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Abstract

Purpose

This study examines the effect of design quality (i.e., appearance, navigation, information, and interactivity) on cognitive and affective involvement leading to continued intention to use the online learning application.

Design/Methodology/Approach

We assume that design quality potentially contributes to enhance the individual's involvement and excitement. An experimental prototype is developed for collecting data used to verify and validate the proposed research model and hypotheses. A partial-least-squares approach is used to analyze the data collected from the participants (n= *662*).

Findings

Communication, aesthetic, and information quality revealed to be strong determinants of both cognitive and affective involvement. However, font quality and user control positively influence cognitive involvement, while navigation quality and responsiveness were observed as significant indicators of affective involvement. Lastly, cognitive and affective involvement equally contribute to determining the continued intention to use.

Originality/Value

Prevalent research in the online context is focused primarily on cognitive and utilization behavior. However, these works overlook the implication of design quality on cognitive and affective involvement.

Implications

This study will draw the attention of designers and practitioners towards the perception of users for providing appropriate and engaging learning resources.

1. Introduction

Technologies enhance learning experiences by providing easy access to resources (Dominici and Palumbo, 2013). Several academic institutions have made substantial investments in developing

digital resources to deliver useful learning content (Chin *et al.,* 2018; Wang *et al.,* 2018). Still, it is a challenge to create an interactive environment that could engage individuals as to maintain their involvement and interest (Guo *et al.,* 2015). On the other hand, design quality encourages individuals to change their level of involvement (Cyr *et al.,* 2018) and plays a crucial role in information deliverance by establishing effective communication between the system and the users. It influences the individual's perceptions and final behavior (Ou and Sia, 2010; Floh and Madlberger, 2013). Thus, a good quality website comprises all the cues used to design it and affect the internal state of users (Hsu *et al.,* 2012). It involves the combination of appropriate information aspects with a precise organization of contents. Besides organization, visual appearance also contributes by initiating positive attitudes towards the system interface, which, in the end, leads to heightened involvement (Greussing and Boomgaarden, 2019). Thus, improvements in design quality foster the user's involvement, along with positive experiences (Guo *et al.,* 2015; Lin, 2007). Such experiences create value for users; in consequence, they spend more time on a system, which ultimately leads to a positive attitude (Kim *et al.,* 2007; Ou and Sia, 2010; Liu *et al.*, 2016) and intention to use (Tarute e*t al.,* 2017). Therefore, consistent efforts are required to enhance the interactivity, engagement, and usability of these applications through design and appearance quality (Abachi and Muhammad, 2013; Tarute *et al.,* 2017; Chin *et al.,* 2018). Likewise, Hasan (2016) argues that the websites having relevant information, visually appealing and that are also easy to use or navigate seem to heighten the individual's involvement with the site and lessen the feelings of irritation. On the other hand, poor usability, imprecise design and interaction discourage users (Hoehle *et al.,* 2016). Besides, poor usability design might cause anger and disorientation in the users, as well as the feeling of losing control over their actions, thus the urge to leave the site (Faisal *et al.,* 2018; Hasan, 2016).

It is essential to retain users and to improve their level of involvement via substantial interaction and engaging-design artifacts (Jiang *et al.,* 2010; Tarute *et al.,* 2017). Involvement is considered as a vital concept for information and communication research (Perse, 1990; Celuch and Slama, 1998; Kang *et al.,* 2015; Reychav and Wu, 2015; Cyr *et al.*, 2018) and is adopted in technological studies to observe positive attitude, utilization, and intention (Jiang *et al.,* 2010; Kang *et al.,* 2015; Reychav and Wu, 2015; Cyr *et al.*, 2018). Still, only few studies focus on this multidimensional construct due to the difficulty of conceptualizing it (DeFranco, 2016). Moreover, we found that prior research primarily focused on fully functional desktop Web browsers usage to determine the

design implications and their impact on involvement (Cyr *et al.,* 2018); there is a need to understand the user's experience and to alter their usage behavior for smartphones as well. The reason is that smartphones have relatively small screens, tiny input mechanisms, and diverse design patterns as compared to the full-screen version of the website (Ribeiro, 2012; Hoehle *et al.,* 2016). Therefore, these devices display the same content in a reduced space, and are prone to higher error rate compared to laptops (Lugtig and Toepoel, 2016). Besides the screen size, another significant difference between the web sites browsed from desktop large screens compared to the same sites explored in the relatively small mobile device screens is the way in which users interact with them (Hoehle *et al.,* 2016; Shin *et al.*, 2016). For instance, websites using desktop environments rely on mouse-driven interactions, while smartphones have touch interfaces, in which there is a more direct manipulation of the screen elements. The human finger is a much more imprecise pointer than a mouse (Ribeiro and Carvalhais, 2012; Hoehle *et al.,* 2016). Thus, it is critical to determine additional usability problems for Mobile applications (Shin *et al.*, 2016; Tarute *et al.,* 2017) These usability issues become important aspects considering the fulfillment of individual needs and encouraging more intense engagement in the further usage of mobile applications (Tarute *et al.,* 2017). Besides these issues, instant changes in consumer usage behavior also force new challenges on companies seeking to influence behavior by making use of mobile technologies (Tarute *et al.,* 2017). Thus, a careful design approach is needed, considering the smartphone constraints that are bound to lessen the quality of interaction (Tsiaousis and Giaglis, 2014) and level of involvement (Sun and Xu, 2019). Likewise, Little (2013) emphasized that the designer should project the learning content in a way that can quickly be delivered via small-screen devices (e.g. Mobile phones).

The objective of the current study is to explore the design background that arouses the emotions, understanding, and indirectly influences the continued intention to use. It is crucial because smartphones can be a viable alternative for information deliverance and are becoming more popular due to its high accessibility and mobility. Hence, this study makes two essential contributions. First, we examine the impact of design quality (i.e., font and aesthetic quality, information quality, navigation quality, and interactivity) on involvement dimensions, including cognitive and affective involvement, ultimately leading to continued intention to use; since limited research has been conducted to assess the role of design quality for user involvement (Cyr *et al.,* 2018). Second, this study proposes the guidelines related to user interface design elements to

promote the individual's involvement. These guidelines enable designers to have a clear understanding of essential design features while developing learning resources for smartphones.

The rest of the article is organized as follows: Section 2 presents related studies, including design, involvement, research model, and hypotheses. Section 3 provides details about the adopted methodology, experimentation, data gathering, and statistical analysis. Section 4 presents the results, while section 5 is related to implications followed by the conclusion, limitations, and future scope of the current research.

2. Literature and Research Model

Various technologies, such as smartphones, tablets, computers, and internet access, have become nearly ubiquitous in everyday life (Golonka *et al.,* 2014). Especially the smartphones, that have become gradually sophisticated; they have a higher potential to heighten user engagement and level of involvement, which, in turn, can result in excessive usage (Reychav and Wu, 2015; Tarute *et al.,* 2017; Barnes *et al.,* 2019).

However, due to emergent requirements and diversification in services and applications, the interaction with smartphones has become highly complex (Choi and Lee, 2012), which may negatively influence the continued intention to use. Use intention and positive attitude are associated with design quality and level of involvement and engagement (Cyr *et al.,* 2018; Kang *et al.,* 2015; Tarute *et al.,* 2017). Accordingly, several researchers also emphasized the need to explore the role of interface design for intention to use (Joo *et al.,* 2014; Kang *et al.,* 2015; Nikou and Economides, 2017; Tarute *et al.,* 2017). So, to retain the users and to continuously use a system can only be made possible with substantial interaction and engaging-design artifacts (Tarute *et al.,* 2017).

User interface refers to the degree to which an individual feels that a system or a website is well designed, and it includes the appropriate features, i.e., navigation, information, visual appearance, and functions to control the systems (Nikou and Economides, 2017). In similar studies, Hasan (2016) and Fortin and Dholakia (2005) argue that visually appealing, informative, and convenient to navigate interfaces seem to enhance website involvement. The design quality of an interface affects the individual's perception of the website as it is the portal through which the activities are conducted. Cyr and Head (2013) argue that the design quality of a website strongly influences the user's adoption behavior. Pelet *et al.,* (2017) argue that design helps to arouse the individual's

emotions, which leads to stimulating intention, revisit websites, and recommendation. Ahn *et al.,* (2007) observed the positive impact of website quality on attitude and behavioral intention. Furthermore, authors argue that usefulness plays a crucial role in enhancing the attitude and behavioral intention to use a website. I-Fan *et al.,* (2010) argue that the quality of the design is imperative for online applications because the user feels more comfortable with a user-friendly interface. Salvador *et al.,* (2015) observed the strong impact of design on intention to use. The authors argue that the use of drag and drop interaction and a good organization contribute to decrease the cognitive complexity; consequently, individuals perceive the systems as more efficient and reliable.

In several other studies (Nikou and Economides, 2017; Tarute *et al.,* 2017; Cyr *et al.*, 2018), the researchers observed the positive impact of web design and its quality on attitude, behavioral intention to use, engagement, and service quality. The authors emphasize the need for further research because the effect of these elements may be different for smartphones. Smartphones have a vast potential to deliver effective services (Keengwe and Bhargava, 2013); still, it is critical to determine additional usability problems for such devices (Tarute *et al.,* 2017) to design an interface that is easy to use with a simple and straightforward design, and visually appealing, and that requires fewer actions before a goal is achieved. This is because user-controlled information, visual aspects (e.g., shape, size, texture, color, labels), standardized layouts and symmetry help users to be more attentive and influence the user's psychological processes as well (Moshagen and Thielsch, 2010; Tuch *et al.,* 2010). The role of layout and symmetry for visual appearance has been identified by the Gestalt laws of perceptual organization (Seckler *et al.*, 2015). It refers to visual perception that focus on the organization rather than on beauty, and it attempts to explain that people perceive objects as a whole instead of individual parts (Arnheim, 1974; Moshagen and Thielsch, 2010). According to the theory, stimulus elements are perceived and organized into groups that make sense to us. The grouping principles such as closure, proximity, and similarity are used in design to arrange the information and to create the visual hierarchy (Hoehle *et al.*, 2016). In several studies (Bhandari *et al.,* 2017; Lavie and Tractinsky, 2004; Moshagen and Thielsch, 2010), the impact of visual design is discussed in terms of understanding, sense-making, involvement, and arousal.

Still, consensus prevails among the researchers on the design factors that constitute the user interface. Kim and Lee (2002) categorized the design into two important aspects: process and

information architecture. The process refers to transactions, while the architecture refers to web-page elements. The architecture also relates to the rules and arrangement of items into a pleasing design. However, the features are extensive; therefore, precise classification of these design elements would be more helpful to understand and determine how these aspects influence the continued intention to use. Accordingly, Palmer (2002) categorized these elements into information, responsiveness, interactivity, navigation, and speed to assess website acceptance and success. Cyr and Head (2013) discussed website interface design in terms of information quality, navigation, and visual design to determine a positive attitude. Faisal *et al.,* (2017) considered design characteristics including aesthetic, navigation, information, and interaction to improve the quality of a website. Hoehle *et al.,* (2016) observed the direct relationship between design guidelines (i.e., graphics, animation, color, entry point, fingertip-sized controls, text, gestalt standards, order, and transition) and continued intention to use.

In the prior research (Ali 2016; Éthier *et al.,* 2008; Hsu *et al.,* 2012; Tarute *et al.,* 2017), several researchers adopted stimulus-organism-response (SOR) to explain the design implications. In these studies, the design attributes and website quality are regarded as stimuli. The SOR framework proposes that stimuli on behavior are mediated through an organism (Albert and Russell, 1974). The theory suggests that environmental cue can impact an individual's internal states (i.e., cognitive and affective reactions), which in turn produce either avoidance or approach behaviors (Liu *et al.,* 2016). In the online context, the stimulus refers to the website quality that affects the internal state of the users (Ali 2016; Hsu *et al.,* 2012; Liu *et al.,* 2016) In several other studies, the design features –including navigation (Éthier *et al.,* 2008; Floh and Madlberger, 2013; Rodríguez-Torrico *et al.,* 2019), perceived visual appearance (Bhandari et al., 2017; Éthier *et al.,* 2008; Koo and Ju, 2010; Liu *et al.,* 2016; Liu *et al.,* 2013; Peng *et al.,* 2017; Rodríguez-torrico *et al.,* 2019; Shu-Hao *et al.,* 2014), information quality (Carlson *et al.,* 2018; Eroglu *et al.,* 2001; Éthier *et al.,* 2008; Floh and Madlberger, 2013; Hsu *et al.,* 2012; Tarute *et al.,* 2017), and interactivity including user control, responsiveness, and communication (Jiang *et al.,* 2010; Hsu et al., 2012; Carlson *et al.*, 2018; Rodríguez-Torrico *et al.,* 2019)– were employed as stimuli or environmental cues to determine the individual's perception (see Table 1), because they play an important role in promoting positive attitude and use intentions (Hausman and Siekpe, 2009; Koo and Ju, 2010). However, majority of these studies were conducted in the context of the website, only few among them discussed the design consideration for mobile but in different usage contexts.

Jiang *et al.,* (2010) adopted design interactivity as environmental stimuli to determine the intention via involvement, where involvement arouses from a wide variety of stimuli: quality of design including navigation, content, visual appearance, interactivity, download speed, friendliness, multimedia capability, and presentation style (Santosa *et al.,* 2005). Thus, design quality is an essential aspect that increases the individual's involvement (Cyr *et al.,* 2018). In the current study, where S-O-R is applied, we argue that design features are environment cues, which are likely to affect the individual's continued intention to use via cognitive and affective involvement.

Table 1 Several related studies based on S-O-R theory

Authors	Stimulus	Organism	Response
Eroglu *et al.* (2001)	High and low task-relevant information	Affect and cognition	Approach and avoidance
Mummalaneni (2005)	Ambience and design factor	Pleasure and arousal	Satisfaction and loyalty
Éthier *et al.* (2008)	Information, navigation, text, and visual aspects	Cognitive processes	Behaviors
Manganari *et al.* (2009)	Virtual layout and design	Affective and cognition	Approach and avoidance
Deng and Poole (2010)	Order and visual complexity	Pleasure and arousal	Approach and avoidance
Jiang *et al.* (2010)	Interactivity (control and communication)	Affective and Cognitive	Purchase intention
Koo and Ju (2010)	Graphics, colors, links, and menus	Pleasure and arousal	Intention
Lee *et al.* (2010)	Interactivity	Enjoyment and risk	Attitude
Hsu *et al.* (2012)	Information, system, and service quality	Perceived flow and perceived playfulness	Satisfaction and purchase intention
Floh and Madlberger (2013)	content, design, and navigation	Shopping enjoyment and impulsiveness	Impulse buying behavior
Liu *et al.* (2013)	Visual appeal	Impulsiveness and instant gratification	Urge to buy impulsively
Gao and Bai (2014)	Informativeness, effectiveness, and entertainment	Flow	Purchase intention and satisfaction
Loureiro and Roschk (2014)	Graphic design and information design	Positive emotions	Intentions to re-visit\ re-use
Shu-Hao *et al.* (2014)	Web aesthetics	Control and pleasure	Purchase behavior
Ali (2016)	Usability and functionality	Perceived flow	Satisfaction and purchase intention
Liu *et al.* (2016)	Aesthetic appeal	Pleasure and ease of use	Satisfaction
Bhandari *et al.* (2017)	Aesthetics	Emotion	Quality perception
Fang *et al.* (2017)	App design and performance	Utilitarian, hedonic, and social benefits	Behavioral engagement intention
Peng *et al.* (2017)	Aesthetic and design	Flow and usefulness	Affective and cognitive attitude
Tarute *et al.* (2017)	Functionality, design, information quality, and interaction	Engagement	Continued intention to use
Carlson *et al.* (2018)	Content quality, interactivity, and contact quality	Customer-perceived value	Customer engagement behaviors
Rodríguez *et al.* (2019)	Visual appeal, interactivity, and Personalization	Satisfaction, trust	Purchase intention

2.1 Involvement

Involvement is "based on inherent needs, values, and interests that motivate one toward the object" (Zaichkowsky, 1985). Previously, it was discussed in terms of engagement (Lee and Kozar, 2009; Henrie *et al.,* 2015; Kim and Baek, 2017; Parihar *et al.,* 2019), playfulness (Lavie and Tractinsky, 2004), as a strong determinant of satisfaction (Jiménez-Zarco *et al.,* 2014), attitude (Cyr *et al.,* 2018), loyalty (Din *et al.,* 2016), intention (Kang *et al.,* 2015; Yang *et al.,* 2019), and perceived usability (Sun *et al.,* 2015) via positive experiences (Guo et al., 2015). Positive perception or experiences increase the sense of involvement, which ultimately leads toward intention to use (DeFranco, 2016). Thus, it is essential to create an engaging environment to promote users' involvement and active participation in online activities (Lin, 2007; Guo *et al.*, 2015; Reychav and Wu, 2015). The design with mass hedonic aspects heightens individuals' emotional response (Zhou *et al.,* 2014) and intention (Kim *et al.,* 2007). An individual's level of involvement with stimulus artifacts, e.g., objects, situations, or activities, is assessed by the extent to which the user perceives that object or concept to be appropriate and relevant. In this study, involvement refers to the degree to which a user feels that the interaction with the contents during information-seeking activity is both necessary and appropriate. It is discussed as a need-based cognition, or goal-directed stimulation, controlled by cognitive and affective motives and considered as a critical construct in communication and information research. It is a central framework to understand the user's final behavior (Chakravarti *et al.*, 2003). This is because, while feeling more involved, the users are more motivated to explore the contents and likely to utilize the interactive features to facilitate the process of exploration. This process of exploration drives the user's motivation and leads toward final behavior. Users' information processing is influenced by the state of involvement (Wu and Hsiao, 2017). This implies that the level of absorption and pleasure of the user, associated with the website design, may be considered as emotional reaction. Digital media, with a more engaging environment, have a positive impact on user involvement with the website contents (Hausman and Siekpe, 2009). Kim *et al.,* (2007) argue that involvement in design is important to determine behavioral intention. Moreover, the authors (Perse, 1990; Jiang *et al.,* 2010; Kang *et al.,* 2015; Reychav and Wu, 2015), suggest that involvement should be studied by separating them into cognitive and affective components as both have a discrete influence on user behavior.

Cognitive involvement explains the rational thinking derived from utilitarian, pragmatic, or cognitive motives (Jiang *et al.,* 2010). It is considered an essential aspect of information processing

and shown in mental processes such as recognition, elaboration, and attention (Perse, 1990). Recognition compares the available information with known patterns in long-term memory and classifies it as either familiar or unfamiliar (Perse, 1990). Elaboration relates the incoming information or observation to existing knowledge, images, and embeds connotative and associative meanings (Perse, 1990). Attention is the selectivity of response that requires effort or allocation of cognitive capacity (Perse, 1990). In this study, cognitive involvement is considered an individual's concern with the design and arrangement of contents to support information processing.

Affective involvement is related to hedonism and emotions, which are induced by value-expressive or affective motives (Perse, 1990; Celuch and Slama, 1998; Jiang *et al.,* 2010). It refers to the emotional investment a user makes to be involved in an environment (Perse, 1990; Celuch and Slama, 1998; Jiang *et al.,* 2010) via communication. It is shown in emotional reactions (Perse, 1990; Celuch and Slama, 1998; Jiang *et al.,* 2010) and related to internal feelings or responses to the information contents (Celuch and Slama, 1998). In this study, affective involvement refers to the individual's perceptions or concerns with emotional and value-expressive content. Thus, it is a kind of feeling associated with a system and how users emotionally feel while interacting with it.

Both cognitive and affective involvement were observed as influencing aspects in the information and communication research (Perse, 1990; Celuch and Slama, 1998; Novak et al., 2000; Jiang *et al.,* 2010; Kang *et al.,* 2015; Reychav and Wu, 2015; Matthes and Beyer, 2017). Novak *et al.,* (2000) observed the impact of website characteristics (e.g., interactivity and speed) on involvement, reaction, and emotive states of the customer while shopping. Éthier *et al.,* (2008) argue that website artifacts are critical elements of the cognitive processes that trigger emotions. This may be due to the richness of features that created the vivid experiences that sustains the individual's interest in a website. In the context of social promotion sites, both cognitive and affective motives have shown to increase users' purchase intent. This increase in purchase intent may be due to the recommendations found in social networks (See-Pui Ng, 2013). For instance, Eroglu *et al.,* (2001) found that online atmospheric cues including colors, graphics, layout, and design can produce various affective reactions on the site visitors, including a positive attitude.

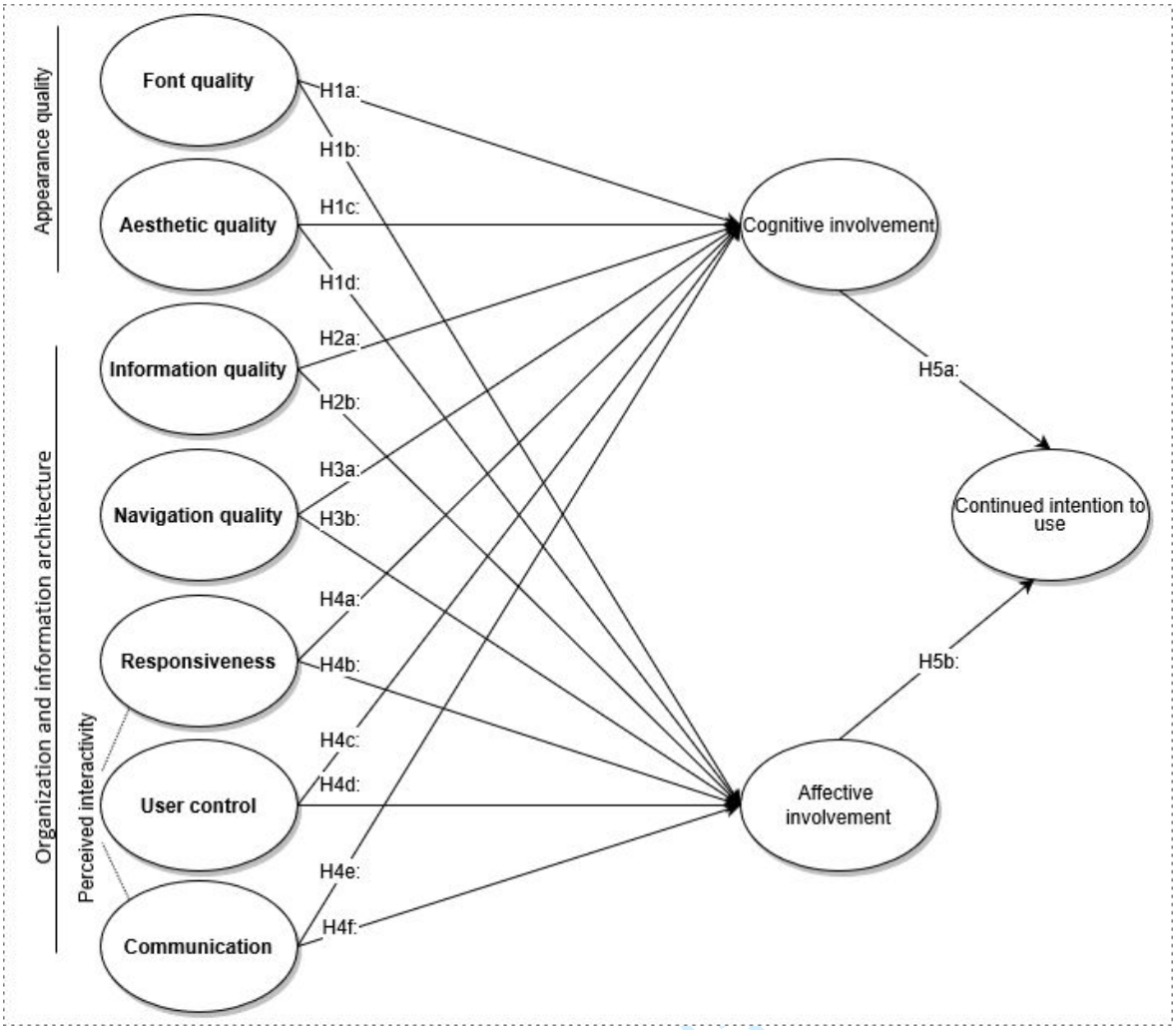


Figure 1 Research Model and hypotheses

2.2 Research Model

Based on previous research, we hypothesized a model that is presented in Figure 1. The objective is to examine the influential role of design quality, including appearance quality and organization and information architecture (Faisal *et al.,* 2017) in determining the continued intention. The purpose is to assess the role of design quality for multidimensional construct involvement and also to determine which design aspects heighten the cognitive and affective involvement along with better experience, which ultimately leads to continued intention to use the smartphones while learning using MOOC (Massive Open Online Course). The appearance quality refers to the look, feel, and beauty of a system such as fonts, color, multimedia, and attraction (Al-Qeisi *et al.,* 2014). The design features related to organization and information architecture (i.e., information, navigation, and interactivity) are complementary aspects and deal with the appearance of

information, navigational orientation, and the nature of the interaction (Faisal *et al.,* 2017). These design artifacts are essential to develop the learning resources and help to establish effective communication between a user and a system.

The appearance quality refers to the look and beauty of a system to capture the user's attention. It includes features related to appearance, such as font, color, multimedia, and appeal (Al-Qeisi *et al.,* 2014). These features play a critical role in the processes of involvement, recognition, and understanding by improving visibility and facilitate directing the individual's attention towards critical information (Faisal *et al.,* 2017; Lavie and Tractinsky, 2004). These elements constitute the interface in such a way to provide better interactivity experiences via sophistication and creativity in design (Moshagen and Thielsch, 2010). In several studies (Bonnardel *et al.,* 2011; Shaouf et al., 2016), appearance aspects of websites were discussed concerning user preferences and recognition.

Additionally, appearance and presentation with appropriate visual elements improve information processing, communication, and level of engagement (Faisal *et al.,* 2017; Tarute *et al.,* 2017). In addition, the arrangement and presentation of similar artifacts grouping them together also improves the user experience through simplicity (Moshagen and Thielsch, 2010). That is why Gestalt theory emphasizes the precise organization of stimulus elements into groups (Arnheim, 1974). The author further argues that information should be structured and presented logically with clear text (Arnheim, 1974). The visual appearance has become an integral part of interactive systems design (Lavie and Tractinsky, 2004) that stimulate emotions (Koo and Ju, 2010; Shu-Hao *et al.,* 2014; Tarute *et al.,* 2017). In the current study, the appearance quality narrows down to font and aesthetic quality. Font quality refers to layout, appearance, and the arrangement of text to improve the legibility and information processing (Faisal *et al.,* 2017). Aesthetic quality refers to the features of the stimulus, appeal, and attractiveness of an interface expressed through graphics, color, and animation (Moshagen and Thielsch, 2010; Hoehle *et al.,* 2016; Faisal *et al.,* 2017). As compared to websites explored in computers, smartphones have numerous constraints i.e., small screen, direct manipulation, and inconvenient input. Due to the small screen, the value of visual aspects increases, especially in the case of font, because it requires excessive mental resources and focuses on reading and exploring the required information. Establishing the theoretical ground and relationship, we believe font and aesthetic quality contribute equally to promote the user's affective and cognitive involvement with e-learning on smartphones.

H1a: Font quality influences the cognitive involvement of online learning on smartphones.
H1b: Font quality influences the affective involvement of online learning on smartphones.
H1c: Aesthetic quality influences the cognitive involvement of online learning on smartphones.
H1d: Aesthetic quality influences the affective involvement of online learning on smartphones.

Information quality refers to relevance, timeliness, accuracy, format, and usefulness of information (Cyr *et al.,* 2018; Faisal *et al.,* 2017). The availability of relevant and updated information is vital for decision-making and is considered as a critical design construct in the user's evaluation research. Thus, the completeness and suitability of the information support the user's needs (Peikari *et al.,* 2014). The ultimate goal of a system should be to deliver clear, useful, and relevant information to develop favorable attitudes and usage intentions. It not only affects the perceptions of users (Balapour and Sabherwal, 2017) but also stimulates their engagement, involvement, and how the contents are perceived (Hsu *et al.,* 2012; Tarute *et al.,* 2017; Cyr *et al.,* 2018). Otherwise, poor structure, incomplete or inconsistent information may lead to usability (Johnson *et al.,* 2005) and understanding problems for the target audience. In a study, McKinney *et al.,* (2002) remark that incorrect information contents dissatisfied the user; resultantly, they left the site without proceeding. Therefore, the design of information should be arranged appropriately to meet the individual's immediate needs (Lee and Koubek 2010; Lee and Kozar 2012; Zhang *et al.,* 2011). In a study, Cyr *et al.,* (2018) discussed information quality in terms of argument quality and considered it as a central route to persuade individuals' positive behavior via involvement for commercial websites. Continued intention to use and adaptation can be increased by presenting the correct information (Tarute *et al.,* 2017). Likewise, Eighmey and McCord (1998) argue that a higher level of web visitor involvement comes from placing the information in a more idea-driven context; as the users who are extremely involved with a website are eager to explore more information on the site (Kim *et al.,* 2007). Establishing the theoretical ground and relationship, the authors believe that information quality is an important aspect that equally contributes to promoting cognitive and affective involvement.

H2a: Information quality influences the cognitive involvement of online learning on smartphones.
H2b: Information quality influences the affective involvement of online learning on smartphones.

Navigation quality refers to the structure and arrangement scheme that helps to explore the information resources (Cyr *et al.,* 2018). In prior studies, it was discussed in terms of ease of use or as a process that facilitates browsing contents conveniently (Cyr *et al.,* 2018). It is a crucial design factor that assists and retains web users. In case of unstructured or confusing navigation

users get irritated, so they will find it challenging to explore the information, therefore, lose interest and leave the application (Hasan, 2016). Hence, convenience to navigate reduces the user's cognitive complexity and time spent and increases the involvement with the system. It also facilitates alternative ways to access the required information quickly (Lee and Kozar, 2012) so users can move freely in and around a website (Grigoroudis *et al.*, 2008). Cyr *et al.,* (2018) and Tarute *et al.,* (2017) observed an indirect impact of search and browsing convenience on intention. However, navigation is still a challenge for smartphones due to the small screen, and most of the mobile navigational patterns have various usability issues. In a study, Cyr and Head (2013) emphasized the use of appropriate navigation structure to develop the individual's positive attitude. Establishing the theoretical ground and relationship, the authors believe that navigation quality is related to ease of browsing and contribute to promoting both cognitive and affective involvement.

H3a: Navigation quality influences the cognitive involvement of online learning on smartphones.
H3b: Navigation quality influences the affective involvement of online learning on smartphones.

Perceived interactivity refers to communication and the extent to which a website supports the exchange of information or interpersonal messages between senders and receivers (Yadav and Varadarajan, 2005). Steuer (1992) describes interactivity as "the extent to which users can participate in modifying the form and content of a mediated environment in real-time." Xu and Sundar (2016) define "interactivity as the ability of the interface to allow consumers to access content through a variety of different interactive features." It allows the users to manage the information on a website and it is considered as a technological characteristic used to determine how the information presented on a system is processed by the users (Jensen *et al.,* 2014). Thus, it is a perception-related design aspect, together with the user's experience (Palmer 2002; Rafaeli and Ariel, 2002; Teo *et al.,* 2003; Zhao and Lu, 2012). Previously, it was used to determine web involvement and positive attitude (Cyr *et al.,* 2018). In the current study, the authors adopted interactivity in terms of responsiveness, user control, and communication (Fan *et al.,* 2017). *Responsiveness* is a mutual discourse, the relatedness of reply to earlier messages, or the extent to which responses in communication are perceived to be appropriate and relevant (Johnson *et al.,* 2006; Fan *et al.*, 2017). Accordingly, it is the ability to respond to user queries and the user sense of how efficient a website behaves providing his/her desired content (Fan *et al.*, 2017). Previously, it was also defined as the immediacy of feedback against the user's queries. *User control* refers to the individual's ability to manipulate and control the information and contents available (Fan *et*

al., 2017). It is the capacity to manage time and sequence of communication to minimize the efforts associated with the tasks to perform (Fan *et al.,* 2017). Features such as content searching, language selection, assessment, and progress tracking enables the user to control his/her interaction with applications. *Communication* refers to an individual's feeling of being connected to others via two-way communication (Fan *et al.,* 2017) to share their experiences using discussion portals, chat rooms, and hyperlinks-based features. It may also refer to social cues and facilitation of interpersonal communication. Various researchers discussed the positive impact of interactivity on revisiting (Dholakia *et al.,* 2001), utilization (Fan *et al.,* 2017), trust (Faisal *et al.,* 2017), involvement (Fortin and Dholakia, 2005; Jiang *et al.,* 2010; Kang *et al.,* 2015; Cyr *et al.*, 2018), engagement (Fan *et al.,* 2017), satisfaction (Faisal *et al.,* 2017), and continued intention (Shin *et al.,* 2016; Zhao and Lu, 2012). Based on previous studies, we define perceived interactivity as the degree to which an individual involved in working on smartphones, perceives his/her interaction to be under control, instantly responsive, and the degree to which the user feels being connected via two-way communication. We assume that interactive features are likely to be perceived as more favorable and result in a higher level of affective and cognitive involvement. Establishing the theoretical ground and relationship, we hypothesize the following:

H4a: Responsiveness influences the cognitive involvement of online learning on smartphones.
H4b: Responsiveness influences the affective involvement of online learning on smartphones.
H4c: User control influences the cognitive involvement of online learning on smartphones.
H4d: User control influences the affective involvement of online learning on smartphones.
H4e: Communication influences the cognitive involvement of online learning on smartphones.
H4f: Communication influences the affective involvement of online learning on smartphones.

Continued intention to use refers to the individual's conscious plans to adopt a particular behavior (Ajzen, 1991). An individual intends to continuously and consistently use the service currently being used (Dehghani, 2018). It also explains the first-time behavioral adoption intention of a user who did not use the system before. Therefore, it is related to the user's instant experience and considered a critical concept for maintaining the user-product relationship (Tarute *et al.,* 2017; Lee and Kang, 2018). Both cognitive and affective involvement are regarded as essential aspects to determine the holistic experiences and behavioral intention (Jiang *et al.,* 2010). Thus, individuals wish to find an application as a useful tool to improve their understanding, attention and productivity. Besides understanding, users also need to find online interaction free from cognitive efforts to get pleasurable experiences. In this study, the proposed model describes the relationship

between the continued intention to use, cognitive and affective involvement. We assume that involvement dimensions equally and positively influence the continued intention to use as the profound involvement with contents and interactive procedure keep users in control, which leads to continued intention to use. Establishing the theoretical ground and relationship between involvement (i.e., cognitive and affective) and continued intention to use, we hypothesize the following:

H5a: Cognitive involvement influences the continued intention to use online learning on smartphones.
H5b: Affective involvement influences the continued intention to use online learning on smartphones.

3. Methodology and Data Analysis

The objective of this research is to understand how the design quality and interactive features affect the continued intention to use via cognitive and affective involvement. The research methodology adopted for this study is primarily based on data collection through a survey from five higher education institutions. The population in the current study are both undergraduate and postgraduate students. An experimental prototype of Coursera (MOOC platform) was developed to be tested by the participants. Thus, the employed design features (e.g., visual appearance, information, navigation quality, and interactivity) of the experimental prototype was quite similar to Coursera and used to enroll in a Human-computer interaction course (see Figure 2). The color scheme (i.e., blue-white, grey-black and blue) was used in the design of links, search buttons, and alerts. The font features used on the experimental prototype include sans-serif typeface with a size ranging from 14 to 22 px. The colors employed for the text were the black (one of the most frequent) as well blue and white (less frequent). The navigation was supported through links, buttons, and list views along with a structured path. To enhance the level of interactivity, a search bar, messaging service, discussion portal, progress bar, help, language change, and other supportive features were also incorporated in the experimental prototype. The developed experimental prototype contains lectures, notes and, other course-related activities. The participants can download the videos and lecture notes and discuss the learning topics with other participants and teachers on a chat and a discussion portal.

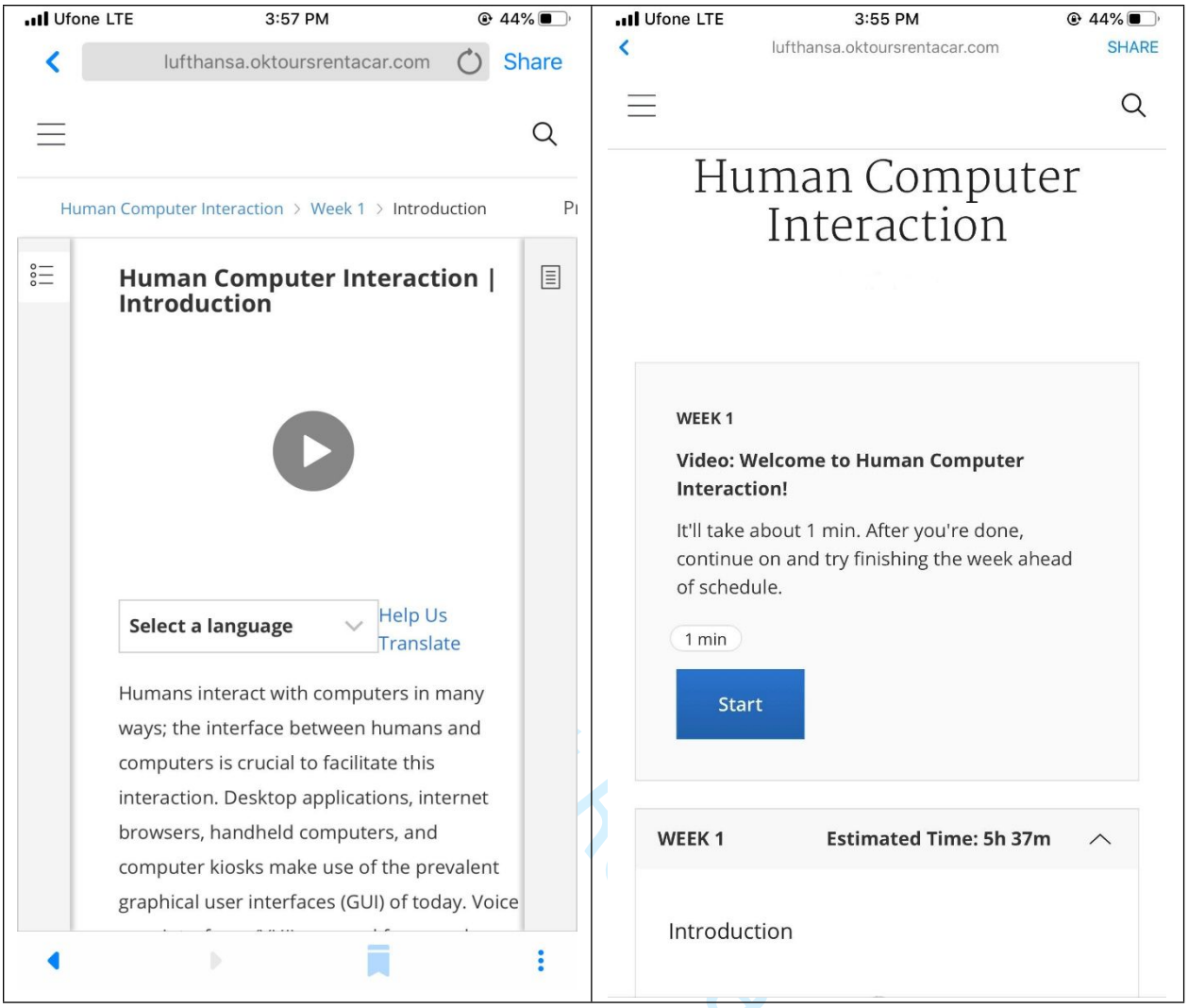


Figure 2 Experimental prototype

3.1 Survey Instrument

A survey tool was designed to validate the proposed hypotheses, and it was categorized into two main sections. The first section aimed at obtaining the participant's demographic information, while the second section was used to assess the proposed research model and hypotheses for the experimental prototype. The measures of current work are adopted from prior studies. This section includes 32 quantitative items based on a seven-point Likert-scale (1 = strongly disagree and 7 = strongly agree) used to assess each observed item. The scale focuses on the individual's response relating to (1) font quality, (2) aesthetic quality, (3) information quality, (4) navigation quality, (5) responsiveness, (6) user control, (7) communication, (8) cognitive involvement, (9) affective involvement, and (10) continued intention to use. It was assumed that a higher score against the

adopted items indicates more positive and favorable perceptions. The measures of this study are shown in the Appendix. Survey reliability and validation are discussed in the data analysis section.

Table 2 Demographic description of the participants

Profile category		Frequency	Percentage
Gender	Male	423	63.9
	Female	239	36.1
Age	Less than 25	196	29.6
	Between 25 and 30	413	62.4
	Above 30	53	8.0
Qualification	Graduate level	500	75.5
	Postgraduate level	162	24.5
Online learning experience	Beginners	235	35.5
	Intermediate	299	45.2
	Advance	128	19.3
Total		662	100.0

3.2 Participants and Data Collection

The developed prototype was introduced to the students at the start of the semester with the help of university teachers. The students were asked to use the application designed for course-related activities on their smartphone. They were provided with the guidelines related to the usage of the experimental prototype in the different class sessions by the instructors. These guidelines incorporated the specific tasks and activities that the student had to perform using the experimental prototype (e.g., searching, enrollment, and downloading lectures). Besides learning, they were also instructed to use the prototype for other academic activities such as quizzes, assignments submission and group discussions. At the end of the semester, the students were requested to share their perception by completing the questionnaire that covered all the measures of the constructs. There were about 2,100 students initially involved; however, only *662* participants actively completed the survey. The demographic description of the participants is given in Table 2.

3.3 Data Analysis

In this analysis section, the authors present the descriptive statistics of the indicators. Table 3 outlines the computed values for mean and standard deviation. All means are above midpoint 5.0. Further, the proposed hypotheses were tested using partial-least-squares, structural equation modeling (PLS-SEM). It is a complete multivariate-analysis method that can concurrently evaluate the relationships among all the indicators in the conceptual model, i.e., measurement and structural components to develop the theories (Chin, 1998; Joseph *et al.,* 2011; Kock, 2014). PLS-SEM also provides stable weights with no inflated measurement (Kock, 2014). It provides a flexible way to

determine the key constructs and helps to execute the complex structured model. Initially, the communalities show the variance explained by the items. It is recommended that the items with communalities under 0.70 should be eliminated to obtain the suggested convergent validity (Chin, 1998; Joseph *et al.,* 2011; Kock, 2014).

Table 3: Construct reliability, validity, and Unidimensionality

Constructs								Unidimensionality			
								Eigenvalues		Variance explained	
	Factor loadings	Mean	SD	α	CR	AVE	rho A	1st Comp	2nd Comp	1st (%)	2nd (%)
Font quality				0.77	0.87	0.689	0.79	2.066	.565	68.857	18.839
FQ1	0.857	4.79	1.66								
FQ2	0.856	4.81	1.69								
FQ3	0.774	5.13	1.66								
Aesthetic quality				0.86	0.91	0.780	0.86	2.339	.453	77.954	15.113
AQ1	0.828	5.33	1.60								
AQ2	0.924	5.40	1.60								
AQ3	0.894	5.28	1.58								
Information quality				0.79	0.88	0.710	0.80	2.129	.517	70.967	17.227
IQ1	0.867	5.13	1.66								
IQ2	0.860	5.41	1.64								
IQ3	0.799	5.28	1.55								
Navigation quality				0.74	0.85	0.662	0.75	1.987	.593	66.234	19.765
NQ1	0.849	5.03	1.64								
NQ2	0.824	5.17	1.53								
NQ3	0.766	5.32	1.79								
Responsiveness				0.80	0.88	0.712	0.80	2.135	.536	71.168	17.871
RS1	0.852	4.86	1.65								
RS2	0.883	4.98	1.59								
RS3	0.793	5.25	1.69								
User control				0.80	0.88	0.720	0.81	2.155	.500	71.842	16.666
UC1	0.876	4.93	1.60								
UC2	0.855	5.19	1.63								
UC3	0.810	5.21	1.62								
Communication				0.80	0.88	0.713	0.80	2.138	.581	71.257	19.372
CC1	0.867	5.14	1.57								
CC2	0.896	5.23	1.56								
CC3	0.763	5.24	1.78								
Cognitive involvement				0.86	0.92	0.785	0.86	2.354	.361	78.470	12.036
CI1	0.883	5.32	1.63								
CI2	0.901	5.30	1.59								
CI3	0.873	5.30	1.59								
Affective involvement				0.88	0.92	0.733	0.88	2.932	.409	73.296	10.236
AI1	0.832	5.26	1.57								
AI2	0.871	5.50	1.60								
AI3	0.877	5.45	1.61								
AI4	0.843	5.31	1.61								
Continued intention to use				0.86	0.91	0.709	0.86	2.835	.581	70.887	14.517
CIU1	0.876	4.82	1.89								
CIU2	0.885	4.94	1.72								
CIU3	0.868	4.93	1.79								
CIU4	0.730	4.94	1.81								

Note: SD = Standard deviation; α = Cronbach's alpha; CR = Composite reliability; AVE = Average variance extracted; 1st Comp = first Component; 1st (%) = % of Variance.

Reliability in this study was computed according to the criteria suggested by Fornell and Larcker (1981), Chin (1998), and Hair *et al.,* (2015) which consists in determining the outer-loadings pattern of the adopted items (Fornell and Larcker, 1981). The value of loadings in this study

exceeded 0.7 and ranged from 0.730 to 0.901 (see Tables 3 and 4) with significance levels (≤ 0.05) along with t values (≥ 1.96). The internal consistency is also important to examine the reliability of the employed factors through Cronbach's alpha (α), which is based on the average inter-correlation of items (Joseph *et al.,* 2011). The appropriate value of Cronbach's alpha α depends on the nature of the study. There are no standardized criteria for the value of Cronbach's α. However, the minimum value of α is generally agreed at about 0.70 (Joseph *et al.,* 2011). If the research is not exploratory, then the lowest accepted value should be 0.80, where a rule-of-thumb for α value refers to "α ≥ 0.9 = excellent, α ≥ 0.8 = good, α ≥ 0.7 = acceptable, α ≥ 0.6 = questionable, α ≥ 0.5 = poor, and α ≥ 0.4 = unacceptable" respectively (George and Mallery, 2003). The range of Cronbach's α in this study is observed from 0.74 to 0.88 (see Table 3). The aggregate value of α is equal to 0.81, which shows that the current survey tool could be considered as a reliable tool with good internal consistency. The other type of internal consistency is composite reliability (CR). It is also similar to Cronbach's α but computed differently as α assumes that all the observed items weigh equally. On the other hand, CR weighs each item depending on the weights of the single items. However, "CR is considered a more accurate approach to assessing reliability" (Richard and Youjae, 1988). The criterion to assess the CR specifies that its value should be equal to or greater than 0.70 (Richard and Youjae, 1988). In this study, all the CR values exceeded 0.7 and ranged from 0.85 to 0.92 (see Table 3). The CR is considered as an appropriate approach to evaluate the reliability. Furthermore, Dijkstra Henseler's rho (2015) was also used to measure reliability. In this study, the rho values exceeded 0.7 and ranged from 0.75 to 0.88 (see Table 3). Lastly, reliability was also analyzed by measuring the loadings of the items with the factors to which they are hypothetically associated (see Table 4).

The outer model was also assessed using additional methods, i.e., unidimensionality, convergent validity (CV), and discriminant validity (DV). First, it is crucial to analyze the unidimensionality of the scale. For this, we used a principal component analysis (i.e., factorial exploratory analysis) with varimax rotation. According to Kaiser's criterion (1960), unidimensionality holds if an eigenvalue above one is achieved for the first principal component (Faisal *et al.,* 2017). All the adopted constructs of this work meet the Kaiser's criterion; moreover, the first principal component extracted provides a significantly higher variance than the second component. Thus, the results obtained satisfy the suggested criteria (see Table 3).

Table 4 Discriminant validity: Combined loadings and cross-loadings (outer loadings)

Constructs	Items	Loadings \ cross-loadings									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(8)	(9)
1-Font quality	FQ1	**0.857**	-0.328	0.002	0.056	-0.093	-0.058	0.043	-0.111	0.028	0.051
	FQ2	**0.856**	-0.191	0.196	-0.018	0.055	0.202	-0.091	-0.175	-0.189	-0.031
	FQ3	**0.774**	0.575	-0.218	-0.042	0.042	-0.160	0.052	0.317	0.179	-0.022
2-Aesthetic quality	AQ1	0.071	**0.828**	-0.053	-0.147	0.176	-0.254	-0.109	-0.087	0.510	-0.019
	AQ2	-0.047	**0.924**	0.010	-0.019	0.008	0.081	0.068	-0.062	-0.225	0.061
	AQ3	-0.017	**0.894**	0.039	0.155	-0.172	0.152	0.031	0.145	-0.241	-0.046
3-Information quality	IQ1	0.328	-0.217	**0.867**	-0.014	0.168	-0.073	-0.068	-0.232	0.039	-0.020
	IQ2	-0.192	-0.010	**0.860**	0.159	-0.118	0.124	0.077	-0.278	-0.130	0.085
	IQ3	-0.149	0.246	**0.799**	-0.156	-0.056	-0.054	-0.009	0.551	0.098	-0.070
4-Navigation quality	NQ1	0.288	-0.057	0.057	**0.849**	0.004	0.110	-0.089	-0.280	-0.125	0.016
	NQ2	0.025	-0.218	0.280	**0.824**	0.132	-0.017	-0.321	-0.096	0.194	-0.002
	NQ3	-0.347	0.298	-0.365	**0.766**	-0.147	-0.103	0.443	0.414	-0.070	-0.015
5-Responsiveness	RS1	-0.149	-0.012	0.090	0.069	**0.852**	0.158	0.047	-0.131	-0.371	-0.027
	RS2	0.054	-0.090	-0.089	0.048	**0.883**	0.082	0.080	0.069	-0.273	0.043
	RS3	0.100	0.113	0.003	-0.128	**0.793**	-0.261	-0.139	0.064	0.073	-0.019
6-User control	UC1	0.129	-0.117	-0.069	0.018	0.256	**0.876**	-0.023	-0.240	-0.089	-0.013
	UC2	0.027	-0.060	0.095	-0.068	0.135	**0.855**	-0.021	-0.350	0.136	0.018
	UC3	-0.168	0.190	-0.025	0.052	-0.419	**0.810**	0.048	0.629	-0.048	-0.005
7-Communication	CC1	0.104	-0.149	0.211	-0.331	0.204	0.094	**0.867**	-0.229	-0.067	0.018
	CC2	0.063	-0.077	0.117	-0.132	-0.023	0.022	**0.896**	-0.203	0.248	-0.006
	CC3	-0.192	0.259	-0.377	0.531	-0.205	-0.132	**0.763**	0.498	-0.216	-0.013
8-Cognitive involvement	CI1	0.021	-0.020	-0.075	0.033	0.068	-0.063	-0.036	**0.883**	0.038	-0.023
	CI2	-0.104	0.126	0.158	-0.148	0.174	-0.050	-0.054	**0.901**	-0.083	0.023
	CI3	0.086	-0.109	-0.087	0.12	-0.249	0.115	0.092	**0.873**	0.048	0.000
9-Affective involvement	AI1	-0.008	-0.136	0.251	-0.389	-0.022	0.123	0.442	0.012	**0.832**	0.024
	AI2	-0.050	-0.281	0.049	0.209	-0.127	0.066	-0.066	-0.021	**0.871**	0.002
	AI3	0.036	0.016	-0.142	0.134	0.000	-0.03	-0.061	-0.044	**0.877**	-0.015
	AI4	0.022	0.407	-0.151	0.029	0.152	-0.158	-0.304	0.056	**0.843**	-0.011
10-Continued intention to use	CIU1	-0.011	0.195	0.000	-0.005	-0.102	0.054	-0.066	-0.051	-0.066	**0.876**
	CIU2	0.098	-0.039	-0.005	-0.006	0.01	-0.045	-0.003	0.001	-0.002	**0.885**
	CIU3	-0.014	-0.082	0.028	0.039	0.06	-0.058	0.001	0.092	-0.053	**0.868**
	CIU4	-0.089	-0.089	-0.027	-0.034	0.039	0.059	0.082	-0.051	0.144	**0.730**

CV "shows the degree to which the items of a certain instrument are related (Ronnie and Doug, 2013)." The CV assessment criterion is related to the computation of the average variance extracted (AVE). The minimum suggested value for AVEs should be higher than or equal to 0.5 (Richard and Youjae, 1988). This means that all the indicators report for more than 50 percent of the variance of their construct. Table 3 shows that all the indicators fulfill the recommended requirement.

DV "is the extent to which the construct does not correlate with other measures that are different from it" (Richard and Youjae, 1988). In a model, it specifies the differences between adopted constructs (Chin, 1998). Its assessment depends on two critical elements, as mentioned in previous research. The first element is that the loadings of the items should be poorly associated with all constructs except the one to which they are hypothetically connected (Chin, 1998). As the "correlation of the latent variable scores on the measurement items needs to show an appropriate

pattern of loadings, one on which the measurement items load highly on their speculatively assigned factor and not high on other factors" (Gefen and Straub, 2005). In simple words, all items are loaded highly on their corresponding factors while lower on other factors (see Table 4). The second criterion is associated with AVE values. AVE illustrates the proportion of variance attained by a construct. Thus, to ensure and to measure this indicator, the $\sqrt{\text{AVE}}$ for each construct should be higher than the correlation value between constructs (see Table 5) (Chin, 1998; Fornell and Larcker 1981; Gefen and Straub, 2005). Table 5 also shows that for each construct, the average $\sqrt{\text{AVE}}$ is more significant than its correlation coefficient with other constructs. In addition to Fornell and Larcker (1981), Heterotrait–Monotrait Ratio of Correlations criterion was also employed to assess the discriminant validity and it shows that the computed values are ≤ 0.90, as suggested in previous studies (Mohseni *et al.,* 2018). In conclusion, this survey has strong reliability and exhibits good convergent validity and discriminant validity; therefore, the results satisfy widely accepted validity standards.

Table 5: Discriminant validity: Fornell–Larcker (Inter-correlations and Sqrt of AVE of latent variables)

	Constructs	Fornell-Larcker Criterion (FL)									
		1	2	3	4	5	6	7	8	9	10
1	Font quality	**0.830**									
2	Aesthetic quality	0.777	**0.883**								
3	Information quality	0.804	0.758	**0.842**							
4	Navigation quality	0.763	0.764	0.809	**0.814**						
5	Responsiveness	0.743	0.755	0.763	0.783	**0.844**					
6	User control	0.776	0.733	0.752	0.799	0.802	***0.850***				
7	Communication	0.737	0.747	0.764	0.765	0.741	0.793	**0.844**			
8	Cognitive involvement	0.742	0.798	0.751	0.739	0.717	0.749	0.777	**0.886**		
9	Affective involvement	0.753	0.814	0.797	0.752	0.814	0.764	0.800	0.769	**0.856**	
10	Continued intention to use	0.543	0.458	0.500	0.506	0.540	0.506	0.475	0.464	0.473	**0.842**

Note: Bold diagonal numbers are the square roots of AVE.

Lastly, the verification for the likely existence of multicollinearity between the variables was analyzed using the full variance inflation factor (VIF) statistic. This technique is used to identify the possibility of similarity. Thus, a higher VIF value between the two indicators suggests that they measure similar things. In such a case, one of the involved variables should be removed from the model. Therefore, a high VIF index can be a severe issue if the computed value is larger than the indicated value. Usually, it is recommended that the VIF value for variables should be less than 5, even the more relaxed criterion recommended in the prior study sets the threshold at 10 (Faisal *et al.*, 2017). In the current study, the computed results show that VIFs are far below the critical value. Hence, no variable had to be removed. The VIF values in this research are observed to be

beneath the significant threshold value = 5, while the average VIF (AVIF) = 1.98 (see Table 6). In prior studies, the ideal recommended value for AVIF is ≤ 3.3 (Hair *et al.,* 1987; Joseph, 2009).

Table 6: Additional model fit and quality indicators

Quality indices	Observed value	Acceptable	Ideal value	95%	99%
SPR.	1.000	≥ 0.7	1		
RSCR.	1.000	≥ 0.9	1		
SSR.	1.000	≥ 0.7			
Nonlinear bivariate causality direction ratio.	1.000	≥ 0.7			
SRMR	0.070			0.040	0.040
d_ULS	2.450			0.730	0.800
d_G	1.130			0.530	0.550
AVIF	1.98	≤ 10	≤ 3.3		

Note: SPR = Sympson's paradox ratio; RSCR = R-squared contribution ratio; SSR = Statistical suppression ratio, SRMR = Standardized root mean square residua.

PLS-SEM also reported other quality indicators i.e. average R^2 = 0.657, p ≤ 0.001, average adjusted R^2 = 0.656, ≤ 0.001, and average path coefficient = 0.155, p ≤ 0.001, respectively. Model Fit is computed using standardized root mean square residual (SRMR) and Tenenhaus GoF (Mohseni *et al.*, 2018; Tenenhaus *et al.,* 2005) criterion $GoF=\sqrt{(AVE)X(ARS)}$ or $\sqrt{(Communality)X(ARS)} = \sqrt{(0.721)X(0.596)} = 0.65$. In recent studies (Wetzels *et al.,* 2009; Kock, 2014), the researchers recommended the GoF criteria as follows: small ≥ 0.1, medium ≥ 0.25, and large ≥ 0.36. The value of SRMR is observed to be 0.08, below the recommended threshold of 0.10, which means a good model fitness (see table 6). In conclusion, all the computed values demonstrated a good quality fit. Thus, the current study implements all the conditions mentioned above to verify the model and hypotheses. For additional quality measures, see Table 6.

Table 7: Coefficient of determination R-squared (R^2) and Q-squared (Q^2) coefficients

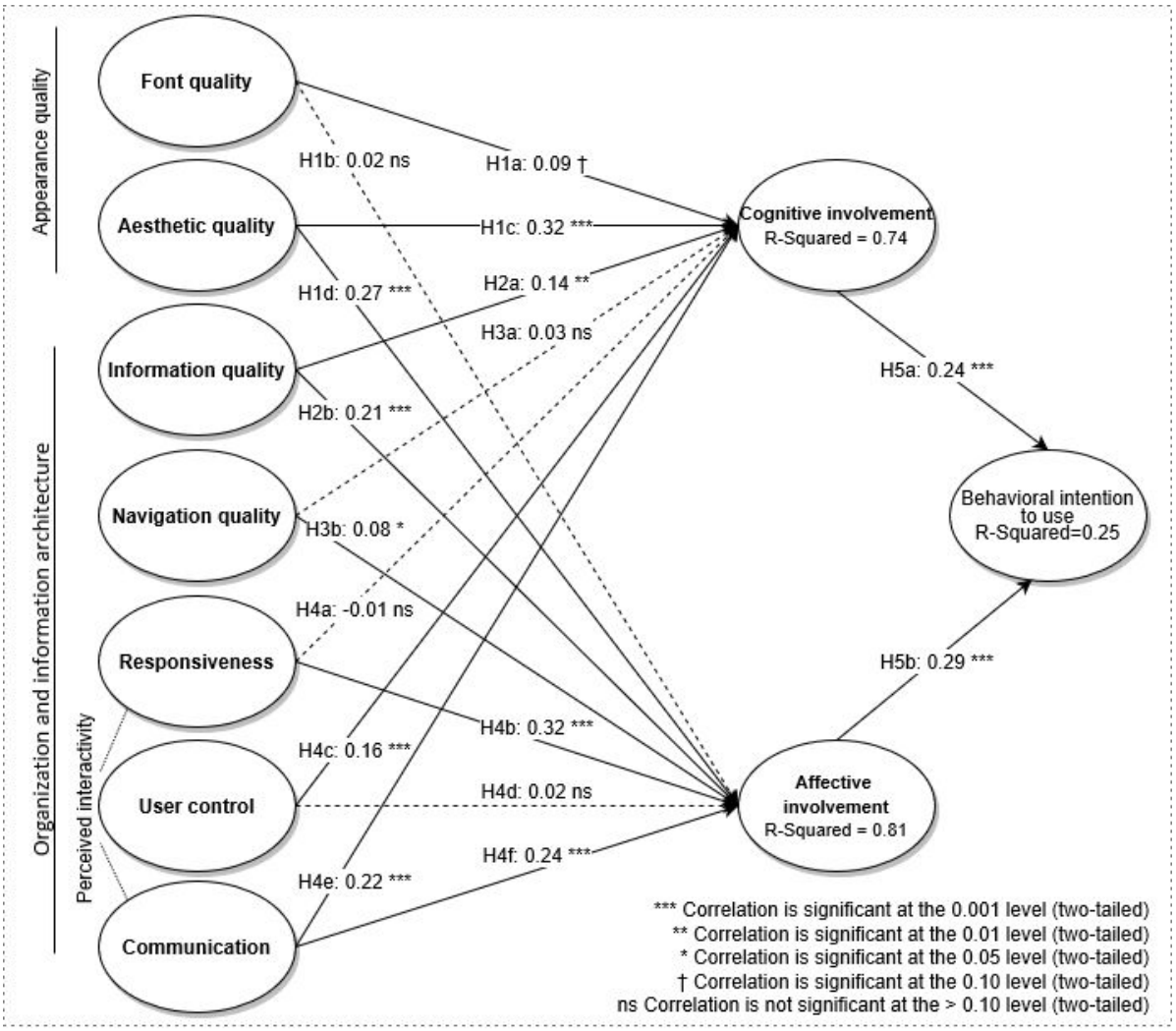
Construct	The coefficient of determination R-squared	Adjusted R-squared	Stone-Geisser Q-squared
Cognitive involvement	0.74	0.74	0.737
Affective involvement	0.81	0.80	0.803
Continued intention to use	0.25	0.25	0.252

After having confirmation of the outer model indicators such as unidimensionality, reliability, and validity, the next stage is to examine the inner model. The inner model describes the strength of the relationship among the hypothesized variables derived from substantive theory (Briz-Ponce *et al.,* 2017; Chin, 1998). We assess the explanatory power of the inner model (β) and the amount of variance (R^2) (Chin, 1998; Fornell and Cha, 1994), where independent factors explain dependent factors. Initially, it is crucial to compute the (β) and its significance. Figure 3 and Table 8

demonstrate the β for each path along with its significant p-value. The R^2 examines the variance for each construct. It is used to describe the model's explanatory power. Tables 7 and 8 depicts R^2 and t-value for each construct, respectively. Accordingly, the outer model explained 74% the variance of cognitive involvement, 81% the variance of affective involvement, and 25 % in continued intention to use, respectively (see Table 7). In other words, the construct affective involvement has the highest value, 81%, followed by cognitive involvement, 74%. However, it is difficult to establish the rule of thumb for the minimum acceptable variance value. Prior literature described the R^2 value 0.75 as strong, 0.45 as moderate, and 0.25 as weak (Joseph *et al.,* 2011). All the constructs in this study have strong and moderate levels of variance except the continued intention to use, which demonstrated a weak level. It is also essential to compute the effect size in order to "identify which one of the independent variables account for most of the variance in a dependent variable" (Joseph *et al.,* 2011). Table 8 shows the effect size values. The values of 0.02, 0.15, and 0.35 suggested small, medium, and large effect sizes, respectively, as described in the classic literature. Finally, all the Stone-Geisser Q^2 coefficients (resampling-analog of the R^2 coefficient) exceeded the minimum threshold of 0.00 value, providing a mark of satisfactory predictive validity (see Table 7) (Joseph *et al.,* 2011). In summary, all indicators are observed to be significant to support the proposed model (see Figure 3, and Table 7 and 8).

4. Results

The results partially support the proposed hypotheses (see Figure 1) and indicate that the employed quality design positively affects the continued intention to use via cognitive and affective involvement. The underlying analysis section illustrates the essential findings related to design aspects (see Figure 3 and Table 8). The results are also interesting because there is no evidence available in prior literature that explains and analyzes the role of design attributes separately in online settings.



Notes: The straight lines represent significant relationships; the dotted lines non-significant relationships or unsupported hypotheses.

Figure 3 Results from Structural Model Analysis [Sample n = 662]

Hypotheses 1a-d: The quality of appearance refers to the use of appropriate graphics, color, font, and multimedia items to organize the visual design of a website (Al-Qeisi *et al.,* 2014). The precise organization and layout are also considered essential aspects of appearance, attractiveness, and appeal. Font quality refers to the appearance and the arrangement of text in order to improve legibility and information processing. The effect of font quality ($\beta = 0.09$, $p \leq 0.08$, $t = 1.73$) on cognitive involvement is observed to be positive (see Figure 3 and Table 8). However, no relationship is observed between font quality and affective involvement ($\beta = 0.02$, $p \leq 0.74$, $t = 0.33$). In this study, font quality (i.e., style, size, and layout) is related to cognitive involvement.

Table 8: Structural relationships and hypotheses testing: effects inference

(H)	Construct	β	Indirect effects	f^2	t-value	p-value 2-tailed
H1a	Font quality → Cognitive involvement	0.09		0.01	1.73	0.08
H1b	Font quality → Affective involvement	0.02		0.00	0.33	0.74
	Font quality → Behavioral intention to use		0.122			
H1c	Aesthetic quality → Cognitive involvement	0.32		0.10	5.87	0.001
H1d	Aesthetic quality→ Affective involvement	0.27		0.10	6.42	0.001
	Aesthetic quality → Behavioral intention to use		0.15			
H2b	Information quality → Cognitive involvement	0.14		0.02	2.64	0.01
H2a	Information quality → Affective involvement	0.21		0.05	4.19	0.001
	Information quality → Behavioral intention to use		0.09			
H3a	Navigation quality → Cognitive involvement	0.03		0.00	0.57	0.57
H3b	Navigation quality → Affective involvement	0.08		0.01	2.00	0.05
	Navigation quality → Behavioral intention to use		0.02			
H4a	Responsiveness → Cognitive involvement	-0.01		0.00	0.24	0.810
H4b	Responsiveness → Affective involvement	0.32		0.14	7.76	0.001
	Responsiveness → Behavioral intention to use		0.09			
H4c	User control → Cognitive involvement	0.16		0.02	2.90	0.001
H4d	User control → Affective involvement	0.02		0.00	0.38	0.70
	User control → Behavioral intention to use		0.04			
H4e	Communication → Cognitive involvement	0.22		0.05	5.00	0.001
H4f	Communication → Affective involvement	0.24		0.08	5.68	0.001
	Communication → Behavioral intention to use		0.12			
H5a	Cognitive involvement→ Continued intention to use	0.24		0.03	4.46	0.001
H5b	Affective involvement → Continued intention to use	0.29		0.04	5.14	0.001

Note: H= Hypotheses; β = Path coefficient; f^2= f-square.

Font quality heightens information processing and readability, which leads to continued intention to use via cognitive involvement. Aesthetic quality refers to the features of the stimulus, appeal, and attractiveness of a website expressed via graphics, color, and animation (Moshagen and Thielsch, 2010; Hoehle *et al.,* 2016). The effect of aesthetic quality ($\beta = 0.32$, $p \leq 0.001$, $t = 5.87$ and $\beta = 0.27$, $p \leq 0.001$, $t = 6.42$) on both cognitive and affective involvement is observed to be positive (see Figure 3 and Table 8). Graphics and multimedia items help to create an engaging environment that promotes the individual's active participation and involvement. Likewise, the appropriate color scheme not only attracts users but also draw their attention towards critical information. It is a vital property of objects and can arouse cognitive, physiological, and emotional reactions (Moshagen and Thielsch, 2010). Thus, look-and-feel quality increases the sense of pleasure (Koo and Ju, 2010; Lavie and Tractinsky, 2004; Liu *et al.,* 2013; Loureiro and Roschk, 2014) and information processing through instant recognition, creativity, and appealing artifacts (Moshagen and Thielsch, 2010). Moreover, arrangement and grouping of similar objects lead to instant perception and understanding, and reduce the complexity (Moshagen and Thielsch, 2010; Tuch *et al.,* 2010). The reduction of complexity facilitates users' information processing, which

will result in a more positive aesthetic response toward the stimulus (Tuch *et al.,* 2010). The findings suggest that online service providers should offer visual design having visual and sensory features as a means of attracting users' attention. Coursaris and Van (Coursaris and van, 2015) argue that look-and-feel related aspects increase motivation, focused attention, and involvement with the website. As design with mass hedonic features is entertainment-oriented, it not only promotes the user's imaginal and emotional responses (Zhou *et al.*, 2014) but it importantly contributes to information processing, understanding, and intention to use (Moshagen and Thielsch, 2010). According to Tarute *et al.,* (2017) continued intention to use can be increased via engaging visual elements. In contrast, Cyr *et al.,* (2018) observed the weak effect of visual features on involvement for commercial websites. Similarly, Éthier *et al.,* (2008) observed no relationship between visual aspects and cognitive appraisal. They further argue that text and visual aspects are not important elements of online shopping evaluation.

Hypotheses 2a-b: Information quality refers to organization, relevance, accuracy, concurrency and logical representation of information (Cyr and Head, 2013). The effect of information quality ($\beta = 0.14$, $p \leq 0.01$, $t = 2.64$ and $\beta = 0.21$, $p \leq 0.001$, $t = 4.19$) on both cognitive and affective involvement is observed to be positive (see Figure 3 and Table 8). However, the relationship between information quality and affective involvement is observed to be stronger than between information quality and cognitive involvement. Overall, information quality contributes to promoting both cognitive and affective involvement and is observed as an influencing antecedent factor compared to other design features. This involvement reduces the complexity and leads to higher productivity due to engagement and information timeliness aspects. Thus, the presented information should be relevant, useful, and concurrent to fulfill an individual's information needs. Furthermore, relevant, simple, and useful information improves the user's understanding and enables them to be more involved. Appropriate information and its precise organization not only increases the consumer level of pleasure but also facilitates to process the information efficiently, which results as a stimulus for a higher continued intention to use. Likewise, individuals who are highly involved and engaged with an application are willing to search for more information (Kim *et al.,* 2007; Tarute *et al.,* 2017). Richard (2005) observed a positive relationship between information effectiveness and site involvement. In several studies (Cyr et al., 2018; Éthier *et al.,* 2008; Loureiro and Roschk, 2014; Tarute *et al.,* 2017), it was discussed as a strong determinant of involvement, emotions, engagement, and situational state. Thus, the continued intention to use can

be increased via engaging information content (Hsu *et al.,* 2012; Tarute *et al.,* 2017). In contrast, Richard (2005) observed the information as a weak determinant of involvement.

Hypotheses 3a-b: Navigation quality refers to the features that support the convenient access to the information. The effect of navigation quality ($\beta = 0.08$, $p \leq 0.05$, $t = 2.00$) on affective involvement is observed to be positive, but no relationship was observed between navigation quality and cognitive involvement ($\beta = 0.03$, $p \leq 0.57$, $t = 0.57$) (see Figure 3 and Table 8). Accordingly, navigational features, including obviousness of buttons, structure, arrangement of menus, hierarchical order, and logical road-map, reduce the utilization of excessive mental resources. Additionally, navigational aids, clue, and search-related features make it easier for individuals to easily find the relevant information, which gives the feeling of pleasure. So, users who are effectively involved with learning applications are willing to search for more information. Likewise, in a study, Kim *et al.,* (2007) and Éthier *et al.,* (2008) discussed that navigational features of a system are positively related to cognitive appraisal and behavior. This is because they provide easy and flexible ways for users to browse and post information. So, it will be easier to encourage involvement, making participation interactive and enjoyable (Zheng *et al.,* 2013). Otherwise, hard to navigate along with broken links, decreased the individual's level of involvement (Santosa *et al.,* 2005).

Hypotheses 4a-f: Interactivity is a multidimensional attribute of design quality and is valued as an important feature of service quality. These dimensions were rarely studied in prior research concerning cognitive and affective involvement. Among the three dimensions of interactivity, only *communication* significantly influences both cognitive and affective involvement ($\beta = 0.22$, $p \leq 0.001$, $t = 5.00$ and $\beta = 0.24$, $p \leq 0.001$, $t = 5.68$) (see Figure 3 and Table 8). Thus, the speed of communication is considered as an important aspect to retain and engage users. Likewise, users may feel irritated whenever the Internet speed decreases, which ultimately influences their level of involvement (Santosa *et al.,* 2005). *Responsiveness* represents the level of user interaction via instant response against their queries. Our results show the positive effect of responsiveness ($\beta = 0.32$, $p \leq 0.001$, $t = 7.76$) on affective involvement but no relationship is observed between responsiveness and cognitive involvement ($\beta = -0.01$, $p \leq 0.810$, $t = 0.24$) (see Figure 3 and Table 8). Thus, instantaneous information and feedback against user requests create a sense of pleasure, which leads to continuous intention to use. Similarly, prompt services to solve users' queries prove to be valuable in inspiring playfulness and perceived flow in customers (Hsu *et al.,* 2012).

According to Fan *et al.,* (2017) quick response to users' requests is initially important in attracting and involving users.

Lastly, *user control* is related to cognitive involvement in this study and the results show the strong influence of user control ($\beta = 0.16$, $p \leq 0.001$, $t = 2.90$) on cognitive involvement, but no relationship was observed between user control and affective involvement ($\beta = 0.02$, $p \leq 0.70$, $t = 0.38$) (see Figure 3 and Table 8). Consequently, the features that help users to search, manipulate, and control the information contents lead to cognitive involvement. This result contrasts with the work of Jiang *et al.,* (2010), who observed an equal role of control for both cognitive and affective involvement. This is because user control can induce consumers to be acutely absorbed and involved in their navigation of websites.

The overall findings indicate that instant response to resolve the user's queries, ability to manage the contents, and speed of communication lead to cognitive and affective motives. These features induce a positive perception about the learning services and help individuals in effectively achieving the desired goals. Fortin and Dholakia (2005) argue that, if the interactive features are well balanced, the design of new media have the ability to impact favorably on involvement. Previous studies also demonstrate the positive relationship between interactivity and involvement (Jiang *et al.,* 2010; Cyr *et al.*, 2018). In the same way, Kang *et al.,* (2015) observed that interactivity is an important antecedent factor that shaped consumers' affective involvement with mobile apps, which in turn influenced their intention to use. In contrast, Rodríguez-torrico *et al.,* (2019) observed no relationship between interactivity (e.g., user control and responsiveness) and cognitive reaction.

Hypotheses 5a-b: Both affective and cognitive involvement remain as important aspects in determining continued intention to use. Results illustrate the positive effect of cognitive and affective involvement ($\beta = 0.24$, $p \leq 0.001$, $t = 4.46$ and $\beta = 0.29$, $p \leq 0.001$, $t = 5.14$) on the continued intention to use (see Figure 3 and Table 8). It indicates that both cognitive and affective involvements are basic constructs and act as key antecedent factors of continued intention to use. Meanwhile, Reychav and Wu (2015) observed that cognitive involvement is an important factor to determine the perceived learning. In contrast, Jiang *et al.,* (2010) and Kang *et al.,* (2015) observed that the role of affective involvement for intention to use is larger than that of cognitive involvement. Likewise, Rodríguez-torrico *et al.,* (2019) considered affective reaction more important compared to the cognitive reaction in the mobile context. In the current study, both

cognitive and affective involvement equally contribute to a continued intention to use. Therefore, it is important to understand which design features can influence cognitive and affective involvement to promote information processing and a sense of pleasure. Yang *et al.,* (2019) also observed the positive impact of both cognitive and affective involvement on mobile learning intent.

5. Implications

This study contributes to online learning on smartphones research by providing a comprehensive understanding of individuals' experiences and perceptions related to design quality that lead to continued intention to use. Although numerous studies are conducted related to mobile usability, engagement, trust, and satisfaction (Hoehle *et al.,* 2016; Tarute *et al.,* 2017; Rodríguez-torrico *et al.*, 2019), there is still a lack of research focusing on the causality and relations between design quality and multidimensional construct involvement, and their potential consequences on continued intention to use. Moreover, research into involvement remains scarce due to the difficulty of conceptualizing it (DeFranco, 2016; Cyr *et al.*, 2018) but is considered as an important concept in information and communication research (Reychav and Wu, 2015; DeFranco, 2016). Therefore, considering the smartphone, this research identifies the key determinants of intention to use. The findings move forward on the understanding of design quality and its role in heightening the level of involvement (cognitive and affective), which are conclusive to securing the continued intention to use the smartphones while learning online.

Furthermore, the current study also validates involvement as an important determinant of continued intention to use, as it establishes its role in the academic effort aimed at understanding individuals' behavioral intentions. Moreover, the current study is built up from the S-O-R framework considering its full scope and is an integrative work that has included the design features as key determinants of continued intention to use as well as affective and cognitive involvement. Therefore, this study offers better insight into both individuals' external stimuli and internal state that impact the continued intention to use.

Regarding practical implications, these findings establish the foundations for user interface design guidelines. Designers and practitioners have long been concerned about design issues. Such recurring issues exist because few studies have attempted to point out how interaction and design features may influence the success of smartphone utilization. For designers and practitioners, this

study reveals that continued intention to use may reside in the design quality. So, they can get the benefits out of our research by adopting the appropriate design strategies to attract new users as well as to retain existing ones. To heighten the level of cognitive involvement, there are few guidelines concerning design quality, such as the precise selection of font style (sans-serif), size (14 to 22 px), color scheme (i.e., blue-white, grey-black and blue), layout, spacing, graphics, and grouping (Gestalt) of these elements to constitute the simplicity that enhances information processing and individuals' understanding, which lead to continued intention to use. These grouping principles (i.e., proximity and similarity) help in arranging and organizing the information so that individuals can easily read and use it. In several studies (Seckler *et al.,* 2015; Pušnik *et al.,* 2016; Faisal *et al.*, 2017), the employed visuals aspects evaluated in the current study were also regarded as appropriate for design quality. The speed of communication to obtain useful information and the ability to manage and manipulate that information –such as language change, advanced search facilities, and customizable features– also increase cognitive involvement via timeliness of the information aspects.

Regarding affective involvement, visual look, information quality, and the arrangement of links, menus, and buttons along with navigational clues, improve the user browsing convenience (Rodríguez-torrico *et al.,* 2019). These aspects reduce the user's efforts while searching for relevant information and ultimately leads to a feeling of pleasure (Loureiro and Roschk, 2014). Similarly, a quick response to users' requests through chat, messaging and supportive services is helpful in building an interactive setting. A quick response to users' requests is likely to increase arousal and sense of pleasure. Overall, the provided guidelines are not only focused on usability features but can also be helpful to evoke certain emotions and alter continued intention to use learning apps on smartphones. These guidelines are relevant to reinforce continued intention to use smartphone apps via cognitive and affective involvement. Lastly, the current study concludes that both cognitive and affective involvement equally contributes to a continued intention to use.

6. Conclusion, Limitations, and Future Study

Smartphone-based online learning has gained popularity among educational institutions for delivering knowledge in a timely and effective fashion. Previous research in the online context was primarily focused on the cognitive and utilization aspects to determine the effective knowledge deliverance strategies. The deliverance of knowledge through online learning on

smartphones is also considered an essential educational approach. In this context, the interface plays a crucial role in adopting these technologies. The current study proposes a model to explore the impact of design quality on the continued intention to use. Some interesting findings related to the implications of design artifacts were obtained. These implications bring practical guidelines for designing more interactive interfaces to meet individuals' positive attitudes or continued intention to use.

An experimental prototype was developed to test the proposed hypotheses. The study was conducted in different educational institutions, and the data were collected from both undergraduate and postgraduate students ($n = 662$). The large student sample was a conclusive and reliable feature of this research. The results partially support the proposed model. The findings indicate that design quality heightens the individual's involvement, which ultimately leads to continued intention to use. The current study will draw the attention of practitioners towards the perception of users for providing them with convenient and appropriate learning resources. This is because convenience and precise procedures, along with understandable terminologies, heighten the involvement, motivation, and excitement, which ultimately leads to continued intention to use. Moreover, the utilization of suitable visual information and interactivity aspects enhance the level of engagement and promote user involvement, i.e., pleasure and information processing, while interacting with learning applications on smartphones. Academic institutions should consider design quality as an essential aspect while developing learning resources. Developers should include visual elements, such as font, graphics, color, and multimedia, in a way to increase individuals' involvement. Moreover, navigation and information features, i.e., information presentation and menus appearance, should be clear and easy to use to provide better experiences. This is because a positive experience or deep involvement increases the overall satisfaction (Maditinos and Theodoridis, 2010). Interactivity, i.e., responsiveness, user control, and communication are also essential to establish effective communication. Other studies (Kang *et al.,* 2015; Tarute *et al.,* 2017; Nikou and Economides, 2018) also discuss the importance of interface design for related technologies. Likewise, Reychav and Wu (2015) argue that a rich design effectively engages individuals to explore informational content conveniently.

Besides, this study also entails several limitations by default. First, the sample used was composed of students from higher education institutions, which may not represent the overall population. Thus, the use of higher education institution students may affect the generalizability of this

research and decrease the applicability of findings into other settings. Second, the age, experience, and educational background of the students were likely to be homogenous. Too many dispersions with regards to this issue are not expectable. Third, only a single prototype with limited activities was used in this work, although this way is consistent with past studies (Saade and Bahli, 2005). This may also reduce the generalizability and transferability of the results. In terms of future scope, previous studies that show the relationship between design attributes and cognitive and affective involvement are limited. Thus, further studies are necessary to determine the relationship between these variables. The environmental and individuals factors, such as gender, experience, traits, culture, motivation, normative beliefs, and moods may impact cognitive and affective involvement may also be good points for future research. We also want to investigate further the role of device type and other visual aspects (i.e., classical vs. expressive, symmetry vs. asymmetry, complexity vs. simplicity, and diversity) in determining the individual's involvement.

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References

Abachi, H. R. and Muhammad, G. (2013) 'The impact of m-learning technology on students and educators', *Computers in Human Behavior*, Vol. 30, pp. 491-496.

Ahn, T., Ryu, S. and Han, I. (2007) 'The impact of Web quality and playfulness on user acceptance of online retailing', *Information & Management*, Vol. 44 No. 3, pp. 263-275.

Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179-211.

Al-Qeisi, K. *et al.* (2014) 'Website design quality and usage behavior: Unified theory of acceptance and use of technology', *Journal of Business Research*, Vol. 67 No. 11, pp. 2282-2290.

Albert, M. and Russell, J. A. (1974) *An approach to environmental psychology*. Cambridge, MA: The MIT Press.

Ali, F. (2016) 'Hotel website quality, perceived flow, customer satisfaction and purchase intention', *Journal of Hospitality and Tourism Technology*, Vol. 7 No. 2, pp. 213-228.

Arnheim, R. (1974) *Art and Visual Perception: A Psychology of the Creative Eye*. Berkeley: University of California Press.

Balapour, A. and Sabherwal, R. (2017) 'Usability of apps and websites : A meta-regression study', in *Twenty-third Americas Conference on Information Systems*. Boston, MA, pp. 1-10.

Barnes, S. J., Pressey, A. D. and Scornavacca, E. (2019) 'Mobile ubiquity: Understanding the relationship between cognitive absorption, smartphone addiction and social network services', *Computers in Human Behavior*, Vol. 90, pp. 246-258.

Bhandari, U. *et al.* (2017) 'Effects of interface design factors on affective responses and quality evaluations in mobile applications', *Computers in Human Behavior*, Vol. 72, pp. 525-534.

Bonnardel, N., Piolat, A. and Bigot, L. Le (2011) 'The impact of colour on Website appeal and users' cognitive processes', *Displays*, Vol. 32 No. 2, pp. 69-80.
Briz-Ponce, L. *et al.* (2017) 'Learning with mobile technologies – Students' behavior', *Computers in Human Behavior*, Vol. 72, pp. 612-620.
Carlson, J. *et al.* (2018) 'Customer engagement behaviours in social media: capturing innovation opportunities', *Journal of Services Marketing*, Vol. 32 No. 1, pp. 83-94.
Celuch, K. G. and Slama, M. (1998) 'The effects of cognitive and affective program involvement on cognitive and affective ad involvement', *Journal of Business and Psychology*, Vol. 13 No. 1, pp. 115-126.
Chakravarti, A. *et al.* (2003) 'The Influence of Macro-Level Motives on Consideration Set Composition in Novel Purchase Situations', *Journal of Consumer Research*, Vol. 30, pp. 244-258.
Chin, K.-Y., Wang, C.-S. and Chen, Y.-L. (2018) 'Effects of an augmented reality-based mobile system on students' learning achievements and motivation for a liberal arts course', *Interactive Learning Environments*, Vol. 27 No. 7, pp. 927-941.
Chin, W. W. (1998) 'The partial least squares approach to structural equation modeling', in *Modern Methods for Business Research*. G. A. M ed. Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers, pp. 295–336.
Choi, J. H. and Lee, H. J. (2012) 'Facets of simplicity for the smartphone interface: A structural model', *International Journal of Human Computer Studies*, Vol. 70 No. 2, pp. 129-142.
Coursaris, C. K. and van Osch, W. (2016) 'A Cognitive-Affective Model of Perceived User Satisfaction (CAMPUS): The complementary effects and interdependence of usability and aesthetics in IS design', *Information & Management*, Vol. 53 No. 2, pp. 252-264.
Cyr, D. *et al.* (2018) 'Using the elaboration likelihood model to examine online persuasion through website design', *Information and Management*, Vol. 55 No. 7, pp. 807-821.
Cyr, D. and Head, M. (2013) 'Website design in an international context: The role of gender in masculine versus feminine oriented countries', *Computers in Human Behavior*, Vol. 29 No. 4, pp. 1358-1367.
DeFranco, C. M. A. (2016) 'Modeling guests' intentions to use mobile apps in hotels: the roles of personalization, privacy, and involvement', *International Journal of Contemporary Hospitality Management*, Vol. 28 No. 9, pp. 1968-1991.
Dehghani, M. (2018) 'Exploring the motivational factors on continuous usage intention of smartwatches among actual users', *Behaviour and Information Technology*. Taylor & Francis, Vol. 37 No. 2, pp. 145-158.
Deng, L. and Poole, M. S. (2010) 'Affect in Web Interfaces: A Study of the Impacts of Web Page Visual Complexity and Order', *MIS Quarterly*, Vol. 34 No. 4, pp. 711-730.
Dholakia, R. R. *et al.* (2001) *Interactivity and revisits to websites: A theoretical framework*. Island: American Marketing Association.
Din, N., Putit, L. and Noor, M. N. M. (2016) 'Inducing Website Design Innovation towards Customer Loyalty', in *7th Asian Conference on Environment-Behaviour Studies*. Taipei, Taiwan: e-international Publishing House, Ltd, pp. 9–10.
Eighmey, J. and McCord, L. (1998) 'Adding Value in the Information Age: Uses and Gratifications of Sites on the World Wide Web', *Journal of Business Research*, Vol. 41 No. 3, pp. 187-194.
Eroglu, S. a., Machleit, K. a. and Davis, L. M. (2001) 'Atmospheric qualities of online retailing: A conceptual model and implications', *Journal of Business Research*, Vol. 54 No. 2, pp. 177-184.
Éthier, J. *et al.* (2008) 'Interface design and emotions experienced on B2C Web sites: Empirical testing of a research model', *Computers in Human Behavior*, Vol. 24 No. 6, pp. 2771–2791.
Faisal, C. M. N. *et al.* (2017) 'Web Design Attributes in Building User Trust, Satisfaction, and Loyalty for a High Uncertainty Avoidance Culture', *IEEE Transactions on Human-Machine Systems*, Vol. 47 No. 6, pp. 847-859.
Faisal, C. M. N. *et al.* (2018) 'Impact of web design features on irritation for E-commerce websites', in *Proceedings of the 33rd Annual ACM Symposium on Applied Computing - SAC '18*. New York, New York, USA: ACM Press, pp. 656-663.
Fan, L. *et al.* (2017) 'Interactivity, engagement, and technology dependence: understanding users'

technology utilisation behaviour', *Behaviour and Information Technology*, Vol. 36 No. 2, pp. 113-124.
Fang, J. *et al.* (2017) 'Design and performance attributes driving mobile travel application engagement', *International Journal of Information Management*, Vol. 37 No. 4, pp. 269-283.
Floh, A. and Madlberger, M. (2013) 'The role of atmospheric cues in online impulse-buying behavior', *Electronic Commerce Research and Applications*, Vol. 12 No. 6, pp. 425-439.
Forneil, C. and Cha, J. (1994) 'Partial least squares', in Bagozzi, R. P. (ed.) *Advanced Methods in Marketing Research*. Cambridge: Blackwell Business, pp. 52-78.
Fornell, C. and Larcker, D. F. (1981) 'Evaluating structural equation models with unobserved variables and measurement error', *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
Fortin, D. R. and Dholakia, R. R. (2005) 'Interactivity and vividness effects on social presence and involvement with a web-based advertisement', *Journal of Business Research*, Vol. 58 No. 3, pp. 387-396.
Gandolfo, D. and Federica, P. (2013) 'How to build an e-learning product: Factors for student/customer satisfaction', *Business Horizons*, Vol. 56 No. 1, pp. 87-96.
Gao, L. and Bai, X. (2014) 'Online consumer behaviour and its relationship to website atmospheric induced flow: Insights into online travel agencies in China', *Journal of Retailing and Consumer Services*, Vol. 21 No. 4, pp. 653-665.
Gefen, D. and Straub, D. (2005) 'A practical guide to factorial validity using PLS-Graph: tutorial and annotated example', *Communications association information systems*, Vol. 16, pp. 91-109.
George, D. and Mallery, P. (2003) *SPSS for windows step by step: A simple guide and reference, 11.0 update*. Michigan: Allyn and Bacon.
Golonka, E. M. *et al.* (2014) 'Technologies for foreign language learning: A review of technology types and their effectiveness', *Computer Assisted Language Learning*, Vol. 27 No. 1, pp. 70-105.
Greussing, E. and Boomgaarden, H. G. (2019) 'Simply Bells and Whistles?: Cognitive Effects of Visual Aesthetics in Digital Longforms', *Digital Journalism*, Vol. 7 No. 2, pp. 273-293.
Grigoroudis, E. *et al.* (2008) 'The assessment of user-perceived web quality: Application of a satisfaction benchmarking approach', *European Journal of Operational Research*, Vol. 187 No. 3, pp. 1346-1357.
Guo, Z. *et al.* (2015) 'Promoting online learners' continuance intention: An integrated flow framework', *Information & Management*, Vol. 53 No. 2, pp. 279-29.
Hair, J. F., Anderson, R. E. and Tatham, R. L. (1990) *Multivariate data analysis: with readings*. 2nd ed. New York, NY, USA: Macmillan Publishing.
Hair, J. F., Ringle, C. M. and Sarstedt, M. (2011) 'PLS-SEM: Indeed a Silver Bullet', *The Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139-152.
Hasan, B. (2016) 'Perceived irritation in online shopping : The impact of website design characteristics', *Computers in Human Behavior*, Vol. 54, pp. 224-230.
Hausman, A. V. and Siekpe, J. S. (2009) 'The effect of web interface features on consumer online purchase intentions', *Journal of Business Research*, Vol. 62 No. 1, pp. 5-13.
Henrie, C. R., Halverson, L. R. and Graham, C. R. (2015) 'Measuring student engagement in technology-mediated learning: A review', *Computers and Education*, Vol. 90 No. 1, pp. 36-53.
Hoehle, H., Aljafari, R. and Venkatesh, V. (2016) 'Leveraging Microsoft's mobile usability guidelines: Conceptualizing and developing scales for mobile application usability', *International Journal of Human Computer Studies*, Vol. 89, pp. 35-53.
Hsu, C. L., Chang, K. C. and Chen, M. C. (2012) 'The impact of website quality on customer satisfaction and purchase intention: Perceived playfulness and perceived flow as mediators', *Information Systems and e-Business Management*, Vol. 10 No. 4, pp. 549-570.
Jensen, M. L. *et al.* (2014) 'Organizational balancing of website interactivity and control: An examination of ideological groups and the duality of goals', *Computers in Human Behavior*, Vol. 38, pp. 43-54.
Jiang, Z., Chan, J. and Tan, B. (2010) 'Effects of Interactivity on Website Involvement and Purchase Intention', *Journal of the Association for Information Systems*, Vol. 11 No. 1, pp. 34-59.
Jiménez-Zarco, A. I. *et al.* (2014) 'The co-learning process in healthcare professionals: Assessing user satisfaction in virtual communities of practice', *Computers in Human Behavior*, Vol. 51, pp. 1303–1313.
Johnson, C. M., Johnson, T. R. and Zhang, J. (2005) 'A user-centered framework for redesigning health

care interfaces.', *Journal of biomedical informatics*, Vol. 38 No. 1, pp. 75-87.
Johnson, G. J., Bruner, G. C. and Kumar, A. (2006) 'Interactivity and its facets revisited: Theory and empirical test', *Journal of Advertising*, Vol. 35 No. 4, pp. 35-52.
Joo, Y. J., Lee, H. W. and Ham, Y. (2014) 'Integrating user interface and personal innovativeness into the TAM for mobile learning in Cyber University', *Journal of Computing in Higher Education*, Vol. 26 No. 2, pp. 143-158.
Joseph F, H. (2009) *Multivariate Data Analysis: A Global Perspective.* 7th edn. Upper Saddle River, NJ, USA: Prentice Hall.
Joseph, H. *et al.* (2011) *Essentials of Business Research Methods*. 2nd ed. New York, USA: Routledge.
Kaiser, H. F. (1960) 'The application of electronic computers to factor analysis', *Educational and Psychological Measurement*, Vol. 20 No. 1, pp. 141-151.
Kang, J. M., Mee, J. and Johnson, K. K. P. (2015) 'In-store mobile usage : Downloading and usage intention toward mobile location-based retail apps', *Computers in Human Behavior*, Vol. 46, pp. 210-217.
Keengwe, J. and Bhargava, M. (2013) 'Mobile learning and integration of mobile technologies in education', *Education and Information Technologies*, Vol. 19 No. 4, pp. 737-746.
Kim, J. *et al.* (2002) 'Business as buildings: metrics for the architectural quality of internet businesses', *Information Systems Research*, Vol. 13 No. 3, pp. 239-254.
Kim, J., Fiore, A. M. and Lee, H.-H. (2007) 'Influences of online store perception , shopping enjoyment , and shopping involvement on consumer patronage behavior towards an online retailer', *Journal of Retailing and Consumer Services*, Vol. 14 No. 2, pp. 95-107.
Kim, S. and Baek, T. H. (2017) 'Examining the antecedents and consequences of mobile app engagement', *Telematics and Informatics*, Vol. 35 No. 1, pp. 148-158.
Kock, N. (2014) *WarpPLS 5.0 User Manual*. Laredo, Texas USA. Available at: http://www.scriptwarp.com/warppls (accessed 11 April 2019).
Koo, D.-M. and Ju, S.-H. (2010) 'The interactional effects of atmospherics and perceptual curiosity on emotions and online shopping intention', *Computers in Human Behavior*, Vol. 26 No. 3, pp. 377-388.
Lavie, T. and Tractinsky, N. (2004) 'Assessing dimensions of perceived visual aesthetics of web sites', *International Journal of Human Computer Studies*, Vol. 60 No. 3, pp. 269-298.
Lee, H. H., Kim, J. and Fiore, A. M. (2010) 'Affective and cognitive online shopping experience: Effects of image interactivity technology and experimenting with appearance', *Clothing and Textiles Research Journal*, Vol. 28 No. 2, pp. 140-154.
Lee, J. Y. and Kang, T. G. (2018) 'A Study on the Use Intention of Long Term Evolution Mobile Service', *Wireless Personal Communications*. Springer US, Vol. 98 No. 4, pp. 3245-3264.
Lee, S. and Koubek, R. J. (2010) 'The effects of usability and web design attributes on user preference for e-commerce web sites', *Computers in Industry*, Vol. 61 No. 4, pp. 329-341.
Lee, Y. and Kozar, K. a. (2009) 'Designing usable online stores: A landscape preference perspective', *Information and Management*, Vol. 46 No. 1, pp. 31-41.
Lee, Y. and Kozar, K. A. (2012) 'Understanding of website usability: Specifying and measuring constructs and their relationships', *Decision Support Systems*, Vol. 52 No. 2, pp. 450-463.
Leguina, A. (2015) 'A primer on partial least squares structural equation modeling (PLS-SEM)', *International Journal of Research & Method in Education*, Vol. 38 No. 2, pp. 220-221.
Lin, H.-F. (2007) 'Measuring Online Learning Systems Success: Applying the Updated DeLone and McLean Model', *Cyber Psychology & Behavior*, Vol. 10 No. 6, pp. 817-820.
Little, B. (2013) 'Issues in mobile learning technology', *Human Resource Management International Digest*, Vol. 21 No. 3, pp. 26-29.
Liu, I. F. *et al.* (2010) 'Extending the TAM model to explore the factors that affect Intention to Use an Online Learning Community', *Computers and Education*, Vol. 54 No. 2, pp. 600-610.
Liu, W. *et al.* (2016) 'How homepage aesthetic design influences users' satisfaction: Evidence from China', *Displays*, Vol. 42, pp. 25-35.
Liu, Y., Li, H. and Hu, F. (2013) 'Website attributes in urging online impulse purchase: An empirical investigation on consumer perceptions', *Decision Support Systems*, Vol. 55 No. 3, pp. 829-837.

Loureiro, S. M. C. and Roschk, H. (2014) 'Differential effects of atmospheric cues on emotions and loyalty intention with respect to age under online/offline environment', *Journal of Retailing and Consumer Services*, Vol. 21 No. 2, pp. 211-219.
Lugtig, P. and Toepoel, V. (2016) 'The Use of PCs, Smartphones, and Tablets in a Probability-Based Panel Survey: Effects on Survey Measurement Error', *Social Science Computer Review*, Vol. 34 No. 1, pp. 78-94.
Maditinos, D. I. and Theodoridis, K. (2010) 'Satisfaction determinants in the Greek online shopping context', *Information Technology & People*, 23 No. 4, pp. 312-329.
Manganari, E. E., Siomkos, G. J. and Vrechopoulos, A. P. (2009) 'Store atmosphere in web retailing', *European Journal of Marketing*, Vol. 43 No. 9/10, pp. 1140-1153.
Matthes, J. and Beyer, A. (2017) 'Toward a Cognitive-Affective Process Model of Hostile Media Perceptions: A Multi-Country Structural Equation Modeling Approach', *Communication Research*, Vol. 44 No. 8, pp. 1075-1098.
McKinney, V., Yoon, K. and Zahedi, F. "Mariam" (2002) 'The Measurement of Web-Customer Satisfaction: An Expectation and Disconfirmation Approach', *Information Systems Research*, Vol. 13 No. 3, pp. 296-315.
Mohseni, S. *et al.* (2018) 'Attracting tourists to travel companies' websites: the structural relationship between website brand, personal value, shopping experience, perceived risk and purchase intention', *Current Issues in Tourism*, Vol. 21 No. 6, pp. 616-645.
Moshagen, M. and Thielsch, M. T. (2010) 'Facets of visual aesthetics', *International Journal of Human Computer Studies*, Vol. 68 No. 10, pp. 689-709.
Mummalaneni, V. (2005) 'An empirical investigation of web site characteristics, consumer emotional states and on-line shopping behaviors', *Journal of Business Research*, Vol. 58 No. 4, pp. 526-532.
Nikou, S. A. and Economides, A. A. (2017) 'Mobile-based assessment: Investigating the factors that influence behavioral intention to use', *Computers and Education*, Vol. 109, pp. 56-73.
Nikou, S. A. and Economides, A. A. (2018) 'Factors that influence behavioral intention to use mobile-based assessment: A STEM teachers' perspective', *British Journal of Educational Technology*, Vol. 50 No. 2, pp. 587-600.
Novak, T. P., Hoffman, D. L. and Yiu-Fai, Y. (2000) 'Measuring the Customer Experience in Online Environments: A Structural Modeling Approach', *Marketing Science*, Vol. 19 No. 1, p. 22.
Ou, C. X. and Sia, C. L. (2010) 'Consumer trust and distrust : An issue of website design', *Journal of Human Computer Studies*, Vol. 68 No. 12, pp. 913-934.
Palmer, J. W. (2002) 'Web site usability, design, and performance metrics', *Information Systems Research*, Vol. 13 No. 2, pp. 151-167.
Parihar, P., Dawra, J. and Sahay, V. (2019) 'The role of customer engagement in the involvement-loyalty link', *Marketing Intelligence and Planning*, Vol. 37 No. 1, pp. 66-79.
Peikari, H. R. *et al.* (2014) 'The impacts of second generation e-prescribing usability on community pharmacists outcomes', *Research in Social and Administrative Pharmacy*, Vol. 11 No. 3, pp. 15-5.
Pelet, J.-E. *et al.* (2017) 'Impact of M-Commerce Website Design on Consumers' Behavioral Intentions: An Empirical Study of Age as a Moderating Influence', in *In: Rossi P. (eds) Marketing at the Confluence between Entertainment and Analytics. Developments in Marketing Science: Proceedings of the Academy of Marketing Science*. Cham: Springer, pp. 111-124.
Peng, X. *et al.* (2017) 'The effect of product aesthetics information on website appeal in online shopping', *Nankai Business Review International*, Vol. 8 No. 2, pp. 190-209.
Perse, E. M. (1990) 'Involvement with Local Television News Cognitive and Emotional Dimensions', *Human Communication Research*, Vol. 16 No. 4, pp. 556-581.
Pušnik, N., Podlesek, A. and Možina, K. (2016) 'Typeface comparison - Does the x-height of lower-case letters increased to the size of upper-case letters speed up recognition?', *International Journal of Industrial Ergonomics*, Vol. 54, pp. 164-169.
Rafaeli, S. and Ariel, Y. (2002) 'Assessing interactivity in computer-mediated research', in *Oxford handbook of Internet Psychology*. Oxford, pp. 43-54.

Reychav, I. and Wu, D. (2015) 'Are your users actively involved? A cognitive absorption perspective in mobile training', *Computers in Human Behavior*, Vol. 44, pp. 335-346.
Ribeiro, J. and Carvalhais, M. (2012) 'Web Design Patterns for Mobile Devices', in *PLoP '12: Proceedings of the 19th Conference on Pattern Languages of Programs*. Tucson, Arizona: The Hillside Group, US, pp. 1-48.
Richard, B. and Youjae, Y. (1988) 'On the evaluation of structural equation models', *Journal of the Academy of Marketing Science*, Vol. 16 No. 1, p. pp 74-94.
Richard, M. (2005) 'Modeling the impact of internet atmospherics on surfer behavior', *Journal of Business Research*, Vol. 58 No. 12, pp. 1632-1642.
Rodríguez-Torrico, P., San-Martín, S. and José-Cabezudo, R. S. (2019) 'What Drives M-Shoppers to Continue Using Mobile Devices to Buy?', *Journal of Marketing Theory and Practice*, Vol. 27 No. 1, pp. 83-102.
Ronnie, C. and Doug, V. (2013) 'Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning', *Computers & Education*, Vol. 63, pp. 160-175.
Ros, S. *et al.* (2015) 'On the use of extended TAM to assess students' acceptance and intent to use third-generation learning management systems', *British Journal of Educational Technology*, Vol. 46 No. 6, pp. 1250-1271.
Saade, R. and Bahli, B. (2005) 'The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: An extension of the technology acceptance model', *Information and Management*, Vol. 42 No. 2, pp. 317-327.
Santosa, P. I., Wei, K. K. and Chan, H. C. (2005) 'User involvement and user satisfaction with information-seeking activity', *European Journal of Information Systems*, Vol. 14 No. 4, pp. 361-370.
Seckler, M., Opwis, K. and Tuch, A. N. (2015) 'Linking objective design factors with subjective aesthetics : An experimental study on how structure and color of websites affect the facets of users ' visual aesthetic perception', *Computers in Human Behavior*, Vol. 49, pp. 375-389.
See-Pui Ng, C. (2013) 'Intention to purchase on social commerce websites across cultures: A cross-regional study', *Information and Management*, Vol. 50 No. 8, pp. 609-620.
Shaouf, A., Lü, K. and Li, X. (2016) 'The effect of web advertising visual design on online purchase intention: An examination across gender', *Computers in Human Behavior*, Vol. 60, pp. 622-634.
Shin, D. *et al.* (2016) 'Interaction, engagement, and perceived interactivity in single-handed interaction', *Internet Research*, Vol. 26 No. 5, pp. 1134-1157.
Shu-Hao, C. *et al.* (2014) 'The influence of web aesthetics on customers' PAD', *Computers in Human Behavior*, Vol. 36, pp. 168-178.
Steuer, J. (1992) 'Defining virtual reality: dimensions determining telepresence', *Journal of Communication*, Vol. 42 No. 4, pp. 73-93.
Sun, H.-M. *et al.* (2015) 'The effect of user's perceived presence and promotion focus on usability for interacting in virtual environments', *Applied Ergonomics*, Vol. 50, pp. 126-132.
Sun, Q. and Xu, B. (2019) 'Mobile Social Commerce: Current State and Future Directions', *Journal of Global Marketing*, Vol. 32 No. 5, pp. 306-318.
Tarute, A., Nikou, S. and Gatautis, R. (2017) 'Mobile application-driven consumer engagement', *Telematics and Informatics*, Vol. 34 No. 4, pp. 145-156.
Tenenhaus, M. *et al.* (2005) 'PLS path modeling', *Computational Statistics & Data Analysis*, Vol. 48 No. 1, pp. 159-205.
Teo, H.-H. *et al.* (2003) 'An empirical study of the effects of interactivity on web user attitude', *International Journal of Human Computer Studies*, Vol. 58 No. 3, pp. 281-305.
Theo K, D. and Jörg, H. (2015) 'Consistent partial least squares path modeling', *MIS Quarterly*, Vol. 39 No. 2, pp. 297-316.
Tsiaousis, A. S. and Giaglis, G. M. (2014) 'Mobile websites: Usability evaluation and design', *International Journal of Mobile Communications*, Vol. 12 No. 1, pp. 29-55.
Tuch, A. N., Bargas-Avila, J. A. and Opwis, K. (2010) 'Symmetry and aesthetics in website design: It's a man's business', *Computers in Human Behavior*, Vol. 26 No. 6, pp. 1831-1837.

Wang, M. *et al.* (2018) 'Reflective learning with complex problems in a visualization-based learning environment with expert support', *Computers in Human Behavior*, Vol. 87, pp. 406-415.
Wetzels, M., Odekerken-Schröder, G. and Oppen, C. van (2009) 'Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration', *MIS Quarterly*, Vol. 33 No. 1, pp. 177-195.
Wu, I.-L. and Hsiao, W.-H. (2017) 'Involvement, content and interactivity drivers for consumer loyalty in mobile advertising: The mediating role of advertising value', *International Journal of Mobile Communications*, Vol. 15 No. 6, pp. 577-603.
Wu, L. (2019) 'Website interactivity may compensate for consumers' reduced control in E-Commerce', *Journal of Retailing and Consumer Services*, Vol. 49, pp. 253-266.
Xu, Q. and Sundar, S. S. (2016) 'Interactivity and memory: Information processing of interactive versus non-interactive content', *Computers in Human Behavior*, Vol. 63, pp. 620-629.
Yadav, M. S. and Varadarajan, R. (2005) 'Interactivity in the Electronic Marketplace: An Exposition of the Concept and Implications for Research', *Journal of the Academy of Marketing Science*, Vol. 33 No. 4, pp. 585–603.
Yang, S., Zhou, S. and Cheng, X. (2019) 'Why do college students continue to use mobile learning? Learning involvement and self-determination theory', *British Journal of Educational Technology*, Vol. 50 No. 2, pp. 626-637.
Zaichkowsky, J. L. (1985) 'Measuring the Involvement Construct', *Journal of Consumer Research*, Vol. 12 No. 3, p. 341.
Zhang, X. *et al.* (2009) 'A Model of the Relationship among Consumer Trust, Web Design and User Attributes', *Organizational and End-User Interactions: New Explorations*, Vol. 21 No. 2, pp. 44-66.
Zhao, L. and Lu, Y. (2012) 'Enhancing perceived interactivity through network externalities: An empirical study on micro-blogging service satisfaction and continuance intention', *Decision Support Systems*, Vol. 53 No. 4, pp. 825-834.
Zheng, Y., Zhao, K. and Stylianou, A. (2013) 'The impacts of information quality and system quality on users' continuance intention in information-exchange virtual communities: An empirical investigation', *Decision Support Systems*, Vol. 56, pp. 513-524.
Zhou, Z., Jin, X. and Fang, Y. (2014) 'Moderating role of gender in the relationships between perceived benefits and satisfaction in social virtual world continuance', *Decision Support Systems*, Vol. 65, pp. 69-79.

Appendix A

Constructs	Items	Mean	SD
Font quality	(Shu-Hao *et al.*, 2014; Ali, 2016; Faisal *et al.*, 2017)		
FQ1	It is easy to read the text on this website with the used font type and size.	4.79	1.668
FQ2	The font color is appealing on this website	4.81	1.690
FQ3	The text alignment and spacing on this website make the text easy to read.	5.13	1.663
Aesthetic quality	(Mummalaneni, 2005; Koo and Ju, 2010; Cyr and Head, 2013; Ali, 2016; Hoehle *et al.,* 2016)		
AQ1	The mobile application groups elements together that are similar and belong together.	5.33	1.609
AQ2	The mobile application uses animations appropriately.	5.40	1.602
AQ3	The screen design of this mobile application (i.e. colors, images, layout etc.) is attractive.	5.28	1.588
Information quality	(Eroglu *et al.,* 2001; Hausman and Siekpe, 2009; Hsu *et al.,* 2012; Al-Qeisi *et al.*, 2014; Ali, 2016; Tarute *et al.,* 2017)		
IQ1	The information provided at this mobile application is useful.	5.13	1.663
IQ2	The information provided at the mobile application is accurate and complete.	5.41	1.647
IQ3	The information provided at this mobile application is relevant.	5.28	1.559
Navigation quality	(Koo and Ju, 2010; Hsu et al., 2012; Cyr and Head, 2013; Ali, 2016; Hoehle *et al.*, 2016; Tarute et al., 2017)		
NQ1	I can easily navigate this mobile application.	5.03	1.643
NQ2	The mobile application uses a navigational hierarchy.	5.17	1.536
NQ3	This mobile application provides good navigation facilities to information content.	5.32	1.794
Responsiveness	(Hsu et al., 2012; Fan *et al.*, 2017; Rodríguez-Torrico *et al.,* 2019)		
RS1	I am able to obtain the information I want without any delay.	4.86	1.658
RS2	The mobile application is very fast in responding to my request.	4.98	1.598
RS3	When I use the mobile application, I felt I was getting instantaneous information.	5.25	1.693
User Control	(Jiang et al., 2010; Fan *et al.*, 2017; Tarute *et al.,* 2017; Rodríguez-Torrico *et al.,* 2019; Wu, 2019)		
UC1	I feel that I have a great deal of control over my using experience.	4.93	1.606
UC2	The mobile application is manageable.	5.19	1.636
UC3	While I was using the mobile application, I could choose freely what I wanted to do.	5.21	1.620
Communication	(Jiang *et al.,* 2010; Fan *et al.*, 2017)		
CC1	The mobile application facilitates two-way communication.	5.14	1.573
CC2	The mobile application facilitates concurrent communication.	5.23	1.562
CC3	The mobile application gives me the opportunity to talk back.	5.24	1.786
Cognitive involvement	(Celuch and Slama, 1998; Reychav and Wu, 2015)		
CI1	This mobile application is needed.	5.32	1.630
CI2	This mobile application is valuable.	5.30	1.593
CI3	This mobile application is relevant.	5.30	1.595
Affective involvement	(Celuch and Slama, 1998; Reychav and Wu, 2015)		
AI1	This mobile application is fascinating.	5.26	1.573
AI2	This mobile application is interesting.	5.50	1.603
AI3	This mobile application is appealing.	5.45	1.618
AI4	This mobile application is involving.	5.31	1.612
Continued intention to use	(Ahn *e al.,* 2007; Hoehle *et al.,* 2016; Tarute *et al.,* 2017)		
CIU1	I intend to continue using the mobile application.	4.82	1.894
CIU2	I will use this mobile application on a regular basis in the future.	4.94	1.724
CIU3	I predict I will continue using the mobile application.	4.93	1.791
CIU4	I encourage friends and relatives to be the customers of the mobile application.	4.94	1.815