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Measuring the effectiveness of e-learning contents for active learning when deployed on mobile and web-based design interfaces using the Multi-Motive Information Systems Continuance (MISC) Model[1]

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ABSTRACT

Active learning is evolving as an interesting area of research at many higher institutions of learning, and this paper presents its practical contributions and implications for developing e-learning contents for both mobile and web-based design platforms and interfaces. With current advances and development in the best design interfaces, the literature indicates that the gaps identified in designing e-learning contents for both mobile and web-based designed platforms need serious attention. This paper looked closely at both mobile and web-based design interfaces, design principles, and online engagement in view of recommending the best approaches to promote active learning. The study followed a Design Science Research (DSR) paradigm to develop the framework to promote active learning. Following a pragmatic research paradigm, the study used one single DSR cycle in the development of the framework after reviewing and analyzing literature. The proposed framework is comprised of 10 steps, and these are supplemented with best approaches using the proposed taxonomy of major motivations for system design and use adapted from the Multi-Motive Information Systems Continuance (MISC) Model.

Keywords: Multi-Motive Information Systems Continuance Model (MISC), user engagement, mobile learning, web-based design, user interface design, active learning

INTRODUCTION

Digital technologies have played an important role in learning and great emphasis has been placed on digital technologies to promote active learning. There has been, however, little emphasis and attention paid to the way learning design platforms, both for mobile and web-based learning, have been designed for the promotion of active learning. This study paid attention to the interface designs used for mobile and web-based platforms to promote active learning and encourage user engagement.

The intersection and the role that both mobile and web-based interface designs present in today's educational landscape have been studied separately in many instances and this paper brings its awareness and practical contributions concerning these two design interfaces in one context through the lens of Multi-Motive Information Systems Continuance Model (MISC) to establish gaps that have not been adequately addressed in Information System Research.

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Some of the questions that have not been answered in the literature include the user engagement for e-learning contents deployed on both mobile or web-based design learning interfaces, challenges associated with e-learning contents deployed on both mobile and web-based interfaces, and the effectiveness of interface designs concerning the user engagement to promote active learning.

PURPOSE OF THE STUDY

This study investigated the effectiveness of e-learning contents deployed on both mobile and web-based design interfaces to promote active learning. There have been several studies on usability, system functionality, accessibility, and user interface design (Goh, Hong & Gunawan, 2013; Scarpin, Mondini & Scarpin, 2018). The authors explain that these studies were conducted to establish aspects related to contents creation and their limitations on learning platforms. There is, however, little that has been done to investigate the user engagement for e-learning contents deployed on both mobile and web-based design interfaces. This study investigated the e-learning contents deployed on both mobile and web-based design interfaces to address the gaps in the literature.

STUDY'S AIM AND RATIONALE

The study's aim is to measure the effectiveness of e-learning contents for active learning when deployed on mobile and web-based design interfaces using the Multi-Motive Information Systems Continuance (MISC) Model.

BACKGROUND OF THE STUDY

The literature shows that active learning is growing as a greater area of interest for many higher institutions of learning in recent years (Ma & Rao, 2017). Ma & Rao (2017) explain that, to date, there have been many efforts to make learning seamless by integrating technologies and moving away from traditional learning approaches on the one hand, and, on the other hand, that digital technologies have changed the way e-learning contents are accessed regardless of the location and technology devices.

Recent developments in e-learning technologies have created new opportunities for learning management systems (LMS) to play an important role in the way learning approaches are used to transfer and share knowledge (Aldraiweesh, Alturki & Athabaska, 2016). The authors argue that there have been studies investigating user interface issues in LMSs; however, little is said about the deployment of e-learning contents for mobile and web-based interfaces concerning user engagement to promote active learning. Venkatesh, Thong & Xu (2016) argue that theories and models such as the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Acceptance Model (TAM) have been extensively used in Information Systems (IS) research to investigate user perceptions and use of user interfaces and designs. There is, however, little that is said in the literature as to how engagement models are incorporated in LMSs to cater for mobile and web-based design interfaces to promote active learning.

Research questions

RQ1: What is the extent of the effectiveness of e-learning contents deployed on both mobile and web-based design interfaces?

RQ2: How is active learning promoted by mobile and web-based design interfaces in e-learning?

Research objectives

The following research objectives are aligned with the research questions:

RO1: To measure the effectiveness of e-learning contents deployed on both mobile and web-based design interfaces.

RO2: To develop a framework for mobile and web-based design interfaces to promote active learning.

LITERATURE REVIEW

This section discusses the literature review. The following aspects are reviewed in this section: user engagement is discussed followed by mobile and web-based learning design interfaces after which usability of interface and implications for active learning are outlined.

User engagement

The context of user engagement has been associated with user experiences. Extensive research has indicated that the context of user engagement has been around for years and is often represented in the way users interact and engage with ISs from shopping, gaming, and web searching to name a few (Thomas, O'Brien & Rowlands, 2016). The authors argue that the extent of user engagement has been critical in the way e-learning contents are presented to engage users and transfer information or knowledge. The ability of an IS to captivate users' attention to engage with a product is one dimension of what a user can experience with a system (Thomas et al., 2016).

Sur & Yazici (2017) explain that engagement is a desirable human response to computer-mediated activities. In the context of learning, user engagement refers to a positive response and activities that include interactions with, discussions on and actions by users on multimedia (Sur & Yazici, 2017). User engagement is also considered as the quality of the user experience that emphasises the positive aspects of the interaction, and, more importantly, the results associated with being captivated by the system's user interface and design, thereby being motivated to use it (Kim & Seo, 2009; Ijsselsteijn, Ondracek & Turetken, 2019). The authors explain that ISs' user and design interfaces are not only about their features and functionalities but about their ability to engage the audience. Depending on the context, variables and metrics that have been used to assess the effectiveness of ISs' functionalities and features, there is little in the literature that speaks about the effectiveness of e-learning contents deployed on both mobile and web-based design interfaces and how these e-learning contents engage users to promote active learning.

Thomas et al. (2016) argues that user engagement manifests in the form of variables such as the captivation of the audience's attention, intrinsic interest, motivation, and curiosity, which lead to positive feedback and responses to engage with a user interface. Furthermore, Thomas et al. (2016) explain that user experience has been identified in many instances as the source for user engagement concerning the flow of activities, which ultimately engages with human-computer aesthetic interaction, experience, and user motivation.

Although the literature provides several definitions regarding user engagement in a user interface setting, this study views user engagement as important feedback and positive response session that translates into enjoyment and satisfaction to meet user learning experiences. This study also approached the various contexts of user interfaces for e-learning contents deployed on both mobile and web-based design interfaces in framing the case of an LMS. Without diverging from the key concepts of user engagement and variables or metrics that might be used to assess the effectiveness of user engagement, the following section discusses the functionalities and features of an LMS in the context of this study.

The literature shows that learning institutions use LMSs to deliver e-learning contents (Aldraiweesh et al., 2016). Athabaska et al. (2016) further explain that many LMSs are readily available on the market, and these come in various formats with customisable and configurable features to suit the needs of their users. Also, Athabaska et al. (2016) explain that learning institutions have customised free open-source versions of LMSs to suit specific needs and which accommodate related activities such as class discussions, instructional contents, class presentations, quizzes administration and wiki creation.

Evaluation mechanisms of user engagement concerning e-learning contents deployed on both mobile and web-based interfaces have not been extensively researched and this study was interested in investigating these gaps to bring its contributions to the body of knowledge.

User engagement for ISs' interfaces needs a combination of variables such as users' perceptions and attitudes, their intrinsic or hedonic motivations, other heuristic variables, interface design principles, and affective variables to take place. Badawood & Steenkamp (2013) explain that e-learning contents deployed on ISs, such as an LMS, can pose many problems from accessibility and usability to configuration and systems requirements. The user interface requirements associated with the mobile and web-based design interfaces concerning user engagement have been identified in many instances as not providing a satisfactory user experience (Ssekakubo, Suleman & Marsden, 2013). The authors argue for the customisation of ISs in the example of LMSs. Although guiding users in many instances does exist, the user engagement for e-learning contents deployed on both mobile and web-based user interfaces still needs much attention.

Mobile and web-based learning design interfaces

To establish the context of mobile and web-based learning design interfaces, there is a need to discuss these two design interfaces to relate them to the context of this study. This section comprises two sub-sections: the first subsection discusses mobile-based learning design interfaces, and the second sub-section discusses web-based learning design interfaces.

a) Mobile-based learning design interfaces

Mobile technology advances, portability and affordability have driven the usage of mobile devices with a strong emphasis on mobile learning approaches (Ma & Rao, 2017). Increased capabilities and network technologies such as General Packet Radio Services (GPRS), Wi-Fi, 3G, 4G or 5G features have provided users with opportunities to engage with mobile-based learning contents (Mehdipour & Zerehkafi, 2013; Pittarello & Pellegrini, 2017). This section discusses mobile-based learning design interfaces about user engagement in the context of this study.

The term 'mobile learning' was coined with the use of mobile devices such as cell phones, smartphones, Personal Digital Assistants (PDAs) and tablets for learning (Ma & Rao, 2017). One of the important considerations for mobile-based learning design interfaces is the flexibility of users to use e-learning contents on their devices (Ma & Rao, 2017).

With the extent of use and the availability on the market of mobile devices, this literature explains that various studies have been conducted to integrate e-learning contents to support users in the way they intend to access them (West, 2013; Shyshkanova, Tetyana & Zaytseva, 2017). The authors argue that the extent of these studies regarding the way users access e-learning contents on mobile devices has opened needs and opportunities such as personalized learning and customization of learning contents. There is, however, little in the literature to ascertain the effectiveness of e-learning contents deployed on both mobile and web-based design interfaces concerning user engagement to promote active learning.

Behera (2013) and Vishwakarma (2015) suggest the following advantages of mobile learning:

- Increased mobility and flexibility: the learning can take place at anytime and anywhere
- Saving cost: as compared to traditional learning interfaces, mobile learning has provided users with opportunities for cost-saving as well as saving on travel costs because of accessing e-learning contents
- Immediate feedback and one-on-one interaction, which sometimes prove to be challenging in traditional learning environments and classroom settings
- Customized e-learning contents for expected needs with greater learning stimulation emphasis
- Enhanced communication with greater exposure to contents sometimes outside the frame of learning processes

- Personalised and spontaneous learning with great emphasis on the maximisation of learning opportunities.

The design interface of mobile devices is critical to establish the context of this study with user engagement. In terms of the portability of mobile devices as one of the interfaces where e-learning contents are deployed, the literature explains that there have been limitations in the way design interfaces have been developed for active learning concerning user engagement (Thomas et al., 2016; Shyshkanova et al., 2017). Sur & Yazici (2016) explain that limitations in the design interface for mobile interfaces have been identified in the form of design requirements and usability principles, which have been identified as playing an important role in the way users engage with e-learning contents deployed on mobile devices.

This study was interested in investigating these gaps. The literature explains that the integration of technologies and network resources has extensively contributed to e-learning contents' accessibility (Ma & Yaw, 2017). There is still, however, little that is known in the literature regarding mobile and web-based design interfaces for e-learning contents deployed on these two interfaces about user engagement.

b) Web-based design learning interfaces

Learning through web-based design interfaces has been associated in many instances with the use of the World Wide Web and several supporting systems to communicate and share knowledge or learning contents (Sur & Yazici, 2017). Establishing the context of web-based learning, Sur & Yazici (2017) explain that terms such as 'online education', 'e-learning', 'Internet-based education', and 'virtual and remote learning' have been associated with web-based learning. This study approached web-based learning in the context of online based-education supported by technologies to deliver online learning contents.

New technological advances have allowed web-based interfaces to use distributed networks to make e-learning contents available to users in a blended fashion, accessible regardless of the location (Khodeir, Elazhary & Wanas, 2018). The authors explain that many learning experiences are using web-based interfaces that have been identified such as the flexibility of the learning contents provided to a larger audience, and technology more effectively supported e-learning contents where live instructions are designed to cater for a target audience with flexibility to engage and practice contents at one's own pace. Furthermore, the literature suggests that users can choose from a variety of e-learning contents that suit their learning needs with simulations where applicable in a non-predictive manner while keeping learning relevant to users' needs (Ayyagain et al., 2013; Vishwakarma, 2015).

There was a need in this study to establish technologies behind the delivery of e-learning contents in a web-based design interface to align with the context of this study. Technologies behind powering e-learning contents in a web-based design interface include programming languages such as JavaScript and HTML codes that are connected to a server (Gerow et al., 2013; Sur & Yacizi, 2017).

Web-based design interfaces have presented many limitations to cater to the different target audiences and student demographics (Arkorful & Abaidoo, 2015). The authors argue that issues associated with accessibility, navigation, usability, and low connectivity, among others, make web-based learning challenging. The creation and deployment of e-learning contents have been cited as another area of complexity for content developers as these require training and awareness when the user and design principles are concerned (Sivakumar, Venkataraman, & Gombiro, 2015; Vishwakarma, 2015; Wanas et al., 2018).

Usability of interface and implication for active learning

The usability of a design interface plays an important role in the way users perceive e-learning contents deployed on mobile and web-based interfaces (Chan, 2019). The author argues that a user interface

should be able to integrate technological tools and features that allow the effective distribution of learning contents to support active learning. Furthermore, the author explains that a user design interface, which is user-friendly and interactive, should be able to function in various contexts and support bidirectional communications amongst various actors involved in the learning process, and, as such, provide consistent feedback on learning progress and assessment.

In a study conducted by Samarakou et al. (2015), the authors present a case of an LMS to evaluate a text comprehension theory. The authors explain that an active learning platform must be adaptive and should possess features for instant feedback, which is vital in monitoring and measuring learning progress. In addition, the study suggested that an effective and interactive system should be able to cater for different student profiles and move away from a 'fit all' type of an IS (Samarakou et al., 2015). What the literature does not speak about is the extent of interface design integration in two platforms in the example of mobile and web-based interfaces to promote active learning.

As discussed in the above, attitude towards a system might influence a system continuance and intention to use it (Chan & Stephan, 2019). In addition, Chan & Stephan (2019) explain that positive performance translated through active learning could be demonstrated in the number of efforts of the user to master an IS and the technical competence of the instructor to support the user. In the context of this study, little is said about the alignment of e-learning contents deployed on both mobile and web-based design interfaces and the degree to which instructors support users to promote active learning.

In his study, Al-Juda (2017) assessed the usability of one online learning interface to ascertain the degree of users' engagement with e-learning contents. Al-Juda (2017) argued that there was evidence of a positive relationship between users' engagement and the easiness of the system because of the benefits gained from the system design, adequate training provided, and technical support provided to users. What has not been extensively researched in the literature is the extent to measure the effectiveness of e-learning contents deployed on both mobile and web-based design interfaces.

Al-Juda (2017) used the Technology Acceptance Model by Davis (1989) to assess factors that influence students' intention to use an IS and their continuation of that use. The author suggests that an IS was able to enhance active learning when the following contributing factors, namely satisfaction with an IS, perceived ease of use, perceived usefulness, self-efficacy, and attitude. In addition, Chan & Stephan (2019) highlight concepts of interest such as customisation, innovativeness, adaptability, and completeness of the information in the context of this study. These concepts are important in supporting active learning for contents deployed on user design interfaces.

Al-Juda (2017) argues that to enhance user acceptance of an IS, e-learning contents and user interfaces design should be such that external variables that have a direct effect on usage are considered. The author explains that a variable such as adaptability from the users' perceptive may enhance ease of use and further influence attitude toward adopting an IS.

Although the focus of this study is to establish how learning contents deployed on both mobile and web-based design interfaces promote active learning, sections of the literature present limitations associated with the acceptance of an LMS such as constant innovations in telecommunications and infrastructure, strategic planning, content creation and deployment of learning contents (Makhaya & Ogange, 2019). This study is interested in assessing these limitations in the context of e-learning contents deployed on both mobile and web-based design interfaces to evaluate how these hinder active learning.

THEORETICAL FRAMEWORK

With the aim of the study to assess the effectiveness of online contents deployed on both mobile and web-based design interfaces to promote active learning, there was a need to identify a theory that would be able to assist the researchers in investigating the variables discussed in this study. Many studies to understand the features and variables associated with user perceptions, design interfaces, and systems' expectations have been conducted (Venkatesh et al., 2016).

There was a need to identify a theory or model that caters for user engagement, motivation, continuance intentions and satisfaction while providing the researcher with tools to evaluate the system performance and effectiveness to engage with e-learning contents to achieve an outcome and in this case, to promote active learning.

Gaps relating to user engagement, motivation, continuance intentions and user satisfaction are worth investigating to align those gaps with the context of this study (Lowry, Moody & Gaspin, 2015). Lowry et al. (2015) developed the proposed Multi-Motive Information Systems Continuance Model (MISC) because of gaps previously identified in the literature to demonstrate the need and role for met and unmet expectations of an IS used to engage and interact while addressing concepts associated with user motivations in a context of interface design to promote an outcome. This study pays attention to this proposed model as it can shed light on the gaps previously identified in the literature using a combination of variables to promote active learning.

User perceptions in IS research have been extensively studied to understand issues such as usability, desires, utility, and productivity (Davis, 1989; Kim & Kankanhalli, 2009; Pittarello & Pellegrini, 2017). There is a need to explore the gaps identified by Lowry et al. (2015) in the context of this study to examine areas that address intrinsic and extrinsic motivations that influence outcome variables such as active learning on both mobile and web-based design interfaces.

It is essential in this paper to elaborate further on the proposed MISC model by Lowry et al. (2015) given its ability to incorporate many constructs that pertain to design interface to promote outcomes and, in this case, active learning. The sections that follow briefly discuss the adopted model and constructs that emerged from the model. Previous studies on human-computer interaction design have pointed to system use and perceptions, which have ultimately presented limitations to generalising user motivations and engagement across various types of design interfaces (Pittarello & Pellegrini, 2017). There was also a need to understand user expectations from a system design perspective, which was considered as another limitation in previous theories and models (Venkatesh et al., 2016). Lowry et al. (2015) believed the proposed MISC model would be able to address these limitations.

The MISC model establishes concepts of great interest in the design area to better understand the role of the system performance and user expectations, the link between different types of users' motivations, and the stimuli toward user engagement and desired outcomes (Lowry et al., 2015). This study views e-learning as intrinsic motivations. Furthermore, this study perceives motivations created in using e-learning contents deployed for both mobile and web-based design interfaces as a direct antecedent of expectations. This study further views user expectations as key components of all interactions and user engagement.

The choice of the MISC model is motivated by its ability to investigate constructs associated with motivations, user engagement, design intents, design interfaces and features, and user evaluations or parameters to measure outcomes in one context (Lowry et al., 2015). From the user and system perspectives, the following variables are worth defining:

- Expectations: They are viewed in this study as one's beliefs about future events (Zhen, 2018); they are instrumental in the way the user perceives the acceptance and engagement of an IS.

- Disconfirmation: This is viewed in this study as the extent to which an event is evaluated as either exceeding or falling short of expectations (Pittarello & Pellegrini, 2017).
- Attitude: This is viewed in this study as the degree to which a user likes or dislikes a behaviour (Rijt et al., 2019). This can have a positive or negative effect on the system or design usage and intentions. Furthermore, Lowry et al. (2015) argue that motivations and expectations may directly affect attitude toward using a system, which subsequently may affect the engagement of the user with a system.
- Performance: This is viewed in this study as the user's beliefs about how an IS performs (Zhen, 2018). The author further explains that expectations can positively or negatively influence user performance.

This study approaches user satisfaction as a positive cognitive and emotional evaluation that results in a sense of contentment and fulfilment (Zhen, 2018). The degrees of one's expectations with one's system experience are usually evaluated in relation to the perceived performance of a system design (Diogo, Oliveira & Tam, 2018). Better user experience with a system design or performance can affect the way the user perceives the system to influence the engagement positively or negatively with an IS (Pittarello & Pellegrini, 2017)

Some constructs used in the MISC Model (Lowry et al., 2015) that are of great interest to this study are the Design-Expectations Fit (DEF), Perceived Ease of Use (PEOU), and the design aesthetics that need to be elaborated further in the context of the study.

DEF has been referred to as an important construct in the MISC Model, and has, therefore, the likelihood to affect the disconfirmation process (Lowry et al., 2015). The authors argue that there is a need to establish the gaps between the IS and the tasks to be evaluated. In the context of this study, it was essential to establish the gaps between e-learning contents deployed on both mobile and web-based design interfaces and effective tasks designed to promote active learning.

PEOU is viewed in this study as the degree to which the user perceives using the system as free from effort (Tommaso et al., 2017). This construct has been extensively investigated in IS research (Davis, 1989; Venkatesh et al., 2003; Delone & Mclean, 2004; Santiago, de Blas & Perez-Victoria, 2018). Lowry et al. (2015) further explain that the usefulness of an IS can lead to positive evaluations also known as disconfirmations of the interactions and user engagement. Additionally, PEOU has been observed in IS research as affecting the degree to which the user positively engages with the IS, which can be assessed with system performance (Moret-Bonillo, Mosqueira-Rey & Alonso-Rios, 2018).

Design aesthetics are viewed in this study as the appropriateness and professionalism of the design interface (Li & Yeh, 2010; Moret-Bonillo et al., 2018). In the context of this study, a mobile and web-based design interface that is appropriately designed and highly appealing to users has the potential to engage users and promote desired outcomes. This may promote in return positive user evaluations and interaction experience to achieve the desired outcome. Aesthetics design may include content layouts and presentations, navigations, learning instructions, trust and quality of contents design and creation, which are often perceived as useful and enjoyable (Lowry et al., 2015; Moret-Bonillo et al., 2018).

There is a need to present the constructs that influence the design interface that is used in the MISC Model (Lowry et al., 2015). Among these are human motivations, traditionally represented as intrinsic and extrinsic motivations: intrinsic motivation is viewed as what users can do without external reward or inducement, as opposed to extrinsic motivation that is viewed as what users can do because of users' external inducement or reward (Lowry et al., 2015). The literature explains that when users are intrinsically motivated to use

an IS to achieve a desired goal or outcome, they might not seek external rewards; however, it might be that external rewards such as marks might not be sufficient to keep the user motivated to achieve a task or desired outcome in the absence of supplemental, intrinsic motivations (Gong, Lee, Liu & Xeng, 2018). This could be translated in the examples of rewards in the form of marks counting toward a formative or summative assessment, which might be an important contributing factor to keep users motivated to using a system.

Lowry et al. (2015) argue that intrinsic motivations are closely tied to related processes, expectations, and outcomes on one hand, while extrinsic motivations are focused on the outcomes rather than on the processes that lead to outcomes, on the other hand. One middle ground between intrinsic and extrinsic motivations is hedonic motivation, which can be defined as behaviours motivated by the feeling of using a system (Lowry et al., 2015).

The study adopted a proposed taxonomy of major motivations for system design use from Lowry et al. (2015) to suit the purposes of this study, and these motivations are presented in Table 1.

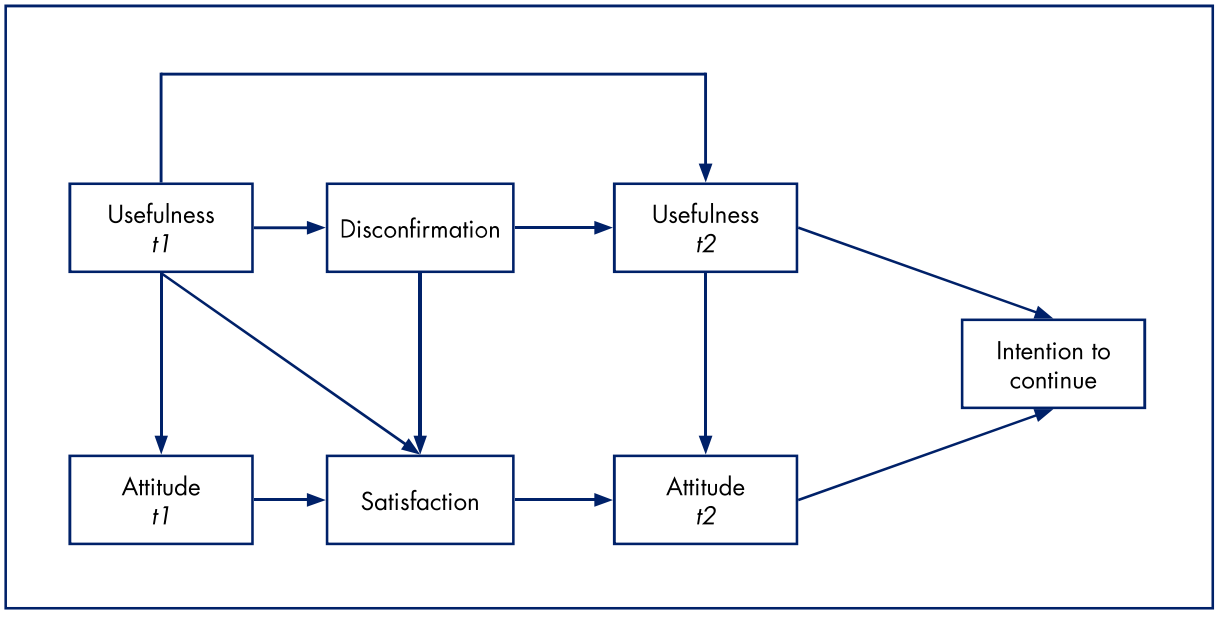
Table 1:
Proposed taxonomy of major motivations for system design use adapted from Lowry et al. (2015)

Motivation main category	General motivation (desired goals or outcomes)	Specific motivation (desire for)
Hedonic	System pleasure	Play/enjoyment/fun
		Entertainment
		Escape/relax
	System motivation	Challenge (the degree to which an activity matches the skills of a user)
		Satisfy curiosity and contents of interest
		Explore/discover new knowledge
		Stimulate practical experience
Intrinsic	System accomplishment	Influence others for learning purposes
		Improve reputation/receive approval
		Leading effective/successful experiences
		Autonomy/freedom
		Gaming achievement
	System learning	Knowledge acquisition
		Knowledge sharing
		Computer skill acquisitions
		System informative nature
	System socialisation	Affiliation with a learning community of interest
		Social communication
		Collaboration with others
		To engage with others

Motivation main category	General motivation (desired goals or outcomes)	Specific motivation (desire for)
Positive extrinsic	System personal gain	Receive positive action from system interaction
		Receive reward and image enhancement
		Receive marks toward completing a task
	System transact	Meet learning objectives
		Meet learning objectives/requirements
	System improve work	Promote best learning practices
		Be more productive, increase performance
		Collaborate/community remotely
		Enhance decision-making
Negative extrinsic	System self-preservation	Avoid threat or injury
	System harm others	Manipulate/extort others
		Cause injury
		Pursue revenge
		Carry out fanatical political agenda
	System misbehaviour	Access proprietary information illegally
		Make mischief
		Computer abuse/non-compliance

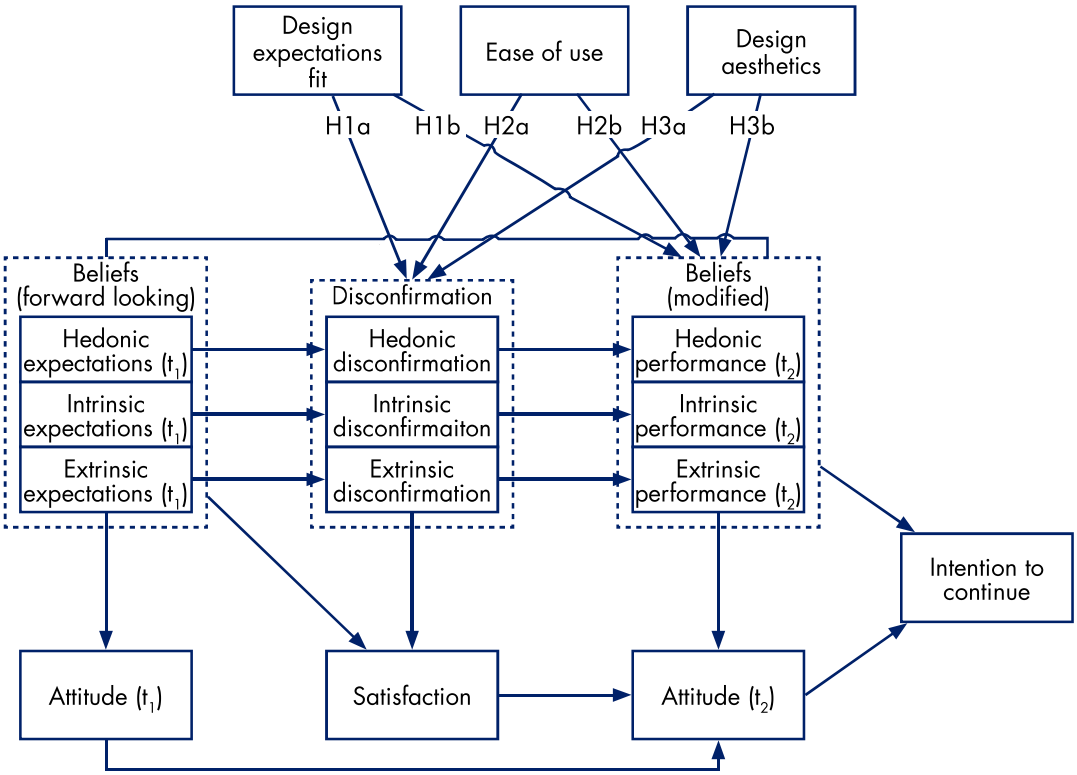
A model initially proposed by Bhattarcherjee & Premkumar (2004) is presented below in Figure 1.

Figure 1:
Bhattarcherjee & Premkumar's (2004: 242) Model



The proposed MISC model by Lowry et al. (2015), developed from Bhattacherjee and Premukumar's model (2004), is presented below. It includes the three additional expectations that are common across many kinds of ISs or interface designs: DEF, Perceived Ease of Use and Design Aesthetics. The other constructs that are included in the MISC proposed model are the three dominant forms of motivations, namely intrinsic, hedonic, and extrinsic.

Figure 2:
The proposed MISC model by Lowry et al. (2015:15)



RESEARCH METHOD

This section outlines an overview of the research design and methodology used in this study. This study follows a Design Science Research (DSR) paradigm, and the following are discussed: research paradigm, research strategies, and data collection methods.

Research paradigm

The literature presents many research paradigms to outline the values, assumptions and different viewpoints shared in an intellectual discipline (Schliesser & De Lange, 2017). The Design Science Research was proposed as a paradigm since this intends to introduce novel artefacts while supporting a pragmatic research paradigm (Vaishnavi & Kuechler, 2015). In the context of this study, the paradigm and knowledge are gained through the process of artefacts design (Vaishnavi & Kuechler, 2015).

Research strategies

While many research strategies are used to answer research questions (Saunders, Lewis & Thornhill, 2019), DSR is first and foremost a problem-solving strategy with the main aim to develop innovative artifacts. DSR presents many forms, and these include models, constructs, methods, instantiations, and better theories (Livari, 2015). With the aim of this study to evaluate the gaps in the deployment of

e-learning contents on mobile and web-based design interfaces to recommend solutions to promote active learning, the DSR strategy used in this study proposes to develop a model.

From the Design Science Research methodology's perspective, this study follows the Kuechler & Vaishanavi (2012)'s Design Science Research methodology, and it is comprised of awareness of the problem, suggestion, development, evaluation, and conclusion. Applying the DSR cycle to this study, the following phases were tackled:

1. **Awareness of the problem**

   The researcher started by evaluating the extent of the problem relating to promoting active learning for contents deployed on mobile and web-based design interfaces. Gaps that were identified in the literature were evaluated against best practices in the development of learning contents deployed while assessing their effectiveness to promote active learning.

2. **Suggestion**

   Given the various iterations of LMSs as platforms for deploying learning contents considering the context of this study, the literature analysis was used to identify some of the design principles and interface approaches that will be suitable for integrating online contents deployed on mobile and web-based interfaces to promote active learning.

3. **Development**

   This study used one single development cycle to identify and design the components of the proposed framework. The researcher made use of a single development cycle in the provision of contributions while analysing literature and identifying gaps. The analysis of the literature followed the following steps, awareness of the problem, suggestion, and development in one single cycle.

4. **Evaluation**

   The proposed framework was evaluated against existing principles in the literature where gaps were previously identified in the awareness phase of this study.

5. **Conclusion**

   This phase presents reflection on the development of the proposed framework to bring the study's contributions to the body of knowledge.

Data collection methods

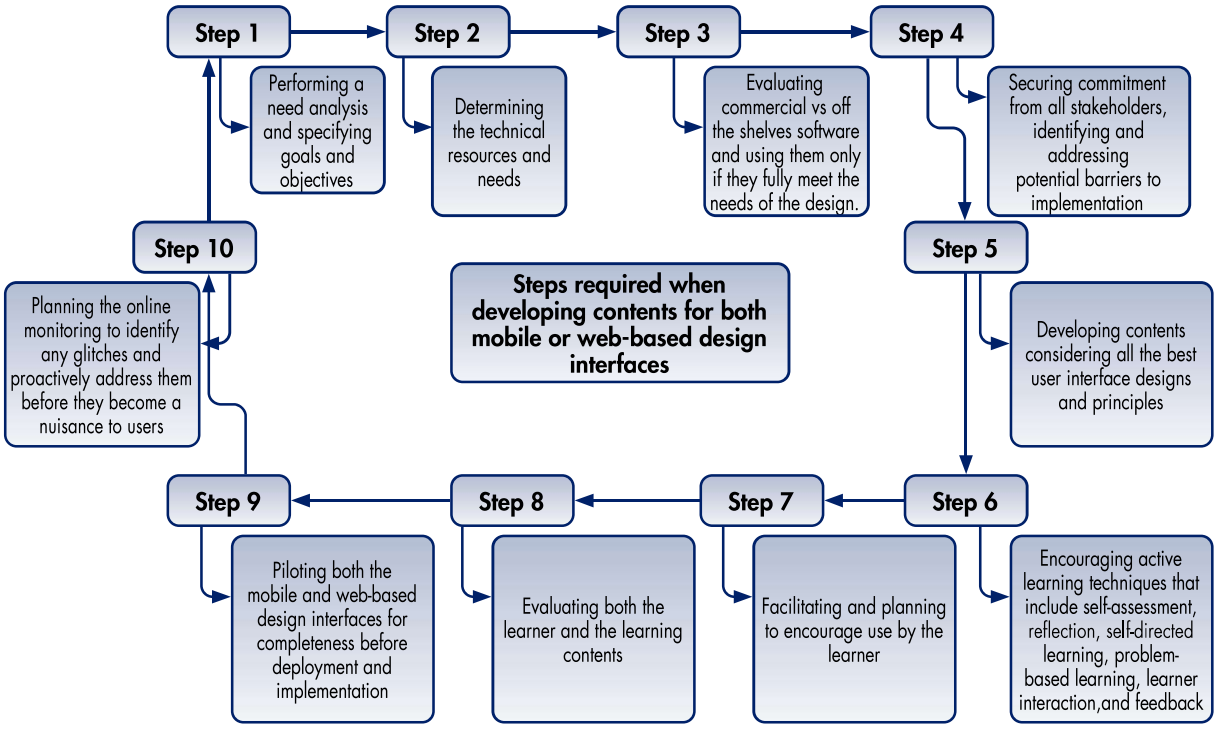
Following the DSR methodology, several collection methods may be used (Saunders et al., 2019). This study used literature review and analysis to identify gaps and evaluate existing methods or approaches in the development of the proposed framework to promote active learning.

DISCUSSION

There is a need in this paper to provide practical contributions to address the gaps in the literature concerning the challenges facing the mobile and web-based learning design interfaces. The researcher points out that the complexity of using best practices in developing design interfaces has been highlighted in previous literature. Hence the researcher proposes to formulate approaches that can be used by educators and interface designers to develop mobile and web-based contents while considering the limitations that each approach might bring.

The proposed framework below provides steps that educators and interface designers might need to consider when developing e-learning contents for both mobile and web-based design interfaces. The interface design steps are adapted from Djamasbi & Strong (2019) and are presented in Figure 3 below.

Figure 3:
The interface design steps



Adapted from Djamasbi & Strong (2019: 224)

The section below elaborates further on the steps required from the framework for deploying contents for both mobile and web-based design interfaces.

Step 1: Performing a need analysis and specifying goals and objectives

This step starts by defining the scope of the user interfaces design for both mobile and web-based environments and the need for e-learning contents that will be deployed. The interface development or design team must spend time together with stakeholders involved in the process to identify the main needs of the online contents as well as the audience who will be using the contents to promote active learning (Strohmeier & Honrbaek, 2017). In completing this step, the team involved in performing this activity needs to assess the level of learners and this assessment includes the knowledge about, skills in terms of, attitudes about and behaviours towards online learning contents deployed both on mobile and web-based environments (Strohmeier & Honrbaek, 2017). Assessment designers need to pay attention to perceived educational needs and preferences while addressing any barriers that might become a stumbling block for learning.

There is also a need to understand the objectives of the learning contents and how these will be deployed. Strohmeier & Honrbaek (2017) argue that the mobile and web-based interface design is, to an extent, driven by the willingness of the learner to learn on his or her own with little technical or academic intervention, hence the need to address all limitations that may hamper a good learning environment while providing the learner with a role that promotes active learning.

Step 2: Determining the technical resources and needs

While the mobile and web-based design interfaces come with some associated user experience principles, one would need to pay attention to the technical requirements. Moret-Bonillo et al. (2018) argue that for

an effective course to be translated into active learning, an understanding of both the subject and the instructional medium, and, in this case, the intersection of requirements needed for both the mobile and web-based user interfaces, is required. There is a need in this step to make use of a multidisciplinary approach with team members understanding the principles and complexities associated with the mobile and web-based design interfaces.

Moret-Bonillo et al. (2018) argue that while the designs for mobile and web-based user interfaces may present different challenges and different nuances from accessibility, navigation, and deployment to name just a few, understanding the technical resources is crucial in accommodating learners from various backgrounds to promote active learning. Moret-Bonillo et al. (2018) further add that technical resources encompass system requirements, network capacity, internet speed and technologies associated with both the mobile and web-based design interfaces.

Step 3: Evaluating commercial vs off-the shelves software and using them only if the fully meet the needs of the design

The evaluation of the type of software required to meet the need of the learning contents where these will be deployed to support learning for both mobile and web-based design interfaces is critical in the process of supporting a seamless learning process (Djamasbi & Strong, 2019). After completing steps 1 and 2, the design team should consider the affordability, ease of use and viability of either commercial or off-the-shelf software that will be suitable for the learning needs while addressing the requirements of both the mobile and web-based design interfaces.

Djamasbi & Strong (2019: 219) propose four key points in the selection process of suitable software:

1. Decide whether the chosen software aligns with the design team's goals and objectives
2. Determine whether the proposed software works across various networks using both the mobile and web-based design interfaces
3. Evaluate the effectiveness of the interface designs as to whether they meet the design principles for online learning contents
4. Evaluate the effectiveness of the online contents deployed on both mobile and web-based design interfaces as to how these promote active learning.

Step 4: Securing commitment from all stakeholders, identifying, and addressing potential barriers to implementation

User interfaces design consists of various aspects that need to come together for a successful deployment of the learning contents for a pleasant user experience (Strohmeier & Honrbaek, 2017). Djamasbi and Strong (2019) argue that the user interfaces design is not only about the deployment of the contents but about having a good understanding of both the learning contents, which involves skills and knowledge from an educational background, the technical skills and expertise that come with the mobile and web-based interfaces. As such, the realm of stakeholders involved in the successful deployment and implementation of learning contents is complex to meet all the stakeholders' objectives.

Strohmeier & Honrbaek (2017) explain that successful deployment and implementation of the learning for interface design for both mobile and web-based platform requires highlighting potential barriers from each field of speciality, which is encompassed in the experience of, skills in terms of, and knowledge and perceptions about the curriculum and alignment of the learning contents and as to how these promote active learning. Strohmeier & Honrbaek (2017) further argue that the commitment strengthens the collaboration of the design team for a rewarding project in meeting the learning objectives to promote active learning.

Step 5: Developing contents considering all the best user interface designs and principles

The key to effective e-learning is to develop contents while considering all the user interface design principles discussed in the sections of this literature (Pittarello & Pellegrini, 2017). Practices such as posting notes and creating contents may not serve the purpose of promoting active learning (Pittarello & Pellegrini, 2017). Pittarello & Pellegrini (2017) further argue that a strong emphasis on the learning content, syllabi or curriculum should be the central focus in aligning the learning contents with the necessary modifications where applicable to promote active learning. Pittarello & Pellegrini (2017) further argue that the traditional approach, if used in the context of this study, will likely not contribute to improving satisfying online conditions and experiences that would promote active learning.

In addressing the requirements that arise during this step, Pittarello and Pellegrini (2017) offer a few hints that are often overlooked when designing user interfaces for the online contents in the context of both mobile and web-based platforms. While the online user interfaces design provides the design team with the possibility to add contents, it is sometimes easy to overdo, thereby providing more than what is required (Pittarello & Pellegrini, 2017). To address such limitations, it is essential to stick to learning objectives and teaching purposes. Basic usability principles and integration of multimedia need to be carefully assessed.

In addition, Khodeir et al. (2018) argue that simply adding multimedia could be distorting for a better learning experience; hence, this needs to be assessed carefully to add value to the online learning experience. The download and upload speed are areas sometimes underestimated following the multitude of resources available from both technical and curriculum perspectives (Khodeir et al., 2018). The authors explain that, from a technical perspective, mobile and web-based interfaces present two different platform environments that come with different sets of designs as discussed in the sections of this literature. The successful implementation of contents and resources for the download and upload largely depend on principles and parameters set for a better learning experience (Khodeir et al., 2018). Tools used such as videos, graphics, animation and other illustrations, speed, size of the frame used, device efficiency to handle large files may contribute to a better online learning experience.

Preparation and planning are the last two items sometimes overlooked by the design team (Vishwakarma, 2015). The complexities and challenges posed by the requirements for both mobile and web-based interface designs are considered critical in the learning trajectory (Vishwakarma, 2015). The author indicates that the lack of preparation and planning often leads to poorly structured learning pages, and unattractive, inefficient, and confusing layouts, which are far from promoting active learning on one hand. On the other hand, time dedicated to preparing online contents for both mobile and web-based interface designs, reduces the pressure from the design team to anticipate problems that might hamper the learning experience (Vishwakarma, 2015). Vishwakarma (2015) further claims that good preparation and planning during the process allows sufficient time to develop well-aligned contents, create and identify appropriate multimedia, develop active learning techniques, prepare evaluation approaches, and pilot the interface design before full deployment and implementation.

Step 6: Encouraging active learning techniques that include self-assessment, reflection, self-directed learning, problem-based learning, learner interaction, and feedback

Vishwakarma (2015) argues that the key to active learning is the involvement of learners in the learning process while providing the right platform to apply new information. The author further argues that encouraging active learning is the most challenging aspect of developing an educational experience; however, it is often its most interesting and enjoyable aspect. To address the complexities associated with developing a user interfaces design to deploy learning contents for both mobile and web-based interfaces, there is a need to apply a combination of creativity, planning and content expertise (Lionel, Bansal & Lutge, 2020).

Khodeir et al. (2018) provide four principles that can be used to develop online contents that promote active learning for both mobile and web-based design interfaces. Research has indicated that there might be many other approaches that set themselves apart from a traditional approach. For this study, principles by Khodeir et al. (2018) will be briefly discussed below:

- ***Instruction and feedback:*** While the traditional approach in a face-to-face environment values the importance of the instructor in class to promote active learning, online learning deployed for both mobile and web-based interfaces seem to put a lot more emphasis on the planning and presentation capabilities of the online contents (Khodeir et al., 2018). The facilitation of active learning in the online environment can be promoted by the appropriate use of multimedia, stimulation of imagination and creativity, clarity around relationships and concepts and the provision of a clear map of how these relate to the learning outcomes or objectives, and the promotion of in depth-study of topics of interest while paying attention to self-assessments and learner interaction (Khodeir et al., 2018).
- Pittarello & Pellegrini (2017) argue that feedback consists of an important aspect of active learning. Embedded tools in both mobile and web-based design interfaces should be able to meet the need of the learners synchronously or asynchronously by providing feedback. Pittarello & Pellegrini (2017) further argue that regardless of the way feedback is provided to learners, it is essential to acknowledge the importance of the instructor and the communication capabilities established in the process to promote active learning.
- ***Application, Self-assessment, and Reflection:*** The paradox between establishing the current and desired level of knowledge constitutes an important aspect of reinforcing active learning (Lionel et al., 2020). Online learning provides students with time and flexibility to manoeuvre the learning pace while encouraging active learning (Lionel et al., 2020). Embedded online learning tools may include pre-tests and post-tests with correct answers and justification provided immediately where applicable.
- ***Self-directed, Evidence-based and Problem-based Learning:*** While the mobile and web-based user interface designs provide flexibility for the learners to monitor and control the learning pace, it is essential to relate to the effort by the learners toward self-directed learning initiated in asking questions and answering theirs (Lionel et al., 2020). The authors argue that self-directed learning should tackle a multitude of questions related to the learning contents and should be supported by reading as well as interaction with other learners. The challenge experienced with self-directed learning is usually associated with intense searches of information to understand a concept (Lionel et al., 2020). The learner sometimes becomes overwhelmed with the amount of information returned from an Internet query.
- ***Learner Interaction:*** Lionel et al. (2020) explain that what sets learners apart in the context of mobile or web-based interfaces is the ability to interact with learning contents. Lionel et al. (2020) further argue that learner interaction plays a dual role which highlights both a social function and a stimulus to promote active learning.

Step 7: Facilitating and planning to encourage use by the learner

Khodeir et al. (2018) argue that learners need to be taken throughout the learning process regardless of the integration of the multimedia tools available in the mobile and web-based design interfaces. Multimedia tools should enhance learner participation to further guide the learner in meeting his or her learning objectives.

Khodeir et al. (2018) explain that three key issues need to be taken into consideration when designing tools to encourage the learner in the process of active learning. Firstly, make the user interface accessible

and user-friendly; secondly, provide time for learning; and, thirdly, motivate and remind the students of what they learnt, consider rewards, and assess consequences if any (Wanas et al., 2018).

Step 8: Evaluating both the learner and the learning contents

Teaching modalities for mobile and web-based interface designs bring new dynamics to the online landscape. Pittarello & Pellegrini (2017) argue that it is essential to evaluate what the learner does and can accomplish online together with the learning contents deployed on the interface designs (both mobile and web-based).

Step 9: Piloting both the mobile and web-based design interfaces for completeness before deployment and implementation

Vishwakarma (2015) explains that testing both the mobile and web-based design interfaces for completeness is crucial as this serves as an important step for successful implementation and future maintenance. Vishwakarma (2015) further argues that mobile and web-based interface designs go through various stages in the design process; hence, the design team needs to evaluate the development process, and review the contents and associated multimedia before full implementation.

Step 10: Planning the online monitoring to identify any glitches and proactively address them before they become a nuisance to users

Pittarello & Pellegrini (2017) explain that enough time is needed to monitor and moderate e-learning contents. The authors further explain that to successfully plan the online monitoring, there is a need for ongoing faculty involvement from the curriculum perspective. Furthermore, Vishwakarma (2015) adds that as the implementation of e-contents progresses, the user requirements often decrease with time after completion of the development phase; however, maintenance will still be necessary.

Vishwakarma (2015) proposes the following three activities to be undertaken to succeed in planning online monitoring:

1. One needs to plan to address the technical challenges that constantly arise from the system perspective. To address these technical challenges, the design team needs to hand these types of technical challenges to a specialist in the field.
2. Internal and external URL links need to be tested periodically. The challenge often arises with external links as these may change frequently, and these may unexpectedly fail.
3. Content should be updated regularly based on the course evaluation as well as any relevant or updated information.

CONCLUSION AND FUTURE RESEARCH

The debate about the context of active learning at higher institutions of learning remains of great interest and these institutions will continue investing large amounts of resources and personnel to meet their stakeholders' academic needs. This paper presented practical contributions and approaches that might be applied in promoting active learning. The complexities posed to date by the technological design of mobile and web-based interfaces to integrate e-contents for learners at various locations need to be addressed purposely to meet the learners' needs.

This paper started by introducing the topic under investigation, followed by the purpose of the study. The background of the study was then presented along with the research questions and objectives of the study. The literature review was also provided to clarify the context of both mobile and web-based design

interfaces, as well as the perspectives used in this study to create awareness about active learning to bring about practical contributions.

The Multi-Motive Continuance Model was used as a lens through which the researcher aimed to investigate complex issues associated with designing learning contents deployed both on mobile and web-based design interfaces.

This paper highlighted the need to review closely the interface designs for contents deployed on both mobile and web-based design interfaces. Areas that remain of great concern in IS research include challenges associated with deploying e-contents following the amounts of data available. While these challenges have decreased in the last decade, the literature indicates that there is still some work that needs to be done in terms of the challenges associated with the design and implementation of LMSs.

Contributions brought about in this paper will go a long way in reviewing aspects related to active learning while establishing challenges associated with addressing e-learning contents for both mobile and web-based design interface designs.

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