research	As with most empirical literature, this research makes a number of recommendations for further work. Future research could investigate other constructs that potentially influence technology success in education such as facilitating conditions, perceived privacy, and security. Moreover, researchers from different contexts are invited to apply this extended model and conduct a mixed methods (quantitative and qualitative) analysis to deepen the current understanding of the effect of SNS on teaching and learning, while also comparing it with the impact of LMS in this digital era.
Keywords	social networking sites (SNS), learning management systems (LMS), DeLone and McLean's Information Systems Success (D&M ISS) model, higher education, the Middle East

INTRODUCTION

The innovation of the Internet and growth in information and communication technologies (ICT) have reconstructed almost all aspects of contemporary life, including education. This sector has in fact been massively influenced by the development of such technologies. According to Yakubu and Dasuki (2018), "The processes involved from when a student applies for admission up till graduation can be captured by computer applications" (p.184). Accordingly, teaching and learning methods have undergone extensive reform. Currently, universities invest heavily in the implementation of e-learning technologies such as learning management systems (LMS). LMS are Web-based technologies for managing the delivery of learning content, receiving learners' responses, administering online exams, interacting with learners and teachers, and tracking the activities of various learners. E-learning has a significant impact on teaching and learning, including information accessibility, adaptivity, the adaptability of learning content, efficient interaction, synchronous and/or asynchronous teaching and learning modes, and reduced learning costs (Al-Azawei, 2017).

Despite the above-mentioned benefits, however, e-learning still faces a high rate of failure (Al-Azawei, 2017; Al-Sabawy, 2013; Dwivedi et al., 2014), particularly in developing countries. This may be due to a lack of ICT infrastructure, absence of financial support, poor technology literacy, and low motivation or awareness (Al-Azawei, Parslow, & Lundqvist, 2016b). Conversely, recent research has revealed a high level of willingness amongst students to use social networking sites (SNS) in education (Karajeh et al., 2018; Manca & Ranieri, 2017). Yakubu and Dasuki (2018) point out that "Students' usage of social media and the internet have ensured that educationists change the traditional methods used to teach and learn" (p.184). This apparent tendency towards the implementation of SNS in the teaching and learning process may help address the issue of LMS failure. Although SNS were not specifically established for the purpose of education, and their key focus is rather on developing communication services that can be availed of anywhere and at any time, the interactive features of such technologies may be exploited to enhance the learning process. According to Watat, Fosso Wamba, and Kala Kamdjougs (2018), most users of SNS are the youth attending various educational institutions at different academic levels. In contrast, these social-networking sites have been recently introduced into certain developing countries like Iraq, which have previously prohibited Internet use for many years (Al-Azawei et al., 2016b; Al-Azawei, 2018).

Although the implementation of ICT is still in its infancy across most of the Arab world, the situation in Iraq is unique for many reasons. First, it has endured two consecutive wars, leading to the destruction of much of its ICT infrastructure. This was followed by sanctions imposed by the United Nations (UN). Economic deficit and political conflicts are other issues that have all led to the disintegration of various sectors in Iraq, including education. According to Al-Azawei, Al-Bermani, and Lundqvist (2016a), the Iraqi people had no Internet access or mobile phones up until 2003. Thus, the Internet and smart technologies have only recently come into use, and their application is still restricted to a limited range of personal purposes. Conversely, Iraqi public-sector universities have taken serious steps towards integrating ICT into education (Al-Azawei et al., 2016b). This includes establishing e-learning labs and centers, providing training sessions on ICT use, and legislating for the implementation of e-learning. However, considering the lack of ICT infrastructure in Iraq, SNS may offer a compromise to be exploited as a solution in educational contexts alongside LMS. This is because SNS are managed by reliable companies and their use requires no more than a moderate Internet bandwidth.

To elaborate on the above, the use of either LMS or SNS in education provides access to learning content and resources, regardless of the boundaries of time and/or place. Therefore, they meet learners' demands for better services, given the global impact of these technologies. However, there is a need to evaluate the success factors that can affect the use of SNS and LMS in Arab nations. According to previous research, there is a dearth of research on users' attitudes to such technologies in developing countries (Yakubu & Dasuki, 2018), more specifically in the Arab world (Ameen & Willis, 2018; Shen & Khalifa, 2010). Even though 'information systems success' (ISS) has been evaluated in information systems (IS) research, it is a complex topic and the question of which variables can best measure the success of applications remains open (Teo, 2016). Hence, the evaluation of platforms that are used in educational contexts (such as SNS and LMS) can assist companies in ascertaining whether their services are capable of meeting users' needs. Therefore, this study pays considerable attention to bridging the current research gap and extending previous knowledge on the success of both SNS and LMS in the developing world.

THEORETICAL BACKGROUND AND THE PROPOSED MODEL

LEARNING MANAGEMENT SYSTEMS (LMS)

The implementation of e-learning has had an important effect on higher education, with students enjoying flexibility in their choice of optimal learning methods, according to their individual preferences (Al-Azawei, 2017). As such, universities worldwide have used various e-learning systems to reap

benefits of this kind. LMS, however, represent the most frequently adopted e-learning technologies in higher education (Emelyanova & Voronina, 2014).

Course management systems, virtual learning environments, and knowledge management systems are often used as synonyms of LMS (Graf, 2007). In such systems, both teachers and learners can benefit from their implementation, whereby teachers are able to present and upload learning materials and content, track students' activities, keep students up to date with course information, and assess students' understanding. Conversely, students can view and download learning content at any time and from anywhere, interact with their peers and teachers, and ask questions. Regardless of the rapid and extensive development of ICT, however, the willingness of users to accept LMS is still one of the most complex issues of technology success (Emelyanova & Voronina, 2014). Thus, understanding what can influence the success of LMS represents a key step towards benefiting from the potential advantages.

In the case of Iraq, ICT implementation is still in its early stages across various key sectors such as health (Meri et al., 2019) and education (Al-Azawei, 2017; Ameen, Willis, Abdullah, & Shah, 2018). Accordingly, the higher education context in Iraq is unique, as this country still faces many political conflicts and the effect of war (Al-Azawei et al., 2016a; Ameen et al., 2018). Moreover, the minimum ICT infrastructure required to deliver educational technologies is sparse in Iraq, compared to other countries in the Middle East (Al-Azawei et al., 2016b). Correspondingly, Iraq is still behind with its policymaking for the integration of e-learning technologies (Ameen et al., 2018).

The research on technology success or failure is grounded on IS studies that have attempted to identify critical success factors (CSF) (Selim, 2007). Pertaining to e-learning technology, Volery and Lord (2000) suggest that the technology itself, combined with the teachers' and learners' previous experience of technology use, represent the CSF of e-learning implementation. In another study, conducted by Selim (2007), four e-learning CSF are defined: the instructor, the student, information technology, and university support. Meanwhile, Al-Sabawy (2013) proposes eight variables as determinants of e-learning success, consisting of IT infrastructure services, perceived usefulness, information quality, system quality, service delivery quality, customer value, organizational value, and user satisfaction. Additionally, work carried out by Al-Azawei, Parslow, and Lundqvist (2017) extended the technology acceptance model to evaluate e-learning acceptance in Iraq, with findings that support this model's ability to determine e-learning acceptance in developing countries. Moreover, Ramirez-Correa, Rondan-Cataluña, Arenas-Gaitán, and Alfaro-Perez (2017) adopted the D&M ISS model to investigate LMS acceptance, whereby the model was extended to include learning styles as moderators. The findings of the above study support the effectiveness of this model in predicting LMS success. Similarly, Yakubu and Dasuki (2018) used the D&M ISS model to examine e-learning success in Nigeria. Their research findings partially confirmed the influence of quality antecedents on behavioural intention and learner satisfaction. Furthermore, there was full support for the association between learners' willingness to adopt e-learning technology, in the form of Canvas, and their satisfaction with the net benefits. In turn, this supports the effectiveness of applying the D&M ISS model in the case of a developing country.

SOCIAL NETWORKING SITES (SNS) IN EDUCATION

From the wide range of freely available SNS, Facebook represents the most frequently adopted site (Teo, 2016). It is defined as "a social networking website intended to connect friends, family, and business associates" (Nasri & Charfeddine, 2012, p.950). Within just a few years after its launch in 2004, the number of Facebook users had increased exponentially worldwide, and as of the end of December 2017, it had 2.13 billion active users (Facebook, 2018). The term, 'active users' refers to those logging into the site within the past 30 days. Meanwhile, in Iraq, there were around 14 million users by 31 December 2017 (Internet World Stats, 2018). Previous research reveals a high level of willingness amongst the Iraqi people to adopt and use Facebook, based on its perceived usefulness, peer and family support, motivation and engagement, and facilitating conditions (Al-Azawei, 2018).

Therefore, the use of SNS such as Facebook in Iraqi higher education could provide a reasonable solution, as it does not require an integrated ICT infrastructure, unlike what is required for an e-learning application. Moreover, the availability of a moderate Internet connection speed is generally sufficient for instructors and students to use Facebook as a means of interaction and information-sharing.

Three features are cited as accounting for the widespread use of Facebook (Boyd & Ellison, 2007). These consist of (1) users being able to create either a public or semi-public profile, (2) the capacity to search for other users in the network, and (3) users being able to track their own and other users' personal connections. In addition, SNS such as those developed specifically for educational purposes (for example, Ning, Edmodo), research platforms (such as ResearchGate, LinkedIn), or those that were originally designed for social and personal communications (such as Facebook, Twitter) are considered as significant technologies for enhancing teaching and learning in the context of schools and higher education (Manca & Ranieri, 2017). With regard to Facebook, its use in education requires specific attention, because it can affect traditional teaching and learning methods, as well as the way in which relationships are formed between teachers and students (Allen, 2012).

Previous research has attempted to identify the factors that could influence the adoption and success of SNS in education. Grounded on the theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003), Mazman and Usluels (2010) found that perceived ease of use, usefulness, social influence, and facilitating conditions had a significant effect on students' Facebook adoption. Moreover, it was indicated that students could use Facebook for many different reasons, including communication, collaboration, and resource-sharing. In addition, Martins, Pinho, and Soares (2011) applied the technology acceptance model (Davis, 1985) to examine Facebook acceptance, based on students' perspectives. Their findings showed that behavioural attitudes formed a significant antecedent of Facebook usage. Similarly, Nasri and Charfeddine (2012) investigated Facebook acceptance in Tunisia from the perspective of undergraduate students, applying the theory of reasoned action (Ajzen & Fishbein, 1980) and the technology acceptance model. The above study concluded that both theories can be successfully adopted in developing countries to identify students' intention to adopt Facebook, wherein attitudes towards use and social norms were significant predictors of behavioural intention. Furthermore, in a study conducted by Sánchez, Cortijo, and Javed (2014), the direct and indirect relationships between Facebook adoption, its educational use, and students' reasons for using it were studied, whereby it was found that perceived ease of use, usefulness, social influence, and facilitating conditions were significant variables for determining Facebook adoption. Furthermore, it was highlighted that students used Facebook to communicate, collaborate, and share materials and resources. However, the above study showed that the educational use of Facebook was directly determined by the reasons for its usage, and indirectly by its adoption. This present study, however, was based on the D&M ISS model as an effective theory for identifying predictors of SNS and LMS success.

THE PROPOSED RESEARCH MODEL AND HYPOTHESES

As mentioned above, this study is grounded on the D&M ISS model that was first proposed in 1992 (DeLone & McLean, 1992). DeLone and McLean (1992) reviewed different frameworks of IS success and proposed a six-dimension model as a taxonomy of IS success, which was subsequently abbreviated to the 'D&M ISS' model. It hypothesizes an association between six constructs, namely information quality, system quality, IS use, perceived satisfaction, user impact, and finally, organizational impact. The model adds two significant contributions to previous research on IS success; the first being the establishment of a scheme to classify the multitude of measures of IS success. It also proposes a model of causal interdependence amongst constructs (Wang & Liao, 2008). As such, it has received considerable attention from researchers and has been successfully evaluated in different contexts, with numerous applications (Petter & McLean, 2009). According to Urbach and Müller (2012) "[the D&M ISS model] [has] quickly become one of the dominant evaluation frameworks in

IS research, in part due to its understandability and simplicity" (p.1). In 2003, Delone and Mclean reviewed studies conducted on their model and proposed an updated version of it. Accordingly, they added a new variable, called 'service quality' (Delone & Mclean, 2003). Moreover, all impacts proposed in the original model were grouped into a single benefit factor known as 'net benefits'. This new model has been successfully validated using a variety of Web-based technologies such as knowledge management systems (Wu & Wang, 2006), e-government (Wang & Liao, 2008), Web portals (Al-Debei, Jalal, & Al-Lozi, 2013), Facebook (Dong, Cheng, & Wu, 2014), and LMS (Ramirez-Correa et al., 2017). The original D&M ISS model is illustrated in Figure 1.
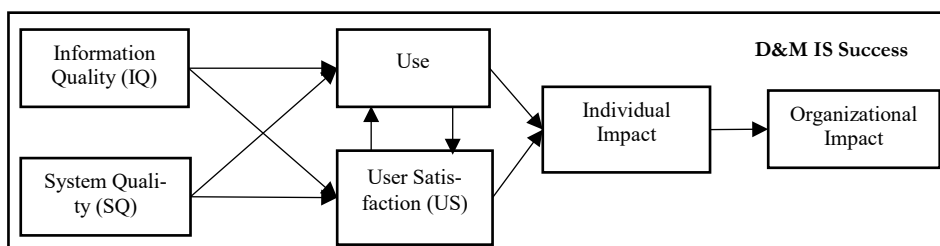
Figure 1: The D&M ISS model (DeLone & McLean, 1992)

The core categories identified in the D&M model are discussed here. System quality is defined as the technology's performance in terms of convenience, accessibility, reliability, functionality, and ease of use (Delone & Mclean, 2003). Delone and Mclean (2003) point out that better system quality can lead to greater system use, as well as greater user satisfaction. In turn, this can lead to a more positive impact on users' productivity (Delone & Mclean, 2003). According to this discussion, we present hypotheses H1a, b and H2a, b.

> **H1a, b**: System quality has a positive and significant influence on technology use (i.e. Facebook and Moodle).

> **H2a, b**: System quality has a positive and significant influence on learner satisfaction.

Delone and Mclean (2003) also suggest that the system's objectivity can be increased by high-quality information and content. Information quality is determined by the system's features, which can be measured in terms of information accuracy, timeliness, accessibility, context, and relevance (Dong et al., 2014). Therefore, it is proposed that this concept can positively affect both system use and user satisfaction (DeLone & McLean, 1992). Here, we suggest hypotheses H3a, b and H4a, b:

> **H3a, b**: Information quality has a positive and significant influence on technology use (i.e. Facebook and Moodle).

> **H4a, b**: Information quality has a positive and significant influence on learner satisfaction.

In the present research, two variables are added to the D&M ISS model, namely technology (SNS and LMS) experience and Internet experience. In this context, users' experience is defined as all aspects of what users require for operating and interacting with the technology effectively. Users may feel uncomfortable when faced with technology that they have no experience of using (Shih, Muñoz, & Sánchez, 2006). Studies have also found that technology experience can influence students' attitudes and perceptions regarding new Web-based courses (Hartley & Bendixen, 2001). According to Liu, Chen, Sun, Wible, and Kuo (2010), users' experience plays a significant role in IS adoption. Furthermore, Song, Singleton, Hill, and Koh (2004) highlight that students' technology experience can influence the performance expectancy of online courses. Therefore, it is suggested here that technology (SNS or LMS) experience and Internet experience can affect the use of both SNS and LMS, as well as perceived satisfaction. Based on this judgment, the following hypotheses are proposed:

H5a, b: Technology experience (i.e. Facebook and Moodle) has a positive and significant influence on technology use (Facebook and Moodle).

H6a, b: Technology experience (i.e. Facebook and Moodle) has a positive and significant influence on learner satisfaction.

H7a, b: Internet experience has a positive and significant influence on technology use (i.e. Facebook and Moodle).

H8a, b: Internet experience has a positive and significant influence on learner satisfaction.

DeLone and Mclean (2002) define technology use as its output, presented according to current or self-reported system usage. Thus, the higher the rate of technology use, the greater the user satisfaction and net benefits (DeLone & McLean, 1992, 2003). In light of the above, we propose that:

H9a, b: Technology use (i.e. Facebook and Moodle) has a positive and significant influence on learner satisfaction.

H10 a, b: Technology use (i.e. Facebook and Moodle) has a positive and significant influence on net benefits.

Delone and Mclean (2003) describe the role of user satisfaction "as the approval or likeability of an IS [information system] and its output" (Ramirez-Correa et al., 2017, p.276). It is defined as users' perspectives of a particular application or system that meets their individual need for information (Dong et al., 2014). Higher user satisfaction can positively and significantly affect the net benefits obtained. The net benefits construct is defined as the influence exerted by the IS on an organization, group, individual, etc. This construct is measured in terms of perceived usefulness and organizational performance (Delone & Mclean, 2003). In this research, we suggest Hypothesis 11:

H11 a, b: Learner satisfaction has a positive and significant influence on net benefits.

Although the updated D&M ISS model proposes that users' inability to identify who will provide support for any technical issues that they might face while using a technology may influence perceptions of the system's service quality (Delone & Mclean, 2003), previous research found issues concerning the integration of this construct (Petter & McLean, 2009; Ramirez-Correa et al., 2017). Following the earlier literature, therefore, this present study does not integrate the service quality variable into the proposed research model (see Figure 2).
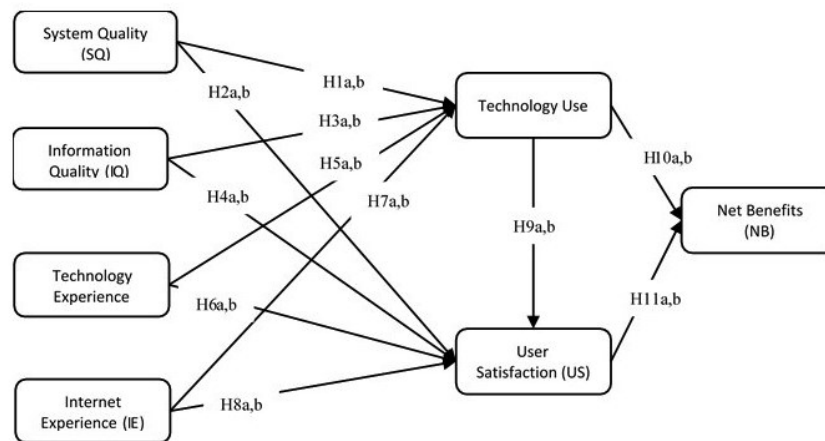
Figure 2: The proposed research model
Note: Technology experience (Facebook or Moodle), technology use (Facebook or Moodle)

RESEARCH METHODS

This study is concerned with investigating the variables that affect undergraduate students' perceptions of utilizing SNS and LMS technologies in public-sector universities in Iraq. Cater-Steel (2004) point out the importance of selecting an appropriate research design in IS research. Accordingly, a survey research approach was adopted here as the most effective means of meeting the present research objective. The survey research design is defined as "acquiring information about one or more groups of people - perhaps about their characteristics, opinions, attitudes, or previous experiences by asking them questions and tabulating their answers" (Leedy & Ormrod, 2001, p.183). Surveys were considered as the most effective component for collecting the research data in this instance, based on the premise that they can help researchers focus on estimating variables with greater precision (Saunders, Lewis, & Thornhill, 2009). Moreover, a questionnaire approach was adopted to identify undergraduate students' perceptions of the validity of the research constructs, using a research questionnaire adapted from previous studies. According to Brislin (1986), the use of existing questionnaires can assist in comparing findings with those of other studies that have used the same questionnaire. In turn, this can assist with the collation of literature. Consequently, the present researcher adopted systematic methodological phases on the grounds of previous research recommendations (Creswell & Clark, 2011).

THE RESEARCH CONTEXT

This current study was carried out at a public-sector university in Iraq. In the College of Information Technology, e-learning in the form of Moodle has been implemented since 2015, with students being highly motivated to use the system (Al-Azawei, 2017). Learning materials are uploaded onto the website in different forms, such as Word, pdf, PowerPoint, videos, and images. Forums and wikis are also used by many instructors to enhance interaction with their students. The study participants had even administered numerous exams using Moodle.

Conversely, closed groups have been created on Facebook, where students use them for many different purposes such as making announcements, sharing learning materials, and discussing different topics, either with peers or with their instructors. In most cases, the students appeared to prefer discussing their learning queries with their teachers on this platform, rather than on the Moodle forum.

INSTRUMENT DEVELOPMENT

At the beginning of the online questionnaire, a brief description of the key aims and focus of this research was presented to the respondents to ensure their informed consent. This introduction also comprised a full description of data privacy and confirmed that the research data would be dealt with confidentially and used purely for research purposes. This was followed by a few demographic questions to gain some insight into the participants' backgrounds. Overall, the instrument included 22 items, designed to measure factors of the proposed research model. However, three items were deleted from the Moodle model, because of their low loading.

All the questions were closed-ended and designed according to a five-point Likert scale, ranging from 1 (Strongly disagree) to 5 (Strongly agree). The instrument items were developed from a research study conducted by Ramirez-Correa et al. (2017) (see Appendix), but adapted slightly, according to the main objectives of this present research. Despite clear differences in the infrastructure and functionalities of Facebook and Moodle, it is possible to use the same measurement indicators in identifying the D&M ISS variables. The rationale justifying this is that Delone and Mclean (1992, 2003) proposed success factors that apply to all information systems (IS), regardless of their particular features. Accordingly, previous literature has adopted this model to identify THE success constructs of several different applications such as Facebook (Dong et al., 2014) and e-learning (Ramirez-Correa et al., 2017).

In this current study, Facebook, Moodle, and the Internet experience were measured based on dichotomic questions adapted from Al-Azawei (2018). These included the following: (1) 'Facebook experience: 1- I have a low level of experience, 2- I have a high level of experience', (2) 'Moodle experience: 1- I have a low level of experience, 2- I have a high level of experience' and (3) 'Internet experience: 1- I have a low level of experience, 2- I have a high level of experience.'

DATA COLLECTION PROCEDURE AND SAMPLING

A cross-sectional instrument was adopted to gather the research data. This study targeted a population selected from amongst public-sector undergraduate students in Iraq. They were chosen because of their actual use of the technologies investigated in this study. Overall, the research sample comprised 143 Computer Science undergraduates, who were aware of Facebook and Moodle services in education. The questionnaire was distributed at the end of the second semester, 2017-2018, with an online survey used in the data collection. This remained available online for approximately three weeks. In total, the response rate was approximately 47.6%, as the questionnaire was distributed to around 300 university undergraduates.

Aside from the above, a non-probabilistic convenience sampling technique was used. According to Muijs (2004), this method is one of the most popular sampling approaches. Although it has some limitations because of its subjective nature, convenience sampling assists researchers in choosing respondents according to their availability (Tarhini, Hone, & Liu, 2015) as well as easy accessibility and willingness to participate (Etikan, Musa, & Alkassim, 2016). Moreover, it is useful when researchers have limited resources, time, and the population is very large (Etikan et al., 2016). Thus, it is difficult to represent the whole population in this study considering that undergraduate students from other disciplines in Iraq still face many barriers using ICT efficiently (Al-Azawei et al., 2016b).

DATA ANALYSIS

The ordinal data gathered in this research was analyzed using the PLS-SEM technique, which is a non-parametric, second-generation multivariate method (Hair, Hult, Ringle, & Sarstedt, 2016). SmartPLS software was used to investigate the research instrument's psychometric properties and to assess the established hypotheses in the proposed research model (Hair et al., 2016). The PLS-SEM technique is indicated as an appropriate approach for investigating technology acceptance when constructing a predictive model (Venkatesh & Bala, 2008).

RESULTS

DEMOGRAPHIC FEATURES

Table 1 shows the demographic statistics for the research subjects. All respondents were undergraduate students. Out of these, around 52.4% were male. Over half the respondents (57.3%) were in their first year of study, and the rest were in their second (31.4%) and third (11.2%) years. Approximately half the respondents (50.3%) were aged between 18 and 20 years. In terms of Internet experience, most of the participants (66.4%) had very little. Likewise, the majority (73.4%) had very little experience of Facebook, while around 60.1% had a high level of Moodle experience. These statistics are unsurprising, as the implementation of ICT is still in its early stages in Iraq.

Table 1: Demographic information

Factor	Frequency	%
Gender		
Male	75	52.4
Female	68	47.6
Study year		
First	82	57.3

Factor	Frequency	%
Second	45	31.5
Third	16	11.2
Age group		
18 to 20 years	72	50.3
20+ years	71	49.7
Internet experience		
Low	95	66.4
High	48	33.6
Facebook experience		
Low	105	73.4
High	38	26.6
Moodle experience		
Low	57	39.9
High	86	60.1

DESCRIPTIVE STATISTICS

Table 2 illustrates that the mean scores for all constructs of the research measurement are higher than the scale's midpoint (midpoint=2.5). All values of the variance inflation factor (VIF) are less than 10, supporting that the multicollinearity assumption was not violated. This could happen in the event of two constructs having a high association (Pallant, 2013). The VIF values ranged between 1.290 and 1.869.

Table 2: Descriptive statistics of Facebook and Moodle variables

Factor	Facebook			Moodle		
	M	SD	VIF	M	SD	VIF
IQ	4.0042	.77404	1.532	3.6748	.70961	1.825
SQ	3.7413	.68168	1.582	3.7238	.62144	1.853
TU	3.4112	.84712	1.869	3.1692	.73247	1.290
US	3.5455	.80252	1.869	3.8159	.66980	1.290
NB	3.3846	.83820	-	3.8059	.67424	-
Experience	1.27	.443	1.494	1.60	.491	1.167

Note: Information Quality (IQ), System Quality (SQ), Technology (Facebook and Moodle) Use (TU), User Satisfaction (US), Net Benefits (NB)

THE MEASUREMENT PROPERTIES

An important step before investigating the established research hypotheses was to examine the reliability and validity of the research survey. 'Construct validity' represents one of the most accepted measures when constructing a research questionnaire. It refers to "the degree to which a scale measures what it intends to measure" (Garver & Mentzer, 1999, p.34). In contrast, Cronbach's coefficient alpha is the most commonly used method for ensuring the reliability of a questionnaire (Pallant, 2013). Generally, an acceptable level of reliability is a Cronbach's alpha greater than 0.7 (Garver & Mentzer, 1999). Based on this threshold, the research questionnaire constructs in this present study achieved an acceptable level of reliability, with alphas ranging from 0.73 to 0.84 for both the SNS and LMS instruments. The only exception was the alpha for the system quality factor in the Moodle survey, which was 0.65, but this is acceptable in exploratory studies (Hair, Black, Babin, Anderson, & Tatham, 2006).

Further to the above, the instrument's convergent and discriminant validity was established. Convergent validity is "the extent to which a construct correlates with the indicators developed to measure it" (Al-Azawei, 2017, p.94). This is validated when the values of average variance extracted (AVE) and composite reliability (CR) exceed the threshold of 0.5 and 0.7, respectively (Hair et al., 2006).

Conversely, discriminant validity means that the indicators representing the factor distinguish the construct from other items that refer to other factors (Garver & Mentzer, 1999). It is established when the variance shared between one construct and another is less than the variance shared by a factor with its own constructs (Fornell & Larcker, 1981). In this research, both the convergent and discriminant validity of the survey was confirmed. Table 3 depicts the outer loading of all items in the instrument, whereas Table 4 presents the values for Cronbach's alpha, CR, AVE, and discriminant validity, wherein all were above the recommended thresholds in previous literature.

Table 3: Outer loading of the Facebook and Moodle survey items

Item	Facebook					Item	Moodle				
	FU	**IQ**	**NB**	**SQ**	**US**		**IQ**	**MU**	**NB**	**SQ**	**US**
IQ1		0.784				IQ1	0.797				
IQ2		0.727				IQ2	0.753				
IQ3		0.772				IQ3	0.785				
IQ4		0.876				IQ4	deleted				
IQ5		0.734				IQ5	0.740				
NB1			0.790			NB1			0.812		
NB2			0.805			NB2			0.739		
NB3			0.782			NB3			0.786		
NB4			0.793			NB4			deleted		
NB5			0.843			NB5			0.800		
SQ1				0.623		SQ1				0.652	
SQ2				0.772		SQ2				0.748	
SQ3				0.697		SQ3				0.611	
SQ4				0.765		SQ4				0.785	
SQ5				0.646		SQ5				deleted	
FU4	0.713					MU4		0.789			
FU1	0.893					MU1		0.816			
FU2	0.848					MU2		0.756			
FU3	0.775					MU3		0.846			
US1					0.604	US1					0.719
US2					0.905	US2					0.836
US3					0.891	US3					0.870

Note: Facebook Use (FU), Information Quality (IQ), Net Benefits (NB), System Quality (SQ), User Satisfaction (US), Moodle Use (MU)

Table 4: Convergent and discriminant validity of the Facebook and Moodle survey

	Facebook Survey							
	Cronbach's α	**CR**	**AVE**	**FU**	**IQ**	**NB**	**SQ**	**US**
FU	0.833	0.883	0.656	0.810				
IQ	0.838	0.886	0.609	0.663	0.781			
NB	0.863	0.901	0.645	0.682	0.655	0.803		
SQ	0.742	0.829	0.494	0.595	0.570	0.503	0.703	
US	0.733	0.849	0.659	0.682	0.706	0.804	0.661	0.812
	Moodle Survey							
	Cronbach's α	**CR**	**AVE**	**IQ**	**MU**	**NB**	**SQ**	**US**
IQ	0.770	0.853	0.591	0.769				
MU	0.816	0.878	0.644	0.546	0.802			
NB	0.792	0.865	0.616	0.665	0.543	0.785		
SQ	0.659	0.794	0.493	0.669	0.487	0.641	0.702	
US	0.741	0.851	0.658	0.674	0.474	0.754	0.654	0.811

Note: Facebook Use (FU), Information Quality (IQ), Net Benefits (NB), System Quality (SQ), User Satisfaction (US), Moodle Use (MU)

THE STRUCTURAL EQUATION MODEL ANALYSIS

This research applied a bootstrapping test, using 5,000 resamples to assess the significance of the strength of the path association between the exogenous and endogenous latent constructs. The PLS-SEM method applies this bootstrapping test to evaluate the significance of the relationship between two variables by accounting for the values of the path coefficient (β), t-statistics, and p-values (Hair et al., 2016). The model's power is measured on the basis of the R^2 value.

With regard to the Facebook model, Table 5 shows the path association between the model variables. It was found that system quality and information quality had a significant and positive effect on Facebook use and learner satisfaction, supporting H1a, H2a, H3a, and H4a. On the contrary, Facebook experience had a significant but negative effect on Facebook use, rejecting H5a. However, it did have a significant and positive influence on learner satisfaction, confirming H6a. Meanwhile, Internet experience had an insignificant effect on both Facebook use and learner satisfaction, rejecting H7a and H8a. Moreover, Facebook use was a significant predictor of learner satisfaction to support H9a. This is in addition to the significant influence of Facebook use and learner satisfaction on net benefits, confirming H10a and H11a. From such findings, it may be concluded that Facebook services in Iraqi higher education have important potential for use by undergraduate students; providing them with an alternative means of sharing information and learning resources, as well as interacting with peers. Figure 3 gives an overview of the relationships between the proposed model constructs. It is clear that the research model accounted for 0.534, 0.650, and 0.681 of variance for Facebook use, learner satisfaction, and net benefits, respectively.

Following the Moodle model, Table 6 reports the results of the path associated with the model constructs. It was indicated that system quality and information quality had a significant and positive effect on Moodle use and learner satisfaction, supporting H1b, H2b, H3b, and H4b. Similar to the Facebook model, experience of Moodle had a significant but negative influence on Moodle use and an insignificant effect on learner satisfaction, rejecting H5b and H6b. Unlike the Facebook model, the Internet experience had a significant influence on Moodle use, but was not a predictor of learner satisfaction. This supported H7b but rejected H8b. Furthermore, Moodle use was not a determinant of learner satisfaction, thereby rejecting H9b. However, both Moodle use and learner satisfaction were predictors of net benefits, supporting H10b and H11b. Thus, it may be ascertained that LMS services can enhance the learning process, if such technologies are used effectively. In this model, R^2 was 0.379, 0.542, and 0.614 for Moodle use, learner satisfaction, and net benefits, respectively (see Figure 4). These findings confirm the predictive ability of most of the endogenous latent constructs in the structural equation model.

Table 5: Findings from the structural equation of the Facebook model

Hypothesis	Facebook					
	Direct effect	t-value	p-value	Indirect effect	Total effect	Result
H1a: SQ→FU	0.281	4.399	<0.001		0.281	Supported
H2a: SQ→US	0.319	3.488	<0.001	0.087	0.406	Supported
H3a: IQ→FU	0.445	6.841	<0.001		0.445	Supported
H4a: IQ→US	0.371	5.161	<0.001	0.137	0.454	Supported
H5a: FE→FU	-0.186	2.379	0.017		-0.186	Rejected
H6a: FE→US	0.161	2.141	0.032	-0.057	0.104	Supported
H7a: IE→FU	0.048	0.761	0.446		0.048	Rejected
H8a: IE→US	-0.038	0.580	0.562	0.015	-0.018	Rejected
H9a: FU→US	0.308	4.335	<0.001		0.308	Supported
H10a: FU→NB	0.250	3.552	<0.001	0.195	0.445	Supported
H11a: US→NB	0.634	10.176	<0.001		0.634	Supported

Note: Facebook Use (FU), Information Quality (IQ), Net Benefits (NB), System Quality (SQ), User Satisfaction (US), Facebook Experience (FE), Internet Experience (IE)
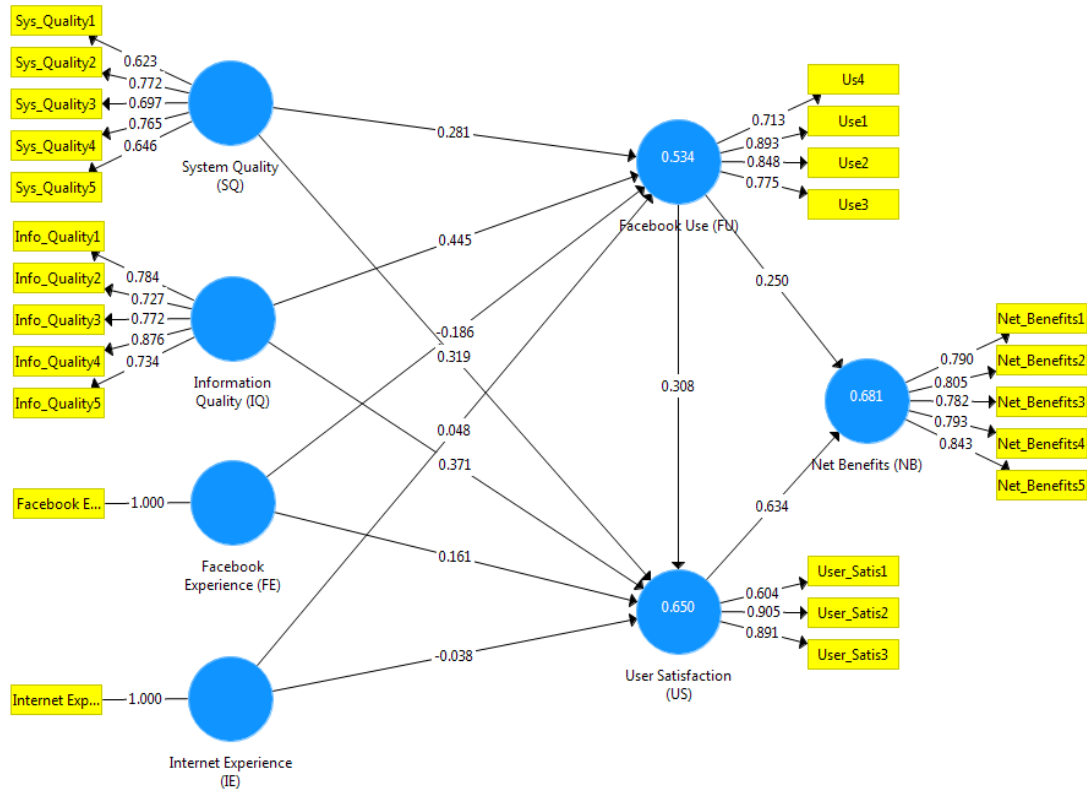
Figure 3: The Facebook Model

Table 6: Findings from the structural equation of the Moodle model

Hypothesis	Moodle					
	Direct effect	t-value	p-value	Indirect effect	Total effect	Result
H1b: SQ➔MU	0.173	1.680	0.093		0.173	Rejected
H2b: SQ➔US	0.354	4.622	<0.001	0.020	0.374	Supported
H3b: IQ➔MU	0.402	4.089	<0.001		0.402	Supported
H4b: IQ➔US	0.387	4.747	<0.001	0.047	0.434	Supported
H5b: ME➔MU	-0.227	3.072	0.002		-0.227	Rejected
H6b: ME➔US	0.097	1.549	0.121	-0.026	0.071	Rejected
H7b: IE➔MU	0.175	2.614	0.009		0.175	Supported
H8b: IE➔US	-0.016	0.276	0.782	0.020	0.04	Rejected
H9b: MU➔US	0.116	1.641	0.101		0.116	Rejected
H10b: MU➔NB	0.240	3.851	<0.001		0.240	Supported
H11b: US➔NB	0.641	11.861	<0.001		0.641	Supported

Note: Moodle Use (MU), Information Quality (IQ), Net Benefits (NB), System Quality (SQ), User Satisfaction (US), Moodle Experience (ME), Internet Experience (IE)
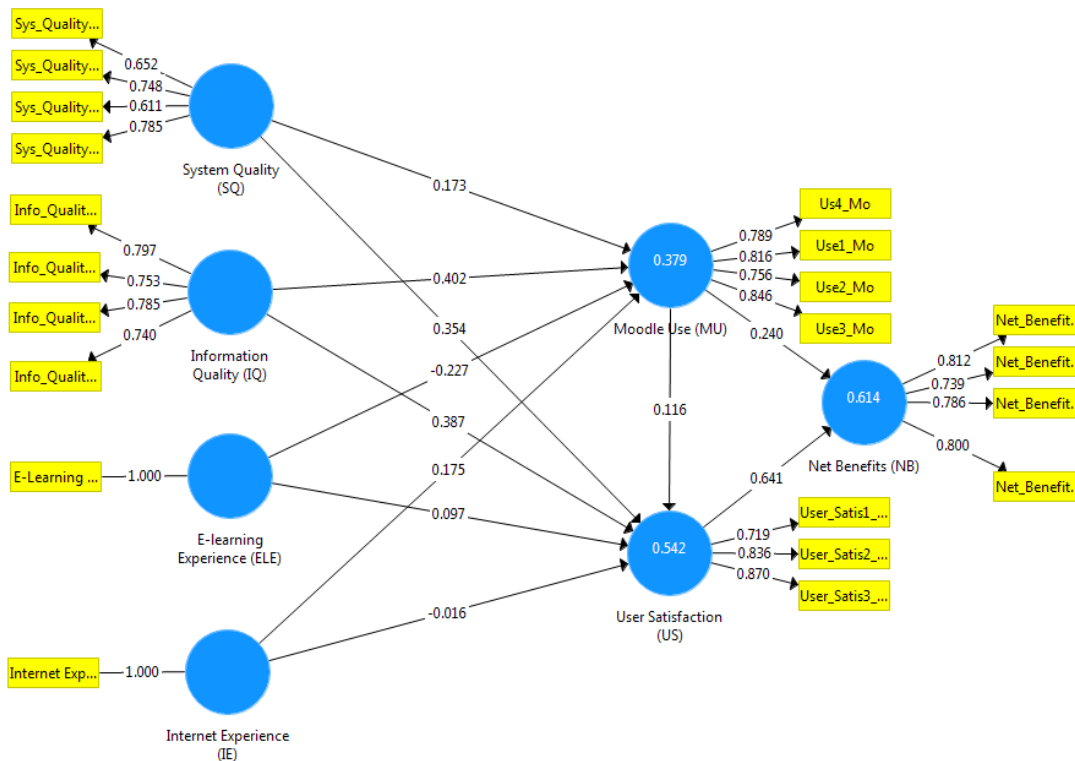
Figure 4: The Moodle model

DISCUSSION

The key objective of this study was to understand the constructs affecting SNS and LMS success in higher education, based on the perceptions of undergraduate students in Iraq. This research objective was met through hypotheses H1 to H11 (see Tables 5, 6 and Figures 3, 4). With respect to this research objective, the findings support the suitability of the D&M ISS model for investigating the success of SNS in education and LMS systems. The model's effectiveness was found in several different elements.

For the SNS model, all original hypotheses of the D&M ISS model were supported (see Table 5 and Figure 3). The Facebook experience was also found to be a significant predictor of learner satisfaction. This means that the students gained higher satisfaction when using Facebook in educational contexts, if they had sufficient experience of using it. On the contrary, Facebook experience had no significant influence on Facebook use. Moreover, Internet experience was not found to be a predictor of either Facebook use or learner satisfaction. The extended D&M ISS model therefore provides high explanatory power of the endogenous constructs, in accordance with the variance explained. It also provides good explanatory power in terms of Facebook use (R^2=0.534), learner satisfaction (R^2=0.650), and net benefits (R^2=0.681). These research findings are consistent with another study that adopted the D&M ISS model to investigate Facebook success in Taiwan (Dong et al., 2014).

Pertaining to the LMS model, most of the original hypotheses of the D&M ISS model were supported (see Table 6 and Figure 4). However, system quality was not identified as a predictor of Moodle use, and Moodle use had an insignificant effect on learner satisfaction. Additionally, Moodle experience had an insignificant effect on both Moodle use and learner satisfaction. Although the Internet experience was not a determinant of learner satisfaction, it had a significant influence on Moodle use, indicating that the actual adoption of Moodle can be increased where there is a high level of

Internet experience. Thus, the proposed model shows high explanatory power of the endogenous variables. Such results are in agreement with other studies on the effectiveness of the D&M ISS model in different research contexts (Ramirez-Correa et al., 2017; Yakubu & Dasuki, 2018). However, our extended model showed significantly better explanatory power, compared to previous research. For example, in their study, Ramirez-Correa et al. (2017) explained LMS use ($R^2 = 0.25$), learner satisfaction ($R^2 = 0.51$), and net benefits ($R^2 = 0.41$), whereas our model successfully explained LMS use ($R^2=0.379$), learner satisfaction ($R^2=0.542$), and net benefits ($R^2=0.614$).

Meanwhile, it was suggested that system quality affected both technology use and user satisfaction with regard to SNS and LMS. This is in agreement with earlier studies (Mohammadi, 2015; Yakubu & Dasuki, 2018). The findings from this current study support the relationship between learner satisfaction and system quality in both models, which may indicate that when learners perceive a technology's functionalities to be of high quality, including its reliability, availability, response time, and design, their individual satisfaction is likely to be higher. In turn, this could lead to their further use of the system. However, system quality was only a significant predictor of technology use in the SNS model, but not in the LMS model. In line with this result, Wang and Liao (2006) also found that system quality did not affect e-Government use. Such an insignificant association between system quality and Moodle use suggests that the adoption of Moodle is not based on system quality. A possible explanation for this insignificant association is that the use of Moodle is mandatory in the context being investigated and so students and teachers are obliged to use it, regardless of its actual quality. Another possible reason is that the students had already used Moodle previously and so their perceptions and experience of using it could be based on factors other than system quality.

The D&M ISS model argues that information quality has a significant influence on technology use and user satisfaction. This assumption was confirmed in this study for both the SNS and LMS models, supporting the findings of previous research (Dong et al., 2014; Alzahrani, Mahmud, Ramayah, & Alfarraj, 2017; Ramirez-Correa et al., 2017; Yakubu & Dasuki, 2018). This means that the students found the quality of information obtained using the SNS and LMS was complete, relevant, and accurate. Accordingly, they were satisfied with this high-quality information. Thus, to implement SNS and LMS successfully in higher education, technology managers and teachers should actively look for methods of enhancing system and information quality. Based on these outcomes, it is clear that when educational technology (SNS and LMS) is provided and updated with new resources, learners tend to have a high degree of willingness to use it and are more satisfied. It may therefore be deduced that learners are more eager to adopt SNS/LMS, if new information is available about such technology in the context of their studies; for example, with regard to uploading, new books, asking new questions, updating reading resources, and connecting with peers.

Similar to the original assumption of the D&M ISS model, technology use was found to be a predictor of user satisfaction in the Facebook model, but not in the Moodle model. One possible interpretation of this is that the use of Moodle did not motivate learners enough to ensure their satisfaction. Some instructors also displayed a low level of willingness to use the system, which could have had a negative influence on their students. Another possible reason is that the use of Moodle was mandatory for all students, which could have reduced their satisfaction, whereas Facebook provided social interaction and its use was optional. Thus, the students were more satisfied with this platform. The above result supports Ojo's (2017) analysis, which also shows an insignificant association between technology use and user satisfaction. Furthermore, technology use and user satisfaction were postulated to influence technology benefits, confirming the findings of earlier research (Ojo, 2017; Ramirez-Correa et al., 2017) and corresponding to the original assumption of the D&M ISS model (DeLone & McLean, 1992). Table 7 summarizes the similarities and differences between the current study findings and some of the previous literature. Although our results are in line with most of the previous research, there are some inconsistencies, which might be due to cultural differences, particularly with regard to features of technology and/or individual users' experience and characteristics.

Table 7: Comparing the findings of this research with some of the previous literature

Study	System	Relationships						
		SQ_SU	SQ_US	IQ_SU	IQ_US	SU_US	SU_NB	US_NB
Wang & Liao (2006)	e-Government	X	√	√	√	√	√	√
Dong et al. (2014)	Facebook	NA	√	NA	√	NA	NA	√
Mohammadi (2015)	LMS	√	√	√	√	NA	NA	NA
Alzahrani et al. (2017)	e-Library	√	√	√	√	NA	NA	NA
Ojo (2017)	Healthcare IS	√	√	√	√	X	√	X
Ramirez-Correa et al. (2017)	LMS	√	√	√	√	√	√	√
Yakubu & Dasuki (2018)	LMS	√	X	√	X	√	√	√
This study	Facebook in education	√	√	√	√	√	√	√
This study	LMS	X	√	√	√	X	√	√

Note: System Use (SU), Information Quality (IQ), Net Benefits (NB), System Quality (SQ), User Satisfaction (US), NA: Not-applicable, √: Supported, X: Unsupported

The constructs integrated with the D&M ISS model were technology (SNS and LMS) and Internet experience. The only significant positive relationships were found between Facebook experience and learner satisfaction, and between Internet experience and Moodle use. These findings provide moderate support for the assumptions of Song et al. (2004) and Liu et al. (2010), wherein experience affects technology adoption. Building on the research outcomes, several recommendations can be made:

1. Incorporating SNS alongside traditional classrooms is becoming necessary in contemporary education, as younger students have a high degree of willingness to use such sites in this digital era. Therefore, the vast embedded capacity for social interaction in SNS can be exploited to provide learners with various means of absorbing learning content, as well as for interacting with peers or instructors outside of class hours.
2. Using SNS in blended learning contexts could play a significant role in addressing the failure of traditional e-learning systems (for example, LMS) in higher education.
3. Teachers should always be eager to update their learning resources, because this could help enhance technology use and learner satisfaction; both of which may lead to the net benefits of technology being perceived.
4. When using a learning technology, its information convenience, accessibility, reliability, accuracy, timeliness, and relevance should be fully included. Thus, teachers should consider such features when designing their learning content.
5. It is necessary to apply high quality learning technologies in the case of optional technology use, whereas it has less effect in terms of mandatory use. As such, to improve technology adoption and user satisfaction, it is important that designers consider the various features of the system.
6. Further training courses or detailed guidelines are still required for undergraduate students on the use of educational technologies, in order to improve their actual use and/or perceived satisfaction.

CONCLUSION

This research was conducted to shed light on the constructs determining the success of SNS and LMS in education, based on an extended D&M ISS model. To date, this research area has only re-

ceived narrow investigation in the developing world. A survey research design was adopted to meet the key research objective; generating study findings to suggest that the D&M ISS model is an effective approach to predicting the success of both SNS and LMS. The proposed model showed a high explanatory power in both the Facebook and Moodle models.

The findings of this research identified significant concepts associated with critical predictors of SNS in education and LMS, in the case of developing countries that have not been highlighted in previous research. Although some of the earlier literature on SNS and LMS focused on implementing the D&M ISS model, this research found an extended framework to be an effective approach to determining the success of both SNS and LMS. This could imply that users' experience, system quality, and information quality can increase the real-life advantages of SNS and/or LMS in contemporary education. Therefore, these factors should be pursued to offer more practical and interesting educational services. Second, this research indicates that SNS and LMS developers should be careful to include software features that are the determinants of technology use, learner satisfaction, and benefits of SNS and LMS. The significant influence of the constructs investigated here could help shape strategies and approaches to enhancing SNS and LMS implementation in educational institutions. Specifically, it was found that the students were more concerned with system and information quality in the SNS than in the LMS, perhaps because the use of the LMS was to some extent mandatory, whereas they had created their own SNS groups to improve interaction and the sharing of learning content.

Nevertheless, regardless of the significant outcomes presented in this study, it is not without limitations. Therefore, further research is required to validate our findings, as this empirical research is cross-sectional and based on the convenience sampling approach. In contrast, a longitudinal approach and random sampling method could provide more reliable and generalizable results. Moreover, repeating this study in different educational institutions in Iraq or in other countries with a different culture could highlight further similarities and differences in the research findings. Even though the proposed model explained more than 60% of the variance of net benefits for the SNS and LMS, around 40% of variance was unexplained. This may indicate that other variables such as trust, price value, social influence, and confirmation need to be integrated with the research model, in order to enhance its predictive ability. It is hoped that our future research will build on the outcomes of this study and expand its key findings.

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APPENDIX: THE RESEARCH QUESTIONNAIRE

System Quality (SQ)	
SQ1	Facebook (Moodle) is user-friendly
SQ2	Facebook (Moodle) provides interactive features between learners and the system
SQ3	Facebook (Moodle) has attractive features to appeal to the learners
SQ4	Facebook (Moodle) provides high-speed information access
SQ5	Facebook (Moodle) has flexible features
SQ6	Facebook (Moodle) is a secure system
Information Quality (IQ)	
IQ1	Facebook (Moodle) provides information that is exactly what I need
IQ2	Facebook (Moodle) provides information that is relevant to my study
IQ3	Facebook (Moodle) provides sufficient information
IQ4	Facebook (Moodle) provides information that is easy to understand
IQ5	Facebook (Moodle) provides up-to-date information
Technology Use (TU)	
TU1	I frequently use Facebook (Moodle) in my study
TU2	I depend upon Facebook (Moodle) in my study
TU3	I use Facebook (Moodle) daily
TU4	I use Facebook (Moodle) often
User Satisfaction (US)	
US1	Most of the learners have a positive attitude to or evaluation of Facebook (Moodle) functions
US2	I think Facebook (Moodle) is very helpful for learning
US3	Overall, I am satisfied with Facebook (Moodle)
Net Benefits (NB)	
NB1	Facebook (Moodle) helps me to improve my academic performance
NB2	Facebook (Moodle) helps me to develop my ability to solve problems in my studies
NB3	Facebook (Moodle) helps the university to offer better education services to students
NB4	Facebook (Moodle) helps the university to save costs
NB5	I believe Facebook (Moodle) is useful

BIOGRAPHY

Ahmed Al-Azawei is a lecturer in the College of Information Technology, at the University of Babylon, Iraq. He undertook his PhD in Computer Science at the University of Reading, UK. His area of research focuses on learner differences, the application of e-learning, inclusive learning theories, technology adoption, Web technologies, analysis of social media data, and adaptive educational hypermedia systems. Ahmed's research aims to enhance the implementation of information and communication technologies (ICT) in higher education in developing countries. Ahmed has published widely in international journals and presented a number of conference papers.