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International Journal of Data and Network Science

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Quality factors impacting e-learning within the mobile environment in Saudi Arabia universities: An interview study

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C H R O N I C L E

Article history:
Received: July 16, 2023
Received in revised format: August 14, 2023
Accepted: September 22, 2023
Available online: September 22, 2023

Keywords:
E-learning with mobile environment
Information systems success model
Quality factors
Saudi Arabian higher education
Instructional quality
Blackboard as a Learning Management System (LMS)

A B S T R A C T

Mobile e-learning within the education domain is now an integral part in education technology. However, there has been little discussion about the benefits and the challenges of the use of M-learning in the higher education system in KSA. Interviews were the primary instruments used for data collection in identifying the enabling and deterring the quality attributes of mobile e-learning use in the context in Saudi Arabia higher education. The research results revealed that learning content/information quality, system quality, service quality and instructional quality were the primary antecedents of Blackboard as a Learning Management System (LMS) in general and within the mobile devices, and this situation can enhance user's attitude towards the use of E-learning. Data were analyzed and results were discussed. Recommendations were made based on the findings.

1. Introduction

The 21st century has been marked by the crucial role of technology in the day-to-day affairs of people from all walks of life, within various domains. Within the domain of education, technology has been used in re-engineering and re-designing education and the training system, which requires all the involved parties like professionals, educators, and learners to alter their core beliefs so that they could successfully use technology in education. Learners and teachers especially, could substantially benefit from using these technological devices, E-learning has been used as the alternative to or to complement the traditional learning, while m-learning has been used to complement the traditional learning and e-learning. Through m-learning, learners could interact with their learning resources outside of learning environments (Clark & Ed, 2007; Kumar Basak, Wotto, & Belanger, 2018).

There are many technological devices available today to facilitate e-learning. Somehow, thoughtless dependency on technological applications has become a major issue in expediting knowledge and in student engagement as it could hinder student engagement (Rettie & Daniels, 2021). Indeed, in order that knowledge is vigorously facilitated, the process of learning must be equipped with operative techniques, engagement devices, as well as user experience (Means, 2010). In examining learner perspective and representation of information between web and mobile applications, Gazzawe, Mayouf, Lock, and Alturki (2022) found that learners as users viewed web applications as more flexible in comparison to mobile devices. However, for remote learning access, learners perceive mobile applications as more flexible.

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ISSN 2561-8156 (Online) - ISSN 2561-8148 (Print)

doi: 10.5267/j.ijdns.2023.9.025

Distance learning and digital information technologies are expansively being used all over the globe, including in Saudi Arabia particularly since the past several years (Kaisara & Bwalya, 2021). Kingdom of Saudi Arabia (KSA) launched its e-learning in 2002, and albeit its slow pace, e-learning in KSA is increasingly recognized and has been increasingly the subject of interest among academic establishments, academics, and students(Abdelmola, Makeen, Hanafi, & Ageeli, 2021). The majority of higher education institutions in KSA are using e-learning as part of blended learning, or as web-based learning, as full online learning, facilitated by the national center. Reciprocal interaction, technological integration, and practicality of different styles of learning have made e-learning implementation possible (AlKhunzain & Khan, 2021). With the e-learning platform made available, education institutions KSA are able to execute the online and remote teaching during COVID-19pandemic that had affected education systems globally. In a way, the e-learning platform has greatly benefitted education institutions. For instance, during the pandemic, Majmaah University teaching program was still able to resume with e-learning, as the university already had a blended learning program in place with Blackboard(AlKhunzain & Khan, 2021).

The use of mobile technologies, particularly mobile learning can be observed among many education institutions today, for the purpose of increasing performance, while lecturers and students could enjoy efficient services and information provided by these institutions. Notably, mobile learning or m-learning isn't to replace the e-learning platform; rather, it is used alongside e-learning. Learning services are accessed via wireless and mobile technologies, and many education organizations are showing concern over these technologies. With mobile technologies offering users with superior mobile devices, wireless capacities, and high bandwidth, e-learning was transformed into m-learning (Alorfi, 2018; Triantafillou & Papanicolaou, 2006).

2. Mobile Learning Management System in SAUDI ARABIA

In recent years, Saudi Arabia has progressively moved towards m-learning utilization, as result of the rapid growth in its ICT infrastructure. More specifically, Saudi Arabia education sector has four distinct technology phases. The first phase marked a passive use of internet where traditional materials were simply repurposed to an online format. The current generation, considered as the fourth phase, is immensely influenced by the advances in mobile technology and has empowered the current generation to have easy and reliable access to rich resources. Saudi Arabia is moving towards m-learning, because of special phenomena such as COVID-19, which not only increases e-learning demand and its move towards mobile usage. Moving from e-learning to m-learning requires a lot of steps and a new educational approach. Accordingly, the attempts to bring the technology of mobile learning in the domain of education have been observed among many universities in KSA, as these universities wanted to increase their education quality, while improving learning among the students and the members of faculty. For instance, in collaboration with Zain Saudi Telecom Company, King Abdulaziz University implemented the use of mobile phone in its "distance education" program. The university utilized the applications of mobile phones to carry out its educational programs as an innovative form of e-learning systems which are not restricted by time or space(Al-Qarni, 2012). Somehow, within the context of higher education system in KSA, the benefits and challenges of m-learning usage have not been adequately explored(Abdelmola et al., 2021; Albazie, 2018).

M-learning implementation often includes mobile phones and modern PDAs and both devices could replace the newly developed emerging technologies (El Miedany (2019), and so, it is now common to see modern mobile phones being part of education as they are expansively utilized in education institutions to share learning material and in online teaching and learning as well. Mobile phones are commonly used in Saudi Arabia among teachers, to teach various subjects. The use of m-learning is common among education institutions in KSA. However, it appears that not much is understood on m-learning usage among education institutions in KSA, particularly in terms of the perceptions of learners on the use of mobile phone devices to promote e-learning. For instance, it has been reported by (AlKhunzain & Khan, 2021) that blackboard usage via mobile phone has not been adequately studied.

Blackboard application through mobile phones as m-learning instrument is demonstrating a potential educational revolution, and some features of Mobile Blackboard have significant effect on the usage perception of user of this application (i.e., Blackboard via mobile phones). As such AlKhunzain and Khan (2021) stressed on the need to consider these features of Blackboard during online learning implementation to assure effectiveness and success in learning and education.. The evolution of m-learning includes the birth of many applications such as learning management system (LMS),and LMS that is accessible via mobile devices is termed as mobile learning management system (M-LMS or mobile LMS) (Hanafi, Murtadho, & Ikhsan, 2020). As a tool of M-learning, M-LMS provides access to courses to both faculty and students through their mobile devices at any time and place (Saroia & Gao, 2019). M-LMS therefore supports a wider access variety to learning opportunities, and as explained in (Ally & Tsinakos, 2014), M-LMS is a form of online learning that prioritizes accessibility and usability. Somehow, concerning M-LMS usage particularly in developing countries, (Aman et al., 2020) reported a lack of studies that look into the determining factors. Hence, such factors need to be investigated particularly in developing countries' context. In this context, the research aims to determine the quality attributes of e-learning use in a mobile context in Saudi Arabian higher education. By identifying these quality attributes the research intends to offer guidance on Saudi higher education institutions to improve their offerings and facilitate their transition to m-learning. The research will focus on King Abdulaziz University (KAU) as a typical case of a Saudi higher education institution.

3. The Delone and Mclean is success model

Learner attitudes have a significant impact on technology or new technology, in this regard. The same can be said with regards to electronic learning through mobile devices. Learner attitudes have an impact on their enthusiasm towards the new technology, namely electronic learning through mobile devices, which in turn will impact the operation efficiency of the mechanism of the technology. Indeed, learner attitudes towards the technology will lead to acceptance or resistance of learners towards the use of this new technology in the educational process (Abdelmola et al., 2021; Al-Halfawi, 2009). This model is an information systems theory introduced by DeLone and McLean. By identifying and describing the relationships among six critical success dimensions and the evaluated IS, the model offers a comprehensive understanding of successful IS. This conceptual model classes measures of success into six dimensions, following the significant cause and effect relationships of the IS process model. As explained in (Buhalis & Peters, 2006), the relationships demonstrate the flow of causality in the direction that is comparable to the information process.

The IS model is among the most frequently applied models in IS studies, and its six dimensions evaluate the effectiveness of the IS domain (Yilmaz, 2008). The dimensions are system quality, information quality, use, user-satisfaction, individual impact and organizational impact. Both system quality and information quality impact use and user satisfaction, both discretely and jointly. On the other hand, system quality, information quality, information system use and user-satisfaction jointly impact individuals and organizations.

Also, the IS success model illuminates the dissimilarities between IS aspects and features as satisfaction determinants. As such, the performance of individuals is directly affected by the level of user satisfaction and use, and the performance of individuals consequently affect that of the organization (DeLone & McLean, 1992). Several modifications have been made to the model, and among the significant ones was the splitting of Use construct into the constructs of Intention to Use and Use. The split, according to J. Mtebe and Raisamo (2014) was to allow measurement of IS success in both voluntary and mandatory environments. Fig. 1 can be referred to.

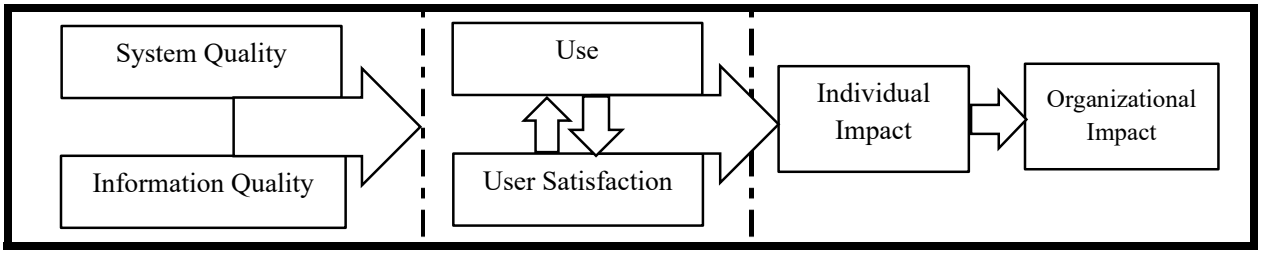

Fig. 1. D&M IS Success Model (DeLone & McLean, 1992)

The IS success model comprises six dimensions. As described by (DeLone & McLean, 1992; Sabeh, Husin, Kee, Baharudin, & Abdullah, 2021) the dimensions are:

- System quality, which refers to the appropriate characteristics of the mobile LMS as the system itself.
- Information quality which is associated with the quality of the outputs of mobile LMS, which includes the information quality provided by mobile LMS.
- Use is about the perceived actual use of mobile LMS by users in their execution of various tasks.
- User satisfaction relates to the satisfaction of users in their use of mobile LMS.
- Individual impact is associated with the perceived individual benefits received by users following mobile LMS usage.
- Organizational impact is about the viewpoint of users towards the organizational level of success of mobile LMS, for instance, the overall productivity improvement and efficiency.

The IS Success Model is a prominent model, and its practicality has been cited, substantiated, and established in various sectors including the sector of education involving academic institutions(Al-Shargabi, Sabri, & Aljawarneh, 2021; Hamidi & Jahanshaheefard, 2019; Heather, Modi, & Feldman, 2020).

3.1 The Updated D&M IS Success Model

In 2003, the D&M IS Success model was updated with the inclusion of service quality measure, which is comparable to a method demonstrated in (Lee & Chung, 2009). The success of a given system is ascertained by measuring its information quality or system quality. On the other hand, the overall success of the IS department is determined mainly through the measurement of the department's service quality.

The revision done to the D&M model in 2003 was to amend the model so that it could cope with the shifting information technology (IT) industry (DeLone & McLean, 2003). As previously mentioned, the amendment involved breaking down the

use factor into intention to use and use – this was to allow the measurement of systems success in areas where the system use is voluntary and mandatory. A new factor was added as well. The factor was the service quality factor, and this was to allow the model to measure the quality of information services furnished by the IT units of various organizations. There are six factors in the updated D&M model as follows: information quality, system quality, service quality, intention to use/use, user satisfaction, and net benefits.

Service quality, as described in Mohamed and Abd El Warth (2012) signifies the overall support provided by the service provider, as well as the existence/lack of such support from the IS department, the organizational unit or the firm that outsources to an internet service provider. On the other hand, intention to use measures the experience of using and navigating the website, retrieving information and interactions, whereas user satisfaction as the fifth dimension entails a variable that gauges the viewpoint of users towards the use of the M-learning system. This relates to the entire experience of user, and this ranges from information retrieval, purchase, payment to service receipt.

Net benefits as the last dimension in the IS success model relates to the balance between positive and negative effects of M-learning on related stakeholders, for instance, markets, customers, employees, organizations, suppliers, as well as the entire society. The IS success model has been used in successful E-learning evaluation (Holsapple & Lee-Post, 2006), M-commerce (Alqatan, Noor, Man, & Mohemad, 2017), M-learning (Alharbi & Drew, 2014) and in online learning system (Lin, 2007). The model is also popular in the IS domain (Alsharafat, 2021). The updated D&M model is accordingly illustrated in Fig. 2.

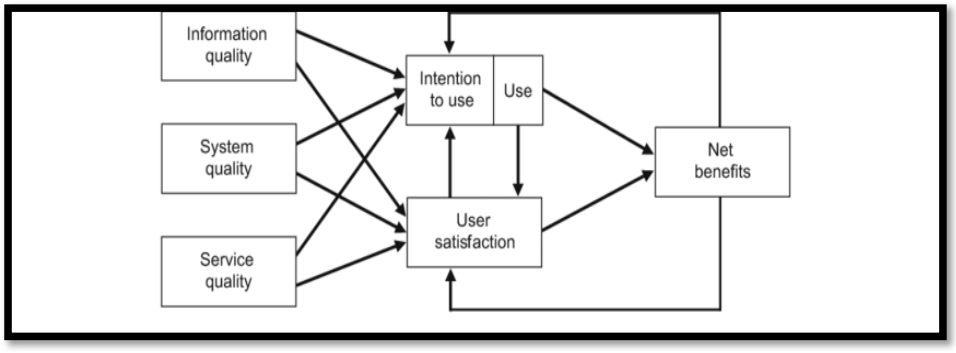

Fig. 2. The updated IS success model

The updated D&M model is somehow not a universal model in IS success measurement, and the constructs in the model should be increased or reduced in accordance with the study context (DeLone & McLean, 2003). Owing to the current developments in Mobile LMSs, the D&M model has to be expanded in order that these systems could be measured in diverse educational settings, in terms of their success (Alsharedeh, Ababneh, Alqatan, & Thneibat, 2022; Han & Shin, 2016; E.-Y. Lee & Jeon, 2020).

Notably, the degree of expansion to the model varies from study to study. For instance, Holsapple and Lee-Post (2006) had split D&M model into three stages of design, delivery and outcome, where, the design stage comprises service quality, system quality, and information quality, and the delivery stage comprises system use, and user satisfaction. As for the stage of outcome, it includes net benefits. A sample comprising 369 Blackboard system users was used in validating the model, and the model proved its appropriateness for evaluating LMS via an iterative process of diagnosing, action planning, action taking, evaluating, and learning.

In Hassanzadeh, Kanaani, and Elahi (2012), the D&M model was expanded in their examination of E-learning, whereby the construct of net benefits was broken down into three different constructs of loyalty to system, goals achievement and educational system quality. Additionally, the constructs of intention to use and system use were treated as two discrete constructs, while system quality was re-termed as technical system quality, and information quality was re-termed as content and information quality. There were 10 constructs in the model applied in this study and all of them proved to be appropriate for measuring E-learning system success. Utilizing a sample comprising 2,858 students, 470 alumni and 270 instructors from a total of five universities, the authors validated the model.

This study has chosen to employ the DeLone and McLean information system success model by DeLone and McLean (2003) to identify the factors that have an impact on the success of LMS success. The model was deemed appropriate for this study because it has a strong theoretical foundation, its ability to evaluate the success of LMS, and the empirical success of many past studies in using this model (Jafari, Salem, Moaddab, & Salem, 2015).

The wide usage IS success model can be observed in IS domain (Alsharafat, 2021) and this model has been deemed the most established model in studies that involve academic institutions (Al-Shargabi et al., 2021; Hamidi & Jahanshaheefard, 2019; Martin, Modi, & Feldman, 2020). Also, as discovered in studies including, Mtebe and Raisamo (2014), Hassanzadeh et al.

(2012) and Holsapple and Lee-Post (2006) ,the IS success model could effectively evaluate LMS via an iterative process that involves diagnosing, action planning, action taking, evaluating, and learning. In the academic domain, there has been expansive application and development of IS success model to make it a fitting theory for the study of Mobile LMS introduction (Alsharedeh et al., 2022; Haddad, 2018; Han & Shin, 2016; Lee & Jeon, 2020). However, it should be noted that the extended models were mostly validated in institutions of higher education in western nations with students as study samples (Mtebe & Raisamo, 2014).

4. Information systems quality attributes for mobile LMS

Quality measurement facilitates the successful implementation of mobile LMS. There are indeed various available quality measurement tools developed for the evaluation of mobile LMS with the purpose of assuring quality teaching and learning on the mobile LMS platforms. In their study, (Alrasheedi, Capretz, & Raza, 2015) mentioned the importance of increasing and assuring quality in order that online learning in higher education institutions could successfully serve its purpose. As Mobile learning becomes more popular, the need to guarantee its quality and effectiveness of mobile learning Management System increases. According to (Green, 1994), quality is dictated by how far a given product or service satisfies its designated purposes. It has been reported that quality factors affect the identification of the needed requirements in the establishment of a successful information system (Al-Debei, 2014; Almaiah & Alamri, 2018; Djouab & Bari, 2016).

As an abstract concept, quality is impossible to describe by just a simple definition. Meanwhile, in the definition of quality in LMS systems, the detailed context and the viewpoints of users are considered. Additionally, Stracke (2006) highlighted the need to class the right criteria in addressing the issue of quality. To this end, past studies have indicated significant interest among relevant bodies concerning the information quality presented by information systems on the whole. Still, as the web has a multifaceted notion of quality, its measurement should be multidimensional (Aladwani & Palvia, 2002; Alkhattabi, Neagu, & Cullen, 2010). In this regard, in the evaluation of information quality, the criteria for determining the quality should be determined (Büyüközkan, Feyzioğlu, & Ruan, 2007). The elements of quality of online learning have been examined by a number of studies, but as indicated in Sofiadin (2018) most of them were carried out in the settings of developed countries. On the other hand, the community in Saudi Arabia is distinct in terms of culture, religion, education level and social norms – all of which may impact the quality needs of Saudi students. Hence, the quality elements that can fulfil the needs of Saudi students should be identified (Alubthne, 2018). Accordingly, Table 2 briefly displays the relevant quality antecedents in the educational IS quality environment.

Table 1
Summary of Literature Review On The Impact Of Quality Factors On The Educational IS Quality Environment

Author & Year	SysQ	InforQ	ServQ	ContQ	InstQ	InterDesQ	Readiness	ReaComQ	InterQ	learQ	Context
Jewer, Compeau, and Besworth (2017)	√	√	√								Information Systems
Gorla, Somers, and Wong (2010)	√	√	√								Information Systems
Almaiah and Man (2016)	√	√	√								Mobile Learning
Alshurideh et al. (2021)	√	√	√	√							Smart Mobile Examination Platforms
Mtebe and Raphael (2018)	√	√	√		√						E-learning
Lee and Chung (2009)	√	√				√					M- Banking
Mtebe and Raisamo (2014)	√	√	√								LMS
Al-Shargabi et al. (2021)	√	√	√								E-learning
Freeze, Alshare, Lane, and Wen (2010)	√	√									E-learning
Jafari et al. (2015)	√	√					√				LMS
Ohliati and Abbas (2019)	√	√	√					√			LMS
Gable, Sedera, and Chan (2003)	√	√									Information system
Haddad (2018)	√	√									LMS
Koh and Kan (2020)					√				√	√	LMS
Mohammadi (2015)	√	√	√	√						√	E-learning
Al-Busaidi and Al-Shihi (2010)	√	√	√								LMS
Kim, Trimi, Park, and Rhee (2012)	√	√			√						E-learning
Almaiah and Al Mulhem (2019)	√		√								M-learning
Cheng (2012)	√	√	√		√						E-learning
Osman, Wahid, and Zakria (2018)	√		√	√							E-learning

SysQ: System Quality, InforQ: Information Quality, ServQ: Service Quality, ContQ: Content Quality, InstQ: instructional quality, InterDesQ: Interface Design Quality, ReaComQ: Readiness Communication quality, InterQ: interaction quality, LearQ:learning quality

Furthermore, most educational information system quality studies were focusing on the effect of system quality, information quality, service quality, content quality and instructional quality. Notably, in E-learning, the aforementioned factors were found to have significant impact on educational information system quality (Al-Shargabi et al., 2021; Cheng, 2012; Freeze et al., 2010; Osman et al., 2018), M-learning (Almaiah & Al Mulhem, 2019; Alshurideh et al., 2021) and LMS (Al-Busaidi & Al-Shihi, 2010; Jafari et al., 2015; J. Mtebe & Raisamo, 2014) as well.

Considering that the implementation of M-learning (Almofadi, 2021) and LMS (Sarwar et al., 2020) in universities in Saudi Arabia is still in the starting phase, both systems in these institutions need to be studied more, particularly in terms of the quality factors that impact the quality of Mobile LMS. In fact, the impact of quality factors (e.g., system quality, information

quality, service quality, content quality, instructional quality) on the quality of Mobile LMS implemented by universities in Saudi Arabia has not been examined, creating a gap in the literature, which, this study will attempt to address.

4.1 Mobile LMS System Quality Attributes

System quality is affected by the quality of measures determined during the phases of system analysis, design and development of a given system (Almaiah & Man, 2016). Meanwhile, from the perspective of E-learning, the measurement of system quality takes into account the accessible hardware to the user and the many respective software applications in terms of application and needs. (Freeze et al., 2010) indicated that E-learning Systems (ELS) users are usually unaware of the systems' network requirements, but E-learning would generally involve network-to-network communication which needs access to the Internet.

System quality relates to the stability of user interface, potential presence of bugs in the system, quality of documentation, ease of use, and at times, quality and maintainability of program code (Seddon, 1997). DeLone and McLean (2003) indicated that System quality can be measured using the following attributes: ease of use, functionality, reliability, flexibility, data quality, and integration. Meanwhile, in their study, Sedera, Gable, and Chan (2004) formulated and validated an all-inclusive instrument for system quality, and the instrument comprises 9 attributes as follows: ease of use, ease of learning, user requirements, system accuracy, system features, flexibility, integration, sophistication, and customization.

Within the application of LMS, system quality and the accompanying information have been found to significantly affect users. In their study, Ohliati and Abbas (2019) found that the acceptance and use of LMS are significantly affected by the system's navigation, flexibility, functionality, facility, accessibility, and reliability. Relevantly, (Pituch & Lee, 2006) found in their study that functionality, interactivity, and response of the system had a significant impact on user acceptance and usage of LMS. In mobile LMS as well as in other systems of mobile learning, system quality has been linked to the observation of students or lecturers on the system in terms of performance. Table 2 briefly displays the associated system quality attributes in the educational IS setting.

Table 2
Exemplary Measures of System Quality

Author & Year	Flex	Soph	Func	EasUse	Perf	Acce	Intera	InterDes	Faci	Navi	Reli	RelAdva	ResTim	Context
Gorla et al. (2010)	√	√												Information Systems
Jewer et al. (2017)			√	√	√									Information Systems
Almaiah and Man (2016)			√	√		√	√	√						Mobile Learning
Ohliati and Abbas (2019)	√		√			√			√	√	√			LMS
Gable et al. (2003)	√	√		√		√					√			Information system
Shin and Kang (2015)						√						√		Mobile LMS
Kim et al. (2012)			√	√							√			E-learning
Pituch and Lee (2006)			√				√						√	E-learning
Bhuasiri et al. (2012)			√	√		√	√				√		√	E-learning
Cheng (2012)			√				√	√					√	E-learning

Flex: Flexibility, Soph: sophistication, Func: Functionality, EasUse: Ease of use, Perf: performance, Acce: Accessibility, Intera: Interactivity, InterDes: Interface Design, Faci: Facility, Navi:Navigation, Reli: Reliability, RelAdva:Relative Advantage, ResTim: response time

4.2 Mobile LMS Information Quality Attributes

Information quality entails content quality and accurateness, and the content is furnished by the information system (Almaiah & Man, 2016). On certain occasions, the system failed to produce the correct content output (format-wise) to the users, as in improperly displayed tests and pictures, or the system may fail to timely provide users with the needed information. Also, as reported in Annan (2014) the system may also fail in providing sufficient output information to users, and this impedes users from understanding or making meaningful inferences from the information.

Information quality was broken down into four dimensions in Huh, Keller, Redman, and Watkins (1990) and these dimensions include the following: accuracy, completeness, consistency, and currency. In particular, the dimension of accuracy involves accord with an attribute relating to an actual being, a value kept in another database, or the arithmetic calculation outcome, while the dimension of completeness relates to certain applications, and it concerns whether all relevant data are available. The dimension of consistency concerns the non-existence of conflict between two datasets, while the dimension of currency is about the recentness of given information. Within mobile learning context, information quality signifies the perceived output of mobile LMS. Table 3 accordingly displays the attributes of service quality within the environment of educational IS.

Table 3
Exemplary Measures Of Service Quality

Author & Year	Cont	Form	Avail	Accu	UseF	Rele	Comp	Usab	UnderS	TimL	Prac	Cred	CourDes	Context
Gorla et al. (2010)	√	√												Information Systems
Jewer et al. (2017)	√		√											Information Systems
Almaiah and Man (2016)				√	√									Mobile Learning
Ohliati and Abbas (2019)			√	√		√	√	√	√					LMS
Gable et al. (2003)		√	√	√		√		√	√	√				Information system
Binyamin (2019)								√						LMS
Kim et al. (2012)	√					√					√	√		E-leaning
Bhuasiri et al. (2012)	√					√								E-learning
Cheng (2012)	√												√	E-learning

Cont: content, Form: format, Avail: Availability,Accu: Accuracy, UseF: usefulness, Rele: Relevance, Comp: Completeness, Usab: Usability, UnderS: Understandability, TimL: Timeliness, Prac: practicality, Cred: credibility, CourDes: Course Design

4.3 Mobile LMS Service Quality Attributes

The definition of the concept of service quality is generally based on the identification of specific user requirements and how to fulfil them (Hassanzadeh et al., 2012). In some studies (Al-Jazzazi & Sultan, 2017; Pakurár et al., 2019), service quality refers to a full customer evaluation of a certain service and how far the service fulfils the expectations of the customer and satisfies the customer. The extant literature has shown the variation of peoples understanding towards service quality as a multidimensional concept, but service quality generally signifies the quality of support services presented to end users.

The measurement of service quality of higher education takes into account several factors as reported in extant studies (Gorla et al., 2010). Accordingly proposed Higher education service (HES) quality indicators adopted from (Ohliati & Abbas, 2019). These indicators which were based on IS success model study, have been applied in several related studies. In Mobile LMS service quality evaluation, users will utilize their perceptions (Ramadiani, Azainil, Frisca, Hidayanto, & Herkules, 2019).

In their service quality study, Parasuraman, Zeithaml, and Berry (1988) mentioned five dimensions to be evaluated as follows: responsiveness, assurance, reliability, tangibles, and empathy. Specifically, responsiveness encompasses the speed of acting and responding to the demands of the receiver of service, while assurance is about the credentials and proficiency of the staff and also the competency in stimulating the trust of the service receiver. Reliability concerns the competency in making available a strong and trustworthy service, while tangibles concern the exterior of premises, equipment, mass media, and staff. As for the dimension of empathy, the authors described it as the identification of the service provider with the needs of clients.

In addition, other studies (Gorla et al., 2010; Ramadiani et al., 2019) proposed the use of 4 indicators in measuring service quality. These indicators are reliability, responsiveness, assurance, and empathy. Specifically, reliability gauges the extent of effort made by the IS department in improving the information services provided to users, while the indicator of responsiveness gauges the extent of readiness of IS staff in providing assistance and in providing timely service to users. Meanwhile, the indicator of assurance refers to the competency of IS staff in establishing the confidence of the user. Table 4 provides the details.

Table 4
Exemplary Measures Of Information Quality

Author & Year	**Reli**	**Resp**	**Assu**	**Empa**	**Avail**	**Trus**	**Pers**	**CompTra**	**ProgFex**	**SupSerQ**	**Context**
Gorla et al. (2010)	√	√	√	√							Information Systems
Jewer et al. (2017)		√									Information Systems
Almaiah and Man (2016)		√			√	√	√				Mobile Learning
Ohliati and Abbas (2019)	√	√	√		√						LMS
Bhuasiri et al. (2012)								√	√		E-learning
Cheng (2012)										√	E-learning

Reli: Reliability, Resp: Responsiveness, Assu: Assurance, Empa: empathy, Avail: Availability, Trus: Trust, Pers: Personalization, CompTra: Computer Training, ProgFex: Program Flexibility, SupSerQ: Support service quality

4.4 Mobile LMS Content Quality Attributes

Learning content greatly affects the motivation of students in learning. It was described in (Alqahtani & Mohammad, 2015) that in technology-based learning among students, content is regarded as an important feature. In discussing the notion of content quality, (Rieh, 2002) stated that it relates to the aptness extent of the content for users, regarding reliability, recentness,

and relevance. Learning content encompasses any written digital material sources, for instance, courses, lectures, images, assignments, as well as quizzes.

In their overview, (Knight & Burn, 2005) presented four most common dimensions of content quality frameworks in evaluating presentations quality, and they are: accuracy, completeness, relevancy and conciseness. The dimension of accuracy relates to the correctness and dependability of the presentation, while the dimension of completeness refers to the extent to which information is available and presents adequate breadth and depth for the given task. Relevancy is about whether the presentation content has relevance and is of value to the given task, while conciseness relates to the divisibility of the content into shareable chunks for the audience (Duval, Olivié, & Verbert, 2008).

In examining content quality, (Baker & Papp, 2004) considered the accessibility, accuracy, authenticity, design, and suitability of the given content for the course. In another study of content quality, (Y. C. Lee, 2006) employed two key criteria of regularity of updates and content richness. In (Alqahtani & Mohammad, 2015), quality of mobile applications was evaluated through the use of two criteria of easy to navigate, and provide accurate and up-to-date information. In M-learning, good quality content generates happiness, satisfaction, and increased interest towards learning, to users.

Lack of content quality was found to cause students to become uninterested towards mobile learning applications (Liu, 2011), and the learning materials offered by the systems were unattractive and boring to the students. Furthermore, the E-learning materials which were designed for personal computer (desk computer) that generally have large screen size, are inappropriate to be displayed over mobile devices with much smaller screen size (Adel Ali & Rafie Mohd Arshad, 2018), Mobile application content quality is therefore an important factor to be taken into account. Table ◦ accordingly displays relevant content quality attributes in the educational IS environment.

Table 5
Exemplary Measures Of Content Quality

Author&Year	EasNavi	AccuInfor	UpDaInfor	ContRic/LearMate	ReleAct	Comple	Conci	Context
Alqahtani and Mohammad (2015)	√	√	√					M-learning
Salloum et al. (2019)			√	√				E-learning
Sinclair, Joy, Yau, and Hagan (2013)		√		√				Learning Objects
Almaiah and Man (2016)			√	√				M-learning
Castiblanco Jimenez et al. (2021)		√		√	√			E-learning
Duval et al. (2008)		√			√	√	√	Learning Objects
Lee (2006)			√	√				E-learning
Cheng (2012)			√	√				E-learning

EasNavi: Easy to navigate, AccuInfor: Accurate information, UpDaInfor: Up to date information, ContRic: content richness/ LearMate: learning materials, ReleAct: relevance and actuality, Comple:completeness, Conci: conciseness

4.5 Mobile LMS instructional quality Attributes

Instructional quality entails a set of factors that cooperatively denote the general quality of teaching effectiveness as expressed by college students in their classroom (Jackson et al., 1999), and it gauges the general satisfaction of students towards both their course and their instructor, and also towards what they had learned. According to (Topper, 2007), instructional quality is affected by class size, responsiveness of the instructor, lecture quality, as well as by other utilized learning activities.

Klieme, Pauli, and Reusser (2009) relevantly established a framework for instructional quality, and it comprises three main dimensions as follows: classroom management, cognitive activation and constructive learning support. Specifically, classroom management relates to the competency of the teacher in leading the learner in a manner that maximizes the instructional time for meaningful learning. In establishing an optimum level of learning time, instructional strategies that could prevent students from feeling bored, disorientated, or challenged, or other negative emotions, could be employed by teachers. Cognitive activation, on the other hand, entails the pedagogical practice that stimulates the engagement of students in (co-) constructive and reflective higher-level thinking, which can consequently result in an expounded and content-related knowledge base. Lastly, the dimension of constructive learning support comprises psychological need support, and this includes all measures used for the creation of a caring and motivating learning environment.

Kim et al. (2012) discussed the concept of instructional quality by stating that it gauges the human factors of the E-learning system, and it is evaluated through the instructor's accessibility, responsiveness, and mastery of the subject matter. It was suggested in Deubel (2003) suggested the provision of a list of additional resources, for instance, supplementary texts and websites, to facilitate those who want to explore the course content further. In this regard, the instructor websites should also offer the following: frequently asked questions (FAQ), online help and technical assistance, required plugins for course

content overview, online libraries and databases, a list of relevant supplementary websites. In addition, Simpson (2012) indicated that the website should have relevant and appropriately sized graphics and other visuals in order that students could download the correct materials easily. Table 6 accordingly displays the relevant instructional quality attributes in the educational IS environment.

Table 6
Exemplary Measures Of Instructional Quality

Author &Year	InsAttToLear	Avail	Respo	Mast	LectQ	ClasSi	InstMate	ClasMan	CongActi	ConsLeaSupp	Context
Cheng (2012)	√										E-learning
Kim et al. (2012)		√	√	√							E-learning
Topper (2007)			√		√	√					web-based learning
Deubel (2003)	√						√				Online course
Klieme et al. (2009)								√	√	√	teaching and learning processes
Pinger et al.(2018)							√				teaching and learning processes
Chisanu et al.(2012)								√	√	√	LMS
Holzberger, Philipp, and Kunter (2013)								√	√	√	Instructional Quality
Clausen (2007)								√	√	√	Learning
Dorfner et al. (2019)								√	√	√	multimedia learning

InsAttToLear: Instructor attitude towards e-learners, Avail: availability, Respo: responsiveness, Mast: mastery, LectQ: lectures quality, ClasSi: class size, InstMate: instructional materials, ClasMan: classroom management, CongActi: cognitive activation, ConsLeaSupp: constructive learning support

This study expands the D&M IS Success model. Hence, aside from its original three quality dimensions (system quality, information quality and service quality), two more dimensions namely content quality and instructional quality have been added. Hence, there are five quality factors included in the extended quality framework, with 51 criteria in total. Refer in Fig.3.

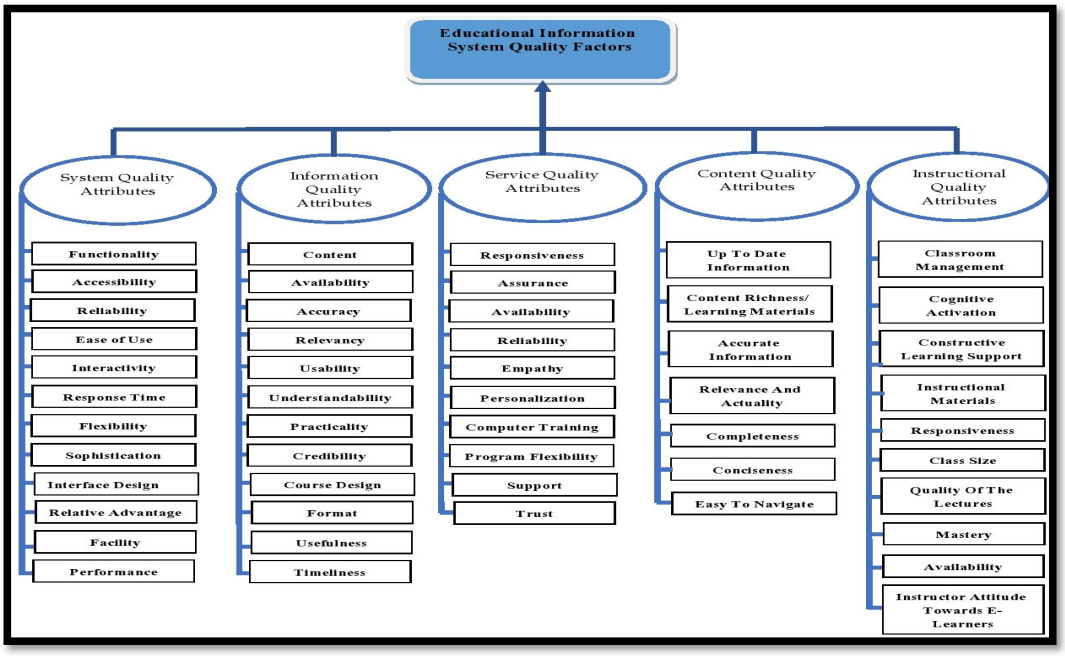

Fig. 3. The Extended Quality Framework

5. Methodology

5.1 Research Design

The current study aims to examine the quality attributes of e-learning use in a mobile context in Saudi Arabian higher education. By identifying these quality attributes, the research intends to offer guidance on Saudi higher education institutions to improve their offerings and facilitate their transition to m-learning. The research will focus on King Abdulaziz University (KAU) as a typical case of a Saudi higher education institution. Further, the approach used in this study was constructed using a qualitative method, and so, the participants could be understood more in-depth concerning the subject under scrutiny

(Bengtsson, 2016). Accordingly, a semi-structured interview, as part of the qualitative approach, was used in this study in obtaining the in-depth information on the attitudes, thoughts, and actions of the study participants (Edwards & Holland, 2013).

5.2 Participants and Context

The data of this study were collected from students, teachers and Technical Support Stuff in one of the Saudi Arabia universities (King Abdulaziz University (KAU)). A total of 36 semi-structured individual interviews were conducted at KAU. Interviewees were from different colleges, majors, levels of study, and positions. Participants involved: 18 students, 11 teachers, and five technical supporters. The department head assisted in establishing contact with and selecting interviewees voluntarily. Interviewees received oral and written information about the study emphasising that the goal was to obtain a comprehensive picture of the interviewee's subjective perceptions through their own choice of experience with the Blackboard within two environments: computer and mobile, and if external factors like social media could affect their behaviour or usage.

5.3 Material

The semi-structured interview questions were designed with thoughtful insight and review of available literature about E-learning, LMS and identity review. The participants responded to the interview questions. Several questions were asked for students, teachers and technical support staff in different domains. The interview consisted of two parts: the first, it was related to the general information (such as experience with the Blackboard within two environments (computer and mobile) and faculty type). The second, it included statements of semi-structured interviews collected together after considering the four quality dimensions of e-learning use in a mobile context in Saudi Arabian higher education. Interviewers were asked to talk about what happened, their usage and reaction with any difficulties. Interview questions were developed as can be seen above to focus on barriers, failures, and problems of the Blackboard system; therefore, the results should help to determine the quality attributes of E-learning within mobile environment.

5.4 Data Collection Procedure and Analysis

The data were collected in a one-week time. The interview timing ranged between 30 to 45 minutes. The researcher was able to collect three samples following an open-ended type of questions, which gave the respondents the opportunity to express their thoughts and naturally interpret their ideas regarding e-learning use in a mobile context in Saudi Arabian higher education. The items were designed in a way that prevents identical responses by the respondents. A letter of consent was signed by the study respondents before the interview session. At the same time, the respondents were assured freedom to leave the study at any time for any or no reason. The respondents were provided with semi-structured questions in the interviews, and the answers provided by the respondents were recorded with a tape-recorder. These answers were then transcribed into written scripts. A Word Software Program was used in the transcribing task. Data were categorized according to the most frequent and accurate responses, as preparation for content analysis. Content analysis encompasses a descriptive, organized and objective, process of data analysis on the subject under scrutiny (Berelson (1952), as cited in Aboud (2020)).

5.5 Data Analysis

Data analysis started after transcribing and translating all the interviews. A thematic analysis approach, one of the most common and accessible approaches in qualitative data analysis, was used to identify the emergence of patterns of similarity and differences within the data. Researchers worldwide use this analysis method to understand qualitative data because it "minimally organises the data and describes it in a rich detail" (Boyatzis, 1998). t is a well acknowledged method of "identifying, analysing, and reporting patterns (themes) within data" (Braun & Clarke, 2006). This particular method of analysis was chosen for this study because evidence suggests that it "can produce an insightful analysis that answers particular research questions" (Braun & Clarke, 2006). The theoretical independence of this versatile method is able to meet the needs of many studies, providing a rich and informative but complex account of results.

NVivo software is employed to analyze the qualitative data, as this program provides an effective means to analyse and organise large interview data sets meaningfully. Computer-assisted qualitative data analysis helps to analyse data efficiently as the software extracts of the data are coded more quickly than in the manual method, which requires the tedious tasks of cutting and pasting the texts from the transcripts to another document (Welsh, 2002), NVivo has different tools and queries which allow to interrogate the data at particular levels and to find the most frequent words or concepts used in the data through the word frequency query. This query helps to identify the potential themes from the data, especially at the early stage of the analysis. Once all the interviews were translated, they were imported into the software to start the data analysis process in which each interview file was created as a case. The sequence of steps is explained below.

i. **Familiarisation:** Once interviews were imported, they were thoroughly read to go beyond the surface meanings of the data and gain further familiarity.
ii. **Code Generation:** Initial codes (nodes on NVivo) were generated (i.e., coding) to capture the important features within the data. These nodes were the recurring patterns (themes) across the data developed during this familiarisation

process. During this process, coding stripes were made visible alongside source documents, allowing the researcher to see how the content was coded and which codes were used.

iii. **Themes Generation:** After coding has been done, nodes were collated and examined to identify broader patterns of meaning (themes). Themes differ from codes as they consist of a sentence or a phrase and sometimes a combination of different codes. After developing the potential themes within the data, all relevant information was organised under their respective themes. I

iv. **Reviewing and Naming Themes:** All the themes were refined and organised through an iterative process and then categorised meaningfully into sub-themes to develop a thematic framework. Similar themes and ideas were clustered in groups and organised in the thematic framework.

6. Results and Discussion

Based on the opinion of the participants regarding the quality attributes of Blackboard, these attributes were divided into four parts, i.e., system quality attributes, content or information attributes, service attributes, and instructional attributes. All the views shared by the participants of the three groups are discussed in detail below.

6.1 Theme 1: System Quality Attributes

This theme seeks to investigate opinions regarding the usefulness of Blackboard and specifically aims to explore the perspectives of the participants regarding the system quality attributes of Blackboard. In this theme, participants discussed two attributes, i.e., ease of use and reliability, illustrated in Figure 4 below.

Ease of Use

Most of the students found Blackboard very effective, highly user-friendly and enables quick access to all instructional resources. However, they stated that despite its user-friendliness, it can be difficult for beginners to use it properly without sufficient instruction as a participant claimed that: "*In the beginning, it was not easy to use the virtual classroom feature, but with practice, it became a good thing*." Another respondent mentioned that: "*I do not know enough about the system to know the shortcoming of the system, but in principle, it is easy to use.*"

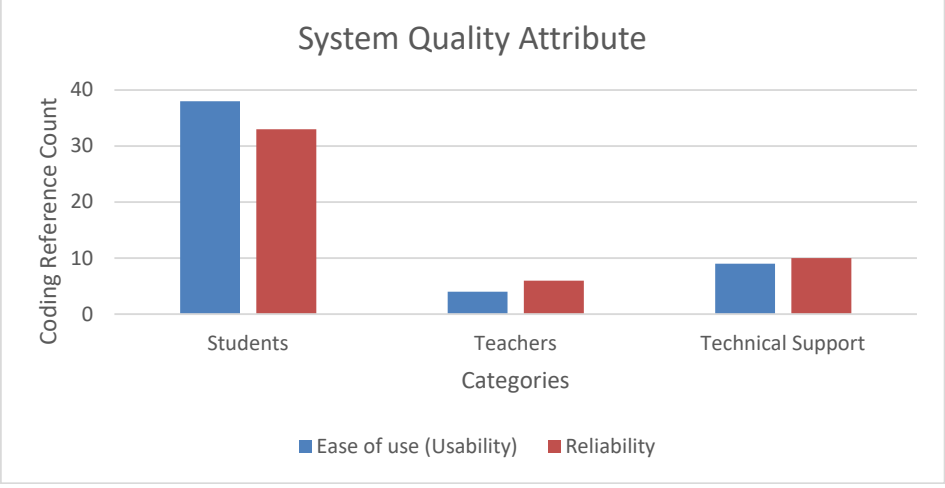

Fig. 4. System Quality Attributes

Similar views were received from the teachers and they claimed that Blackboard is user-friendly and customisable and they loved its interface and ease-of-use feature. Two of the teachers highlighted that: "*Excellent interface, user-friendly, excellent presentation." and "Ease-of-Use is the best feature of Blackboard.*"

While discussing the use of Blackboard, technical support staff stated that it is an excellent learning platform with all the necessary features for students and instructors. It is a simple-to-use system that is easier to operate if the user has prior computer experience or training. "*The Blackboard is a powerful system, and most tools work perfectly without any problem. For example, a virtual classroom is considered an online university and can carry out many courses and training for the users.*"

Reliability

According to the students, using the Blackboard posed no particular challenges. The only issue they felt was that it was easier to use on a computer than on a mobile device. Moreover, some tools are unavailable on mobile phones compared to computers or laptops. The students underlined this issue as follows:

"*There is no difficulty in using the tools for their clarity, but the available tool may only be sufficient with another alternative. For example, the default separation tool is inconvenient to use on mobile and does not provide all the control options, unlike using it on a computer. But if the Zoom program is used, it provides all the necessary basic options, whether a computer or a mobile phone.*"

While evaluating the usefulness of Blackboard under various working conditions, the students revealed that they occasionally had trouble uploading their homework, and the lack of a voice option during the lecture was also causing problems in their virtual class. While talking about their preference and access, a student stated that: "*Usually, the students and the teachers use the Blackboard in the university lab and network; otherwise, they access it outside the university using their devices and network. The students prefer mobile devices.*"

The teachers had similar observation. Most of them revealed that they use Blackboard at home on their laptops or desktop computers because it is more convenient than using it on mobile devices. In addition, they have access to various inaccessible technologies on mobile devices; this was the sole issue raised by teachers. One of the teachers stated that: "*I enjoy using The Blackboard so much, and no restrictions on using it. However, since it is valid, I would love to have the same quality when I use it on my mobile.*" Another respondent claimed that "*I don't like my experience when I use the Blackboard system using my phone.*"

The technical support group identified a similar issue. They shared that the students and teachers do not have complete control or access to tools when using them on mobile devices. The system is more efficient when used on a computer; therefore, users strongly suggest switching mobile phones to PCs if they have issues with any tool. "*It could have some extra functions and improvements, such as what the user usually claims (does not feel comfortable when it (opens on mobile devices)*."

6.2 Theme 2: Content and Information Attributes

In this theme, the participants discussed how Blackboard's content helps them in their educational process and how easy it has made it for both the students and the teachers. Moreover, the participants explored the navigability of the Blackboard system and its compatibility with other products that require interaction. The graph in Figure 5 illustrates the Blackboard's ease of navigation, flexibility, and usability.

Easy to Navigate

According to the students, Blackboard has significantly contributed to the educational process by enabling access to the scientific material, keeping track of grades, administering tests, and providing rapid feedback. They reported that the system's robust navigation makes it simple for users to locate relevant information quickly and efficiently. As quoted by the students: "*The Blackboard is very useful, enhances the educational process, and saves time by sharing multiple sources and scientific references and sharing them. It is nice to perform the tests on The Blackboard and clarify the result directly.*"

Most of the students faced issues while using it on the mobile phone, as quoted in the following: "*I wouldn't say I like performing exams on a mobile phone or doing homework. I prefer to use the computer for tests and assignments. I encountered a problem in the e-exam; the clarity of the tests from the mobile could be better.*"

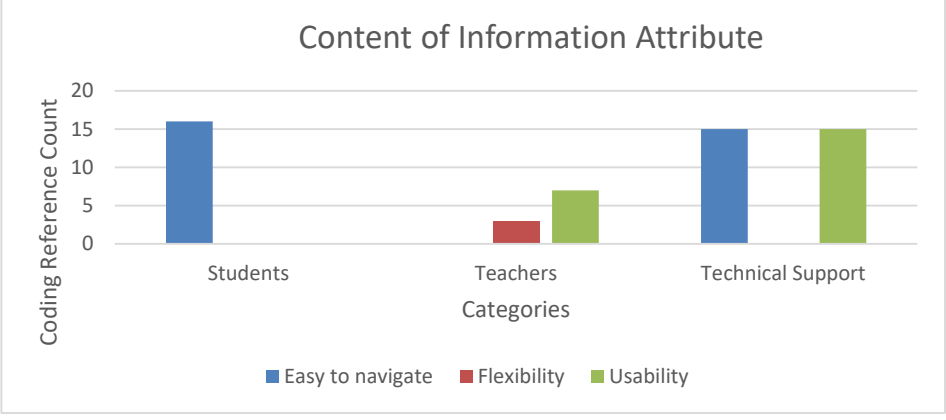

Fig. 5. Content or Information Attributes

In students' opinion, the content was explicit and smooth, and using various tools was simple which does not require prior knowledge. Also, the fantastic range of educational resources is excellent. According to the teachers, Blackboard was utilised for everything during the course and proved highly effective in handling online sessions and tests. It was also quite helpful in

posting course materials and quizzes. "*I use Blackboard: to create online sessions and deliver online lectures and record sessions, give workshops, conduct online exams (quizzes, midterm, and final), upload course materials, post announcements, upload students' grades, create question pools, and use them to create exams, to communicate with students, to take students' presentations, etc.*"

They stated that it was particularly beneficial during COVID and Ramadan. Although the on-premises sessions have resumed, they have started integrating it with regular classes to maximize their utility. "*During covid, we use it for everything, and we try to get an advantage from what is available. Recently because we allow being in class partially we merged between the Blackboard and on the class to gain advantage. From both. The thing that students like to be online more.*"

In the opinion of the technical support group, users most often used tools are virtual classrooms for online lectures, assignments, and learning materials for uploading and downloading course-related resources. "*Most of the tools are used such as virtual classroom, e-exam, learning content and assignment.*"
"*Learning content is a great tool for uploading/downloading materials. It also allows transferring of materials from one course to another. Also, the virtual classroom tool has many improvements and works great with online classes*."

While discussing the system's effectiveness, participants from the technical support group added that the most effective tool of the Blackboard for teachers was the Grading Center to display the exam results as one of the respondents claimed that: "*Grading Centre is great for showing the immediate result of tests and all grade details. The teacher like to post some announcements.*"

Flexibility

During the study, students also discussed the system's flexibility; most students claimed that it does not allow communication within the system or that the system is not adaptable to other products requiring interaction. They stated that while using Blackboard, students cannot communicate with their peers or classmates; as a result, they must rely on alternate communication platforms. "*Students do not use the Blackboard communication tool much because it does not compete and does not provide many possibilities, and does not provide quick access to the user. Not linking the Blackboard with other university systems, such as (ouds) and (my Kau)*."

Another issue that concerned the students was the lack of an alerting system. They shared that: "*The negative that was found is that when comparing some tools in the Blackboard, such as alerts, notifications, or communication with others outside the Blackboard system appears the latter is more prevalent among users than the Blackboard tool.*"

According to the teachers, Blackboard was a positive experience for them, and the content-sharing feature is outstanding. However, they suggested that the Blackboard should be more interactive and adaptive for adding and removing contents. "*Good experience with Blackboard. I prefer to use it in the lab top. Content is flexible, and I like to use it; great to share this*."

6.3 Theme 3: Service Attributes

This theme discussed the service attributes, measured in terms of the time the system takes to execute any given task. In this theme, the efficiency and interoperability of the system are explored. All the views observed regarding these attributes are depicted in Figure 6 and subsequently discussed.

Efficiency

Most students, while discussing the system's effectiveness, agreed that it is pretty effective in terms of use and accessibility. They reported that uploading and downloading instructional resources is quite simple. Additionally, the tools they employ are simple and bug-free. They mostly utilized quizzes and assignments tools. However, they do not utilize the application's calendar and communication functions because they can access better alternatives outside the application. According to one of the participants: "*The information is helpful and always meets the student's needs. But I wish there was a calculator in the Blackboard as an additional tool. Also, I don't prefer using the calendar because I prefer the iPhone calendar, which gives a warning before the time*."

However, the technical support team revealed that Blackboard lacked the capacity to handle many users, creating problems simultaneously. *"Nothing much but the system at the beginning could only deal with a few users. When they use, for example, the virtual classroom simultaneously, some of them in different courses are not allowed to access the virtual classroom (depending on the time they try to log in)."*

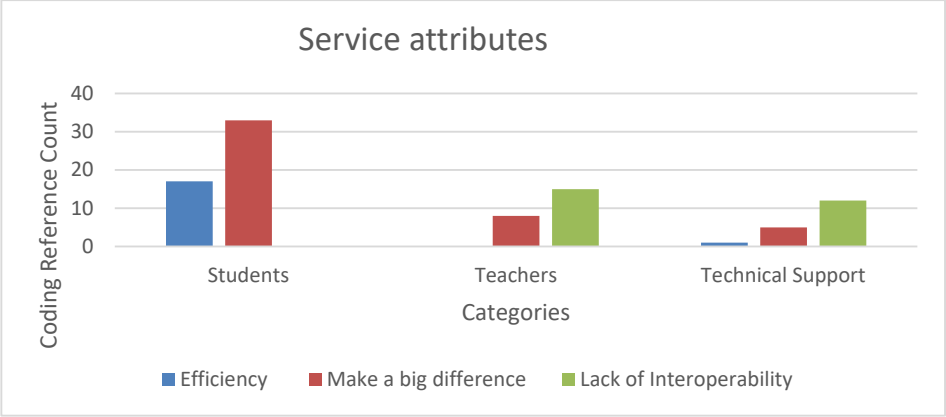

Fig. 6. Service Attributes

Features that could make a big difference

The participants highlighted various features that, if added to Blackboard, would increase its efficiency. A few of the tools suggested by the group participants throughout the discussion are described below.

Students suggested the availability of the whole course on Blackboard with additional Blackboard sessions be made accessible via a virtual classroom. "Having *a complete course on the Blackboard and the diversity of its sources, as well as a large number of question banks and samples of what is required in the lab, is one of the most essential things required for any course study."*

Regarding the availability of the scientific content, one of the students highlighted that: *"Making the scientific material available in full and easy to access, providing multiple sources and models for tests and assignments, and giving a bonus to students who access The Blackboard very frequently and for all active students."*

The students also discussed the underutilized features which they prefer to use on their mobile phones rather than on Blackboard. Among the important but underutilized tools are calendar and discussion groups. "*Often I do not use the Blackboard to add tasks to my calendar, as the calendar available on the mobile phone application is more effective for me.*"

The students also mentioned the need of a stable Internet connection and regarded Chrome as a better web browser for Blackboard usage. *"Improving the speed of the system if the university's goal in the future is to rely entirely on Blackboard."* Also, most students use alternative communication tools for educational purposes since they found them convenient. *"For example, WhatsApp is faster and more effective because most users prefer it, and exchanging messages and files is faster*." and *"Use Microsoft Office applications for writing and assignments, such as Word and PowerPoint. It is better to deal with it using a computer and not a mobile phone. Because it is easier to use a computer to finish editing."*

Similar views were received from the group of instructors. According to the teachers, the tools are pretty user-friendly, but they need to be more enticing to students, perhaps by having a more appealing interface. *"As said before, please encourage students to enrol in online tools by encouraging them and making them easy to use with some attractions*." To engage with the students, they also prefer alternate communication and teaching tools. *It needs to link Blackboard to social media apps such as WhatsApp as much as possible to be interactive for students."*

Technical Support staff added that communication and announcement tools are used sparingly because they require logging in to Blackboard. Furthermore, students like using Telegram to allow the students from other sections, departments, or universities to participate in discussions. *"Also, they feel uncomfortable when they cannot contact other students from other sections or classes using discussion tools. The announcement does not send a notification to the mobile as messages send an email*." Also, *"Many users usually claim that they prefer to have a connection between all university systems, such as Ouds and MYKAU. They would like it if they could enter one system from another*." According to the technical support team, users sometimes struggle to adjust a default choice. They stated that this could be minimised using Google Chrome with Blackboard. *"Recommend the user reconnect or change the network and the devices (use a laptop instead of a mobile or iPad). Also, change the browser and use Google chrome."*

6.4 Theme 4: Instructional Quality Attributes

This theme focuses on the quality of lectures, the assistance offered to students and professors, and the teacher's perspective on support. In addition, it emphasises the instructor's attitude toward online students. Refer to Fig. 7.

While discussing the instructional attributes, most students reported that they asked the course lecturer or professor to always provide assistance in the scenarios of having trouble dealing with the platform. Regarding the service they shared, they reported that: "*Usually, the course professor supports the use of The Blackboard tools in his course, provides support to students, and clarifies the tools for them. Some tools can be used by students like virtual classes and exams*".

According to the students, Blackboard has benefited the educational process considerably by facilitating access to scientific knowledge, keeping track of grades, delivering exams, and completing assignments. However, there was a mixed response to the teacher's support, as students felt that the course instructor's assistance was beneficial, but not all instructors utilize all the Blackboard capabilities. "*Often the teacher of the course encourages entering the Blackboard continuously. Still, he does not use all the available tools possible because they are alternatives, such as discussion groups and others*."

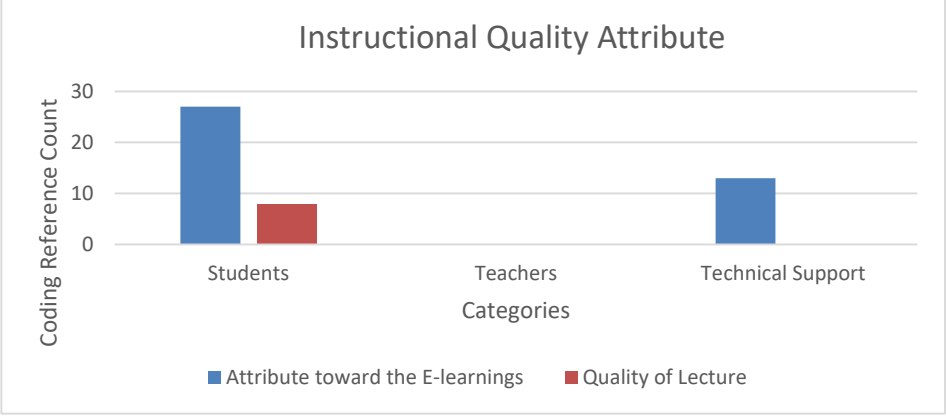

Fig. 7. Instructional Quality Attributes

As for the support provided for the teachers, the technical support group provides support in multiple ways as stated below. "*If the teacher has a problem with a virtual classroom, we help to create one and set the setting.*" and "*Moreover, in some cases, send a person to fix the problem that the teacher faces or ask him to bring his laptop over depending on the problem he faced.*"

When discussing the support provided to students, the group shared that if a student asks them to help, they "*Contact them, ask them about the problem and provide them with a solution through phone or email*." They stated that if it is the user's first time taking an e-exam, they recommend using a computer rather than a mobile device. They usually ask users to re-login or switch devices, browsers, or networks to solve frequent difficulties. Sometimes, they ask them to read the manual available on the IT website.

Another participant shares that "*Usually, it is recommended to report any problem to the IT unit in the college then the unit tries to provide the solution. If not, the unit will communicate with the IT dean through a specific form that is available on the website or through email*."

According to the technical support, the best way to improve the support is by providing training to the users regarding the use of Blackboard. "*The training is usually practical, and many colleges ask to have specific training each semester for the new students, which generally has a significant impact and decreases the number of issues and problems.*" They also shared that having an updated manual every other month could help users resolve their issues. As quoted by the group in the following statement: "*It is great, and most students and teachers like assistance from the IT dean. Could improve it by encouraging them to visit the IT website and watch all videos and read the documents and manual.*"

7. Discussion

The interviews revealed that system quality attributes include:

- **Ease of Use – (Usability):** This can be measured in terms of user-friendliness, ease of learning and convenience in navigation.
- **Reliability:** It is the reliability the Blackboard provides to sustain any condition and consistently give correct results. The Blackboard reliability is measured in terms of working under different working environments and conditions.

Also, Content /Information attributes include:

- **Easy to Navigate:** Strong system navigation makes it easy for users to quickly find information that interests them efficiently and effectively. Conversely, poor navigation needs to be clarified for users and sends them to other tools and places to find the information. Consistent navigation –how and where it appears on the Blackboard materials – promotes ease of use and increases the ability to find relevant information more quickly.
- **Flexibility:** Blackboard is flexible enough to modify the content, materials, exams, and assignment. Adaptable to other products with which it needs interaction, such as MS Word.

Moreover, Service attributes indicate:

- **Efficiency:** It is one of the significant system quality attributes and is measured in terms of the time required to complete any task using the Blackboard system. If the system is inefficient, it cannot be used in real-time applications. (e.g., communication services are more efficient than other social media apps.)
- **Interoperability:** Interoperability of one system to another should be easy to exchange data or services within the Blackboard with other systems. (e.g., the link between other university management systems and Blackboard)

Finally, Instructional quality attributes include:

- **Quality of the Lecture:** The teachers and students hold different perspectives for these attributes. However, the technical support point of view provides the best support to both types of users for these attributes.

After the analysis, the codebooks of three groups, framework matrices, word clouds, charts, and Nvivo files were conducted. The transition from desktop to mobile affected some of Blackboard's services. While also seems to have the the same influence on other services, such as communication is same in desktop /mobile environments.

8. Conclusion

In this study, we proposed a hybrid model of quality features from the updated DeLone and McLean model with additional features to investigate the effects of electronic learning (Blackboard) as learning and teaching systems in Saudi higher education (King Abdulaziz University). With regard to the part of quality features as the antecedents of user attitudes (users are represented by students, teachers and technical staffs),it was revealed that system quality, information quality, and service quality, content quality, and instructional quality have significant effects on electronic learning (Blackboard) as learning and teaching systems in Saudi higher education. Hence, five quality factors were included in the comprehensive quality framework, with 51 criteria. However, this interview study integrated content and information quality attributes since both have the exact dimensions in e-learning based on the previous studies. The proposed conceptual model includes Content/Information Quality (CIQ), System Quality (SQ), Service Quality (SRV Q), and Instructional Quality (IQ). The primary purpose of this study was to specify which e-learning quality aspects have a significant impact when used in a mobile environment and which m-learning quality parameters substantially affect e-learning system use within a mobile environment (case study: Blackboard-LMS in KAU). To summarise the above results, the conceptual proposed model is introduced to measure system quality for e-learning use in a mobile context through a set of questions.

There are a number of limitations found in this study, and the first one concerns the generalizability of the study outcomes as it was carried out only in one institution namely King Abdulaziz University. Hence, the study outcomes may only be generalized to universities in Saudi Arabia, not in other countries. In order to increase generalizability, similar study should be carried out in other universities in other countries. Another limitation relates to the used sample. Clearly, this study employed a limited sample as it was from King Abdulaziz University in Saudi Arabia only. As such, in order to improve generalizability, similar study should be performed on other university populations in Saudi Arabia that differ in aspects like in education, psychology and demography. This will allow E-learning systems (Blackboard) to be developed as learning and teaching systems in accordance with the quality features that function as antecedents of E-learning acceptance.

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