MALAYSIAN JOURNAL OF LEARNING AND INSTRUCTION
http://e-journal.uum.edu.my/index.php/mjli

How to cite this article:
Nassr, R. M., Aldossary, A. A., & Nasir, H. (2021). Students' intention to use emotion-aware virtual learning environment: Does a lecturer's interaction make a difference? *Malaysian Journal of Learning and Instruction*, *18*(1), 183-218. https://doi.org/10.32890/mjli2021.18.1.8

STUDENTS' INTENTION TO USE EMOTION-AWARE VIRTUAL LEARNING ENVIRONMENT: DOES A LECTURER'S INTERACTION MAKE A DIFFERENCE?

[1]Rasheed Mohammad Nassr, [2]Alia Ahmed Aldossary & [3]Haidawati Nasir
[1&3]Malaysian Institute of Information Technology
Universiti Kuala Lumpur (UniKL), Malaysia
[2]Community College Dammam
Imam Abdul Rahman Bin Faisal University
University of Dammam Saudi Arabia

[1]Corresponding author: rasheed@unikl.edu.my

Received: 18/8/ 2019 Revised: 1/10/2020 Accepted: 8/11/2020 Published: 31/1/2021

ABSTRACT

Purpose – This study explored students' perspective of using emotion-aware Virtual Learning Environment (VLE) in Malaysia's higher education institutions. The purpose is to investigate the relationships amongst dimensions of Technology Readiness Index (TRI), attitude, intention to use VLE, and lecturer interaction. The outcomes concerned the emotions involved in the educational process of Malaysia's higher education institutions.

Methodology – Quantitative data were collected via an online survey from 260 students. An empirical analysis was then conducted using structural equation modelling (Smart PLS) in two phases: (1) examining the direct effect of students' attitude on VLE adoption intention, and (2) examining the indirect effect of constructs using lecturer interaction as a mediator.

Findings – The findings revealed a significant mediating role of lecturer interaction on the relationship between attitude and intention to use VLE

across the student cohort. Inhibitors, such as insecurity and discomfort, were less significant in affecting students' attitude towards emotion-aware VLE. The results indicate that students are motivated to use VLE when lecturers understand their emotions and react accordingly.

Significance – This is one of the studies pertaining to emotions in VLE and lecturer interaction in higher education institutions. The results facilitate an understanding of the pedagogical role of lecturer interaction as a practical learning motivation. It is of particular interest to curriculum and e-learning stakeholders looking to improve students' interactions with the VLE systems. Apart from extending the current literature, this study has significant practical implications for education management in higher learning institutions.

Keywords: Emotion-Aware VLE, Technology Readiness Index (TRI), attitude, intention to use, lecturer interaction, online learning, Smart PLS, higher education.

INTRODUCTION

Students' emotions play an essential role in education (Arguedas et al., 2016; Artino Jr., 2012; Feidakis, 2016; Feidakis et al., 2014; Feidakis et al., 2011; Gómez-Díaz et al., 2017; Harley et al., 2015; Lehman et al., 2012; Marchand & Gutierrez, 2012; Petrovica et al., 2017). Educationists have expressed increased interest in emotions due to their impact on students' performance (Caballé, 2015; Feidakis et al., 2014; Lehman et al., 2012; Marchand & Gutierrez, 2012), stress-handling ability (Lehman et al., 2012), problem-solving capability, and capacity to find creative solutions (Hernández-Amorós & Urrea-Solano, 2017; Krithika & Priya, 2016; Tian et al., 2014). A vision by Horizon 2020 ICT programme of the European Commission serves to make e-learning an emotion-aware form of instruction in the future (Caballé, 2015) as currently, e-learning systems are regarded as suffering from "emotional illiteracy" (Caballé, 2015; Feidakis, 2016; Feidakis et al., 2014; Tian et al., 2014). Although technologies such as facial expression analysis, electrodermal activation measurement devices, and self-report measures facilitate the process of emotion-capturing in virtual learning environments (Feidakis, 2016; Feidakis et al., 2014; Harley, 2015), none of the strategies have recommended integrating such features into VLE systems (Caballé, 2015).

When students work to comprehend tough materials and solve challenging problems, their emotions flow between positive and negative poles throughout this process (Lehman et al., 2012). In a face-to-face learning environment,

lecturers are in a position to perceive students' emotions and change their teaching style as needed to motivate students. However, in blended and virtual learning environments where students spend more time online and have less physical interaction with lecturers, a mechanism is needed that can capture students' emotions and share them with lecturers. Theoretically, this procedure should not be complicated, as VLE is presumably equipped with several relevant tools (Nortvig et al., 2018). However, VLE with emotion-aware capabilities is still in its early stage (Caballé, 2015; Feidakis, 2016; Feidakis et al., 2014; Tian et al., 2014). Moreover, the emotion awareness emergence across diverse learning environments remains a challenging issue that entails complex and argumentative questions, such as "What do we want to evaluate?", "How can we do it?", and "When to get involved and why?" raised by (Feidakis, 2016, p. 225), yet no answers have been found. This study explored students' perspective towards this type of smart learning environment that is aware of their emotions.

A lecturer's role is crucial in perceiving students' emotions, changing their teaching strategy accordingly to remotivate students. The lecturer's positive reaction towards the students' emotions may encourage them to engage more in the virtual learning environment. Interestingly, students show different reactions toward applied pedagogical strategies (Lehman et al., 2012) which enables emotion-aware systems (or at least VLE) to capture emotions. Doing so facilitates lecturers to formulate and implement multiple strategies to suit the different learning styles of students based on their emotions, which could, in turn, motivate students to engage in VLE further (Caballé, 2015). Although few scholars have focused on students' intentions to use VLE systems (Hernández-Amorós & Urrea-Solano, 2017), its effective adoption requires investigating related challenges such as the acceptance of VLE amongst students (Alzahrani et al., 2018) along with the disclosure of their emotions with such systems (Caballé, 2015).

This research examined students' intentions to engage in Virtual Learning Environment (VLE) and the ability of lecturers and course content creators to capture students' emotions to help select the appropriate teaching style for optimal educational efficiency. To this end, this study measured students' acceptance to the extension in the boundaries of educational technologies by including emotion-aware tools, which may provide new insights into the teaching and learning paradigm. Furthermore, this study investigated the acceptance of emotion-aware VLE with and without lecturer interaction to evaluate the significance of lecturer interaction as a mediator to incentivise students to engage more in VLE. To achieve this goal, this study integrated several scales to measure students' acceptance of such technology.

LITERATURE REVIEW

The term "academic emotions" is used to describe emotions that students experience through educational programmes (Pekrun, 2010). According to Pekrun (2010), the academic emotions that learners experience during the semester can be classified into four key categories: topic, achievement, epistemic, and social. In particular, learners experience emotions that are associated with achievement (anxiety, contentment, and frustration), inclination towards specific topics, interactions with lecturers and peers (shame, pride, and jealousy), along with processing innovative information (surprise and confusion) (Lehman et al., 2012). Confusion results from lack of knowledge. It is considered as a common emotion that students express to their lecturers in VLE to encourage lecturers to change to a more suitable pedagogical strategy (Lehman et al., 2012).

Regarding the emotion types to be considered in academics, Hernández-Amorós and Urrea-Solano (2017) revealed that although students have no emotional preferences, they portray a marginal inclination towards positive emotions and choose explicitly to express emotions face-to-face. Regardless of the types of emotion, students implicitly and/or explicitly project emotions to their lecturer, who then acts accordingly (Arguedas et al., 2016). In the case of VLE, emotional awareness, as the awareness of others and self-emotion (Feidakis et al., 2014), recognises emotion-related input, implicitly or explicitly, coupled with a particular response provided through human or machine interaction (Feidakis et al., 2014, p. 39).

Emotions in Education

Emotions play a considerable role in education (face-to-face, blended, e-learning) (Feidakis et al., 2014; Krithika & Priya, 2016; Marchand & Gutierrez, 2012). Emotions are highly correlated with learners' motivation (Caballé, 2015). Hernández-Amorós and Urrea-Solano (2017) highlighted the substantial role of emotions in education. Undoubtedly, understanding students' emotions assists lecturers to improve their interaction with students (Arguedas et al., 2016; Krithika & Priya, 2016). Capturing emotions, particularly in a virtual environment, adds value to the learning process by helping to keep students motivated and engaged (Caballé, 2015; Feidakis, 2016; Krithika & Priya, 2016). The control-value theory of achievement emotions speculates that students' perception about their learning environment, along with their motivational beliefs, cognitive qualities, as well as other factors, affects students' value assessment and control of academic circumstances, which consequently determine students' emotions leading towards learning achievement results (Marchand & Gutierrez, 2012).

Theoretical Foundation

Most studies focused on system capabilities to capture emotions or the role of understanding those emotions and reflected this understanding of the education process. However, few scholars have concentrated on students' acceptance to use emotion-aware VLEs in an attempt to solve unanswered questions. In a similar endeavour, this study focuses on students' acceptance of VLE with emotion-capturing capabilities. The selection of a model or theory that measures students' acceptance of VLE with emotion-aware capabilities is a challenging process. Scholars have proposed numerous theories and frameworks to understand individuals' behaviour in various contexts (Marto et al., 2019). Furthermore, researchers are continuously working to improve these models and theories by integrating them and thereby, developing new models, aimed at finding better solutions for each area of work (Marto et al., 2019). However, very few studies embarked on a context similar to this study where emotions and technology are combined in a single model.

Technology Acceptance Model

The indispensable function of the Technology Acceptance Model (TAM) framework is to advance a foundation for understanding the influence of external environmental factors on an individual's internal factors such as attitude, specific beliefs, and behavioural intentions (Almarabeh, 2014; Pires et al., 2011). TAM employs a multi-item scale to investigate behavioural intentions. TAM has been used in several IT adoption and usage studies to assess user acceptance of new technologies, such as processors and applications, spreadsheet, web browser, e-mail, telemedicine, and blackboard (Almarabeh, 2014). Furthermore, as the respondents of this study are familiar with VLE systems, known to have minimal issues in performance and infrastructure, the theories and models with system performance, facilitating conditions, and related social factors may be less relevant to our proposed model.

Technology Readiness Index

Technology Readiness Index (TRI) discusses the factors that can potentially affect a user's behaviour towards technology (Hallikainen & Laukkanen, 2016). It is only logical that since specific behaviour differs amongst users, their beliefs about diverse aspects of technology could also vary. Many students believe that an emotion-aware VLE is an important aspect in their education and it helps deliver their emotions to their instructors, whereas others think that the technology (emotion-aware VLE) challenges their interaction with their instructors. Accordingly, technology readiness theory represents a collection

of ideas and beliefs about technology, regardless of individuals' competence in using it (Ahmed et al., 2012).

Users vary in their beliefs and traits, and as such their perspectives about technology differ (Parasuraman & Colby, 2007). TRI suggests that the relative strength of each trait showcases an individual's openness towards the use of a certain technology (Ahmed et al., 2012). TRI consists of discomfort, insecurity, optimism, and innovation (Parasuraman, 2000). Innovation and optimism are enablers that boost the readiness to use technology. On the contrary, discomfort and insecurity inhibit the adoption of innovative technologies (Parasuraman, 2000). This leads to the understanding that if users are not ready and willing to utilise new systems, they are more likely to express discomfort and a sense of insecurity towards it. This will, in turn, initiate negative feelings to the specific technology. Hüer (2015) explained that the TRI components at the core of the model affect the intention and behaviour to adopt innovative technologies. According to Parasuraman (2000), the model is significant in clarifying individual user behaviour. Caison, Bulman, Pai, and Neville (2008) outlined that TRI is substantial in clarifying and identifying user intent towards using technology. Massey, Khatri, and Ramesh (2005) also noted that TRI is robust in outlining the level of user satisfaction with technology.

Comprehending the beliefs, feelings, and views of users is critical when introducing a new technology. Hence, TRI can be significant in explaining the general view about technology (Guhr et al., 2013). The TRI model has been applied to investigate user readiness towards technology-based services such as VLE (Ahmed et al., 2012), e-banking (Pires et al., 2011), e-commerce (Astuti & Nasution, 2014), e-learning (Bessadok, 2000), telecommunication services (Dahlan et al., 2002), and e-government (Caison et al., 2008; Napitupulu, 2017). TRI facilitates identifying target users' intention towards using technology prior to the actual adoption of online services (Caison et al., 2008). Chen et al. (2009) used an extended TRI model to find that insecurity, optimism, and discomfort influence usage behaviour towards a specific technology. Hence, this study proposes examining innovation, optimism, discomfort, insecurity, and their effects on the intention to use VLE amongst students.

TRI Factors as Antecedents of TAM

User acceptance and technological readiness are gradually recognised as a protocol in the process of implementing innovative technologies (Hallikainen & Laukkanen, 2016; Larasati, Widyawan, & Santosa, 2017). Integration of TRI and TAM could be used to analyse the constructs, adoption, and implementation

of innovative technologies (Endratno, 2018; Hallikainen & Laukkanen, 2016; Larasati et al., 2017). Technology Readiness and Acceptance Model (TRAM) is a recent advancement that integrates TRI's common personality factors with TAM specific factor system (Buyle et al., 2018). This explains how the integrated perspective of the two theories can influence user perception and the way individuals use innovative technology. In such a combination, TRI personality dimensions would act as an antecedent to TAM.

Parasuraman and Colby (2015) stressed that a holistic framework ought to be proposed to assess numerous factors and their respective consequences, particularly by combining the TRI model as required to advance the four identified dimensions (i.e. innovativeness, optimism, insecurity, and discomfort). The presence of TRI factors in the TAM framework is justified due to the interest shared by both perspectives to test the critical features regarding usage and capability of individuals to live comfortably by adopting technologically advanced products and services (Pires et al., 2011). TRI includes constructs which inhibit (insecurity and discomfort) and induce (innovativeness and optimism) the usage of new technologies. The inclusion of personal constructs in the research model had modelled the work of Buyle et al. (2018), Larasati et al. (2017), and Hallikainen and Laukkanen (2016). Therefore, we investigated the influence of personal dimension on attitude directly.

TAM is considered the most influential theory employed commonly to describe technology user behaviour (Venkatesh & Morris, 2000). However, TAM does not examine technology readiness characteristics with its proven influence on technology user behaviour (Erdog˙mus & Esen, 2011; Larasati et al., 2017; Walczuch et al., 2007). In terms of technology readiness, TAM cannot explain the readiness of students towards VLE, but it measures their acceptance. Therefore, in conditions where students' readiness is low, TAM provides minimal interpretation as to why students' intention to use VLE is low. In other words, technology readiness has a considerable impact on people's intention to use systems (including VLE) which could be explained using TRI dimensions (Parasuraman & Colby, 2015). Given that VLE systems have improved and students have used them in their learning process, it is necessary to know the perceived usefulness and ease of use that motivate students' involvement due to familiarity with VLE. This study focuses on attitude related to using VLE with emotion-aware capabilities.

TRI is widely used and accepted as a means to understand the readiness characteristics through four core variables: optimism, innovation, insecurity, and discomfort. However, its specific nature causes it to overlook other

important issues related to the intention towards technology (attitude) as a building block of technology user behaviour (Guhr et al., 2013; Lin & Chen, 2012; Roy et al., 2018). Therefore, Lin, Shih, and Sher (2007) integrated TRI with TAM to form the Technology Readiness and Acceptance Model (TRAM). The rationale behind such integration is the notion that TRI and TAM are intuitively interrelated.

Intention to Use

Upon reviewing the literature, this study proposed that intention shows a positive effect on the use of technology (Venkatesh et al., 2003). The questions developed to capture this variable were adopted from previous studies (Bhattacherjee, 2001a, 2001b; Chatzoglou et al., 2009; Demet et al., 2011; Gunawan et al., 2019; Lee et al., 2011; Lee et al., 2009; Liu et al., 2010; Mohamed Noh et al., 2014; Nugroho & Fajar, 2017; Roy et al., 2018), with minor modifications to fit this study's context (see Appendix A).

Attitude and Intention

Attitude designates a user's general perception of favourableness or unfavourableness towards specific technology (Jan et al., 2012). Factors of behavioural intention portray the degree of exertion that a user invests in employing a technology (Ajzen, 1991). Several studies confirmed that attitude shapes user behaviour. For instance, TAM proposes that attitudinal explanation determines the intention to adopt a specific new technology or service (Davis et al., 1989). The TPB and TRA frameworks further postulate that adoption intention is collectively specified by the attitude towards specific behaviour, along with subjective norm and perceived behavioural control (Jan et al., 2012). Empirically, many studies established that attitude has a noteworthy effect on the intention to use online services including e-learning (Al-Hujran et al., 2015; Alenezi et al., 2010; Alotaibi et al., 2014; Nortvig et al., 2018; Ong et al.g, 2004; Raaij & Schepers, 2008; Yu, 2006; Yu et al., 2007). Hence, we expect that user attitude towards emotion-aware VLE would predict its intention of use. Consequently, we have proposed the hypothesis as follows:

H_1 : *Learners' attitude positively influences intention to use emotion-aware VLE.*

Lecturer's Interaction

Students emphasise the roles of lecturer interaction and attitude to better deal with their emotions, thereby enhancing the learning process (Hernández-

Amorós & Urrea-Solano, 2017). Lecturers have found VLE as an appropriate medium of communication with students that increase their interaction (Uziak et al., 2018). (Hernández-Amorós & Urrea-Solano, 2017) revealed that once lecturers received training on handling students' emotions, students reacted positively to the lecturers' interactions. Lecturer interaction and positive response towards students' emotions are keys to improving students' performance in the classroom (Hernández-Amorós & Urrea-Solano, 2017, p. 514). Similarly, Nortvig et al. (2018) found that the strong presence of educators in VLE encourages students to be attentive and interactive. This indicates that the lecturers' interaction and responsiveness motivate students, as such behaviour signifies the lecturers' understanding and valuing of students' emotions (Caballé, 2015). Studies suggested that the more involved lecturers are in handling students' emotions, the better the students' engagement and performance (Lee & Doh, 2012; Sagayadevan & Jeyaraj, 2012). This means that students appreciate lecturers when they respond to their feedback including emotional status (Rowe, 2011).

This study showed the importance of lecturer interaction. It was guided by the work of Buenaventura-Vera (2017); Claudy et al. (2013); Hong and Cha (2013); Woody (2011) to measure the impact of a lecturer's interaction on students' attitude on using emotion-aware VLE, given the lack of studies that empirically developed and assessed a model for it. The majority of related studies qualitatively investigated the impact of emotion on education process and impact of lecturers' training to understand students' emotions or experimentally conducted classes by considering students' emotions in school. Technically, there is a gap in terms of assessing students' acceptance of emotion-aware VLE at university level. Studies have emphasised the role of lecturer interaction such as Caballé (2015); Hernández-Amorós and Urrea-Solano (2017); Lee and Doh (2012); Nortvig et al. (2018); Rowe (2011); Sagayadevan and Jeyaraj (2012); Uziak et al. (2018). However, lecturer interaction has not been investigated empirically. Therefore, this study has the dual aim to assess students' acceptance of emotion-aware VLE in higher education and assess lecturer interaction's role in this acceptance.

Based on the above arguments and studies (e.g. Hernández-Amorós and Urrea-Solano (2017) and Uziak et al. (2018), this study proposed lecturer interaction as a mediator between intention to use emotion-aware VLE and students' attitude, thereby hypothesising as follows:

H_2: Lecturer's interaction mediates the relationship between students' attitude and intention to use emotion-aware learning system

Insecurity

Insecurity could be worded as distrust in technology along with scepticism about its capability to function properly (Parasuraman, 2000). Insecure users perceive technology negatively. Insecurity is a key issue related to the usage behaviour of VLE (Ahmed et al., 2012). Several studies have highlighted the effects of insecurity on user behaviour of many online services including VLE. Insecurity has affected the usage of online services (Alateyah et al. 2013; Alharbi, 2016; Berdykhanova et al., 2010; Syamsuddin & Hwang, 2010). Accordingly, this study investigated the role of insecurity on students' attitude towards emotion-aware VLE. Therefore, we have hypothesised as follows:

H_3: Insecurity influences students' attitude towards emotion-aware VLE.

Discomfort

Discomfort represents the perception of a lack of control over innovative technologies along with an overwhelming feeling while utilising them (Kuo, Liu, & Ma, 2013). Users who are not comfortable with technology (emotion-aware VLE in this context) perceive that they remain spellbound by new technology, hence it is supposedly not meant for the general public. According to Parasuraman (2000), users who are at discomfort with technology believe that the systems are not suitable for them, thus they feel unpleasant. Therefore, they tend to have anxiety in using technology (Kuo et al., 2013). Discomfort is perceived to have a negative influence on students' attitude, which suggests a negative effect on the utilisation of technology (Mariethoz et al., 2010). El-Kasheir et al. (2009) found that if users are not comfortable with the online system, their attitude and behavioural intention to utilise the system will be influenced. In the present context, discomfort could be a key factor in determining the usage of emotion-aware VLE. As a result, students may hesitate to share academic emotions with others (Nassr et al., 2019). Based on the above arguments, we used discomfort as a critical factor to investigate students' attitude towards emotion-aware VLE, thus, we have posited the following hypothesis:

H_4: Discomfort has a negative influence on the attitude of students towards emotion-aware VLE in higher education.

Optimism

Parasuraman (2000) used the term 'optimism' to describe users with an optimistic way of looking at technology. This dimension influences users to

trust technology and leads them to believe that technology contributes to a more controllable, flexible, and efficient life. This factor could designate the positive view of emotion-aware VLE amongst students in higher education. Thus, optimism could have a positive significance on students' intentions to employ emotion-aware VLE. Optimism can be the engine of technology readiness (Parasuraman, 2000). Ambali (2009) concluded that intention of usage, actual usage, and continuity of usage of any technology, particularly for transactions, are determined collectively by optimism. Several studies have supported this argument such as Adams et al. (1992); Ambali (2009); Dorasamy et al. (2010); Igbaria et al. (1997); Ndubisi et al. (2001); Ramayah and Aafaqi (2004), advocating that optimism has a direct influence on user intention of technology usage and attitude. Caison et al. (2008) found that optimism influences the intention to employ specific technology positively. Furthermore, Kaliannan et al. (2010) stated that optimism has an influence on the usage behaviour of online systems. Accordingly, there is a possibility that optimism can affect students' attitude to use emotion-aware VLE. Hence, we have hypothesised as follows:

H_5: Optimism has a positive effect on students' attitude towards emotion-aware VLE

Innovativeness

Innovativeness refers to the feeling of mastering technology and being a leader in a specific technology (Parasuraman & Colby, 2015). This dimension measures the degree of people's capability to keep up with emerging technologies (Godoe & Johansen, 2012; Parasuraman & Colby, 2015). Innovativeness reflects technology pioneering, trying out new things (Lin & Hsieh, 2007), and having the willingness to use innovative technology (Boon-itt, 2015). In terms of measurement, innovativeness could be measured by indicators such as technical expertise and new technology acquisition. Nugroho (2015) used seven items to measure innovativeness that can be summarised as rapid familiarity with emerging technology, capability to develop personal skills to master it, and assist others with it. Furthermore, the innovativeness was measured with a 5-item scale (Rojas-Méndez et al., 2017), which is similar to the previously used 7-item scale. Expecting an association, this study investigated the influence of innovativeness on students' attitude towards emotion-aware VLE. Hence, we have hypothesised as follows:

H_6: Innovativeness has a positive effect on students' attitude towards emotion-aware VLE

METHOD AND MEASURES

For the empirical study, full-time students from two universities (one public and one private) in Kuala Lumpur were sought to participate in an online survey due to its convenience and cost-effectiveness. Cluster sampling was applied to select one public and one private university from the Kuala Lumpur region. The selection of the two universities served to represent the feedback of private and public universities. Selection of the two universities was based on how they were represented in terms of variances amongst students' backgrounds; their origin from almost all states in Malaysia and from foreign countries too. Also considered is the higher percentage of their utilisation of their respective universities' VLE compared to other universities in Kuala Lumpur.

The target population for this study was students who have experienced using their universities' VLE at least for one year. As this study is aimed at the general population of students, the non-probability sampling technique was applied (Hui, 2017). The sample was selected using the convenience sampling method from university students. The survey link was included in the two universities' VLE. The survey asked students to answer questions regarding their acceptance of emotion-aware capabilities if it were to be included in their universities' VLE systems. Initially, 137 responses were received. In order to control the bias factor, no incentives were given to the respondents. After an e-mail reminder, three weeks after the first announcement, 203 additional responses were obtained. Out of the 340 responses collected, 80 (i.e. incomplete responses, outliers, and unfamiliarity with VLE) responses were dropped. Table I provides the profile of the respondents.

Instrument Development

The constructs and the research model in Figure 1 were developed based on an extensive literature review, as reported above. The scales for TRI components (insecurity, discomfort, innovativeness, and optimism), attitude, and intention to use were adopted from prior studies, with minor modifications in terms of the language of the items in order to capture the constructs with regards to VLE users. The items employed to evaluate the construct "intention" were adopted from the literature (Bhattacherjee, 2001a, 2001b; Chatzoglou et al., 2009; Demet et al., 2011; Gunawan et al., 2019; Hung et al., 2014; Lee et al., 2011; Lee et al., 2009; Liu et al., 2010; Mohamed Noh et al., 2014; Roy et al., 2018) with minor modifications to fit the study context. Items of "attitude" were adopted from previous studies (Chatzoglou et al., 2009; Davis et al.,

1989; Demet et al., 2011; Lee, 2010; Nugroho & Fajar, 2017; Park, 2009; Roy et al., 2018; Venkatesh et al., 2003) with minor modifications to fit this study context. The scales for "lecturer interaction" were developed primarily from suggestions made by six users (one psychology professor and five regular VLE users) during face-to-face interviews.

The item questions were developed to be clear, simple, and free from overlaps. Indistinguishable and double-barreled questions were avoided (Creswell, 2013). For survey items development, researchers suggested that three to five-item questions per scale may provide adequate internal consistency (Hinkin et al., 1997). This study thus limited the number of items per construct to five items or less. To record the responses for each item, a five-point Likert scale was used, where 1 represents "Strongly Disagree" and 5 represents "Strongly Agree". This type of scale has a higher reliability coefficient than other scales (Hayes et al., 1998). Furthermore, Likert scales allow respondents to express their opinions in varying degrees. They allow researchers to examine the fractions of different responses for each measure. Finally, several demographic items were included in the questionnaire, which employed different measurement scales. For each variable, a minimum of ten respondents should be included for a representative sample (Nunnally & Bernstein, 1994).

Regarding reliability, this study followed the guidelines, tests, and values recommended by previous studies (Anderson & Gerbing, 1992; Fornell & Bookstein, 1982; Fornell & Larcker, 1981b; Hayes & Carr, 2015; Preacher & Hayes, 2004a, 2004b; Tavakol & Dennick, 2011; Yoo & Alavi, 2001). Therefore, the reliability of the questionnaire was established through internal consistency, construct reliability, indicator reliability, convergent reliability, and discriminate validity. In terms of data analysis and research model testing, we used Structural Equation Modelling (SEM). SEM is a statistical technique that incorporates factor analysis and path analysis (Qureshi & Compeau, 2009; Wetzels et al., 2009). The benefits of SEM compared with first-generation statistical techniques comprise more flexible assumptions wherein multicollinearity is partially allowed, and less measurement error with confirmatory factor analysis is applied (CFA) (Hong & Cha, 2013). Specifically, we tested the model through partial least squares (PLS) using SmartPLS 3.0 applying bootstrapping (Hong & Cha, 2013; Wetzels et al., 2009).

RESULTS

The respondents' information presented in Table 1 shows that the majority of respondents were males (68.5%), aged 18–24 years (43.8%) with undergraduate

qualifications (75.8%). Regarding the viewpoints of respondents towards accepting emotion-aware VLE, four questions were asked. The first question addressed whether the adoption of emotions in education process is preferable. The majority (79.2%) welcomed the consideration of emotions in education process. The second question served to find out if positive responses from lecturers towards students' emotions could encourage students to reveal emotions while using VLE. Respondents largely agreed to this question (81.1%).

Table 1

Respondents' Demography and their Perspective for Emotion-Aware VLE (N=260)

Item	Freq	%
Gender	Male:178	68.50
	Female: 82	31.50
Age	18-24Yrs: 114	43.80
	25-30Yrs: 67	25.80
	31+ years: 79	30.40
Study level	Undergraduate: 197	75.80
	Postgraduate: 63	24.20
The most effective emotion recognition	Facial recognition: 174	66.90
	Keyboard usage pattern and keypress: 52	19.90
	Mouse movement pattern: 44	16.90
	Voice: 151	58.00
	Textual message exchange with lecturers: 105	40.40

Measurement Model Assessment

Cronbach's alpha, along with composite reliability, was used to determine the internal consistency of the items. The results, as summarised in Table 2, show that all composite reliability values exceeded the recommended threshold of 0.7 (Fornell & Larcker, 1981a). However, Cronbach's alpha values for certain indicators were below 0.7 (DIS and INS). A low alpha appears due

to test length and dimensionality (Tavakol & Dennick, 2011). Therefore, all of the items were considered reliable. Additionally, this study evaluated the convergent validity of the items by calculating the Average Variance Extracted (AVE). Table 2 portrays that for all constructs, the AVE values were higher than 0.5, inferring adequate convergent validity (Yoo & Alavi, 2001). This study also evaluated the discriminant validity by comparing the square root of AVE for each construct with its cross-correlation with other constructs. The results supported the discriminant criteria set for all constructs. In all cases, the values of the diagonal elements in the matrix (the square root of AVE) were higher than the off-diagonal elements in the corresponding rows and columns (see Table 2).

Table 2

Reliability and Convergent Validity Assessment of the Measurement Model

Construct	Mean	SD	Alpha	C.R	AVE	1	2	3	4	5	6	7
1. ATT	3.79	.93	0.87	0.91	0.79	**0.89**						
2. DIS	3.08	.90	0.67	0.79	0.56	-0.10	**0.75**					
3. INN	3.49	.87	0.79	0.86	0.61	0.53	0.08	**0.78**				
4. INS	3.19	.82	0.67	0.82	0.60	-0.14	0.56	0.11	**0.77**			
5. ITU	3.74	.92	0.86	0.91	0.78	0.77	-0.02	0.57	-0.05	**0.88**		
6. LI	3.97	.89	0.86	0.92	0.78	0.63	0.04	0.51	0.02	0.71	**0.88**	
7. OPT	3.73	.87	0.84	0.90	0.68	0.72	0.08	0.58	0.03	0.71	0.59	**0.83**

Note: 1. ATT: Attitude; 2. DIS: Discomfort; 3. INN: Innovativeness; 4. INS: Insecurity; 5. ITU: Intention To Use; 6. LI: Lecturer Interaction; 7. OPT: Optimism. The principal diagonal (boldface) of the inter-correlation matrix represents the square root of the average variance extracted (AVE) per construct.

Finally, this study verified the convergent validity of items using the factor and cross-loadings of all indicator items in relation to their respective latent constructs. The results are summarised in Table 3, indicating that all items were loaded (except INS1 and DIS4 with a low value) (i) on their respective constructs with a factor between 0.58 and 0.915 and (ii) more highly on their respective constructs than on any other construct. Furthermore, all factor loadings were highly significant (t-statistics > 3.419, $p < 0.001$) based on the SmartPLS output, which showed that the indicators represent considerably distinct latent constructs.

Structural Model Assessment

The evaluation of the structural model involved estimation of the path coefficients and R^2 values. To calculate the effect of mediation in the research model, we consecutively assessed two separate structural models: the unmediated model and the mediated model. Table 4 illustrates the unmediated structural model results with the b values of all path coefficients. We found that innovativeness (INN) (b = 0.199, t-statistic = 3.829, $p < 0.01$) and optimism (OPT) (b = 0.613, t-statistic = 11.906, $p < 0.01$) positively affected attitude, whereas insecurity (INS) (b = -0.124, t-statistic = 2.3, $p < 0.05$) negatively affected attitude. However, the data did not allow us to conclude that discomfort (DIS) had a significant influence (b = -0.1, t-statistic = 1.628, n.s.) on attitude. On the other hand, attitude (ATT) was found to significantly and positively influence intention to use (ITU) (b = 0.774, t-statistic = 19.486, $p < 0.01$). The R^2 for attitude was 0.572, reflecting that the variation in the given TRI factors explained 57 percent of the total variance of attitude, whereas R^2 for intention to use reflected that attitude explained 60 percent of variance for intention to use.

Table 3

Reliability Assessment: The Cross-Loading Matrix where all items are Loaded to their Factors.

	ATT	DIS	INN	INS	ITU	OPT	LI
ATT1	**0.89**	-0.10	0.48	-0.13	0.71	0.65	0.59
ATT2	**0.89**	-0.08	0.48	-0.11	0.67	0.63	0.51
ATT3	**0.89**	-0.08	0.46	-0.12	0.68	0.62	0.57
DIS1	-0.11	**0.92**	0.02	0.43	-0.05	0.02	0.00
DIS2	-0.04	**0.68**	0.11	0.55	0.02	0.12	0.07
DIS3	-0.04	**0.62**	0.16	0.39	0.03	0.14	0.07
INN1	0.22	0.17	**0.58**	0.18	0.26	0.26	0.20
INN2	0.57	0.03	**0.86**	-0.02	0.57	0.55	0.50
INN3	0.32	0.09	**0.82**	0.18	0.37	0.41	0.38
INN4	0.42	0.04	**0.84**	0.12	0.47	0.50	0.42
INS2	-0.09	0.43	0.07	**0.75**	0.01	0.05	-0.06

(continued)

	ATT	DIS	INN	INS	ITU	OPT	LI
INN3	0.32	0.09	**0.82**	0.18	0.37	0.41	0.38
INN4	0.42	0.039	**0.84**	0.12	0.47	0.50	0.42
INS2	-0.09	0.43	0.08	**0.76**	0.01	0.05	-0.06
INS3	-0.11	0.38	0.08	**0.82**	-0.09	-0.00	0.03
INS4	-0.11	0.48	0.11	**0.74**	-0.01	0.03	0.07
ITU1	0.70	-0.01	0.51	-0.01	**0.88**	0.62	0.61
ITU2	0.70	-0.09	0.45	-0.11	**0.90**	0.63	0.60
ITU3	0.65	0.04	0.54	0.00	**0.87**	0.62	0.65
OPT1	0.62	0.05	0.52	0.03	0.59	**0.84**	0.53
OPT2	0.63	0.06	0.51	0.04	0.65	**0.88**	0.53
OPT3	0.47	0.15	0.45	0.06	0.45	**0.74**	0.43
OPT4	0.62	0.04	0.43	-0.02	0.61	**0.84**	0.45
LI1	0.57	-0.02	0.40	-0.01	0.64	0.58	**0.88**
LI2	0.62	0.07	0.51	0.02	0.64	0.52	**0.91**
LI3	0.46	0.06	0.45	0.04	0.58	0.46	**0.85**

Note: ATT: Attitude; DIS: Discomfort; INN: Innovativeness; INS: Insecurity; ITU: Intention to use; LI: Lecturer Interaction; OPT: Optimism.

Figure 1 reveals the mediated structural model results with the b values (t-values) of all inner paths. The results portrayed consistency with the unmediated model. After controlling the lecturer interaction, attitude maintained its significant direct effect on intention to use ($b = 0.547$, t-statistic $= 7.31$, $p < 0.001$). Finally, this study found a significant positive effect of lecturer interaction on the intention to use ($b = 0.362$, t-statistic $= 5.08$, $p < 0.001$), which is necessary to support the hypotheses regarding the indirect influence of attitude on intention to use by means of lecturer interaction. R^2 for intention to use was 0.68, which is higher than the 0.60 value found in the unmediated model, implying that the mediated model has a better predictive power than the original model.

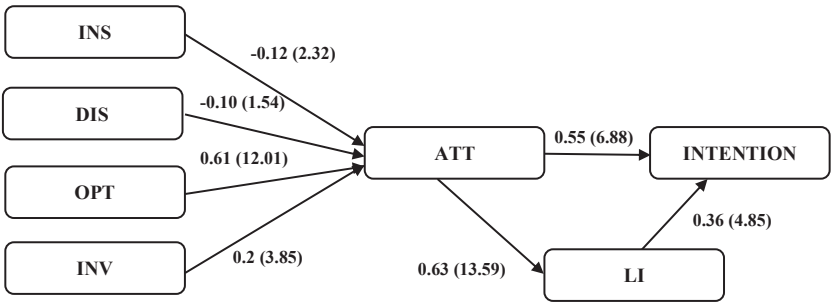

Figure 1. *The results of the mediated research model: inner model's values presented as: b value (t-value).*

Note: ATT: Attitude; DIS: Discomfort; INV: Innovativeness; INS: Insecurity; LI: Lecturer Interaction; OPT: Optimism

Considering the results from the mediated model, this study further examined the mediating effects of lecturer interaction following the steps of Preacher and Hayes (2004b) (see Table 4). Table 4 presents the results of the relevant analysis in order to confirm the mediational hypotheses. Lecturer interaction was found to partially mediate the pathway between students' attitude and students' intention to use VLE.

Table 4

Summary of the Results of the Unmediated Model.

Hypothesis	Effect	Coefficient	S.E.	T-Values	Conclusion
H3	INS -> ATT	-0.12	0.05	2.30**	Supported
H4	DIS -> ATT	-0.10	0.06	1.63	Not Supported
H5	OPT -> ATT	0.61	0.05	11.91***	Supported
H6	INN -> ATT	0.20	0.05	3.83***	Supported
H1	ATT -> ITU	0.77	0.04	19.49***	Supported

**$p < 0.05$.

***$p < 0.01$

Note: ATT: Attitude; DIS: Discomfort; INN: Innovativeness; INS: Insecurity; ITU: Intention to use; OPT: Optimism.

In addition, a bootstrap estimate of indirect effects was conducted at 95 percent confidence interval on 5000 bootstrap samples (Preacher & Hayes, 2004b). Since zero was not in the 95 percent CI [0.15, 0.31], attitude was found to have a significant indirect effect on intention to use through lecturer interaction (Preacher & Hayes, 2004b). The amount of mediation was regularly worded as the reduction of the effect of initial variable (attitude) on the outcome (intention to use) or the difference between the total effect and direct effect. Baron and Kenny (1986) suggested that a small effect size would be |ab| = 0.01, medium size would be |ab| = 0.09, and large size would be |ab| = 0.25. In our results, attitude showed a value of 0.25, which represents a large effect. Hence, H2 has been supported.

Coefficient of Determination: R^2 Value

R^2 indicates the amount of variance of dependent construct, which is explained by the independent constructs. The larger the R^2 value, the higher the predictive ability of the structural model. It is essential to ensure that R^2 should be high enough for the model to attain a minimum level of explanatory power (Urbach & Ahlemann, 2010b). Falk and Miller (1992) recommended that R^2 should be greater than 0.10 in order to explain the variance of a particular endogenous construct to be considered adequate. Cohen (1988b) suggested that R^2 is substantial when it is greater than 0.26. According to Chin (1998), R^2 is substantial when it is greater than 0.65. However, Hair et al. (2013) recommended that R^2 has to be larger than 0.75 in order to be perceived as substantial. Table 5 shows the results of R^2 from the structural model, indicating that all the R^2 values are high enough for the model to attain an acceptable level of explanatory power. Note that the variance explained in the endogenous construct's intention to use (ITU) was 0.68 (68%) by ATT and LI.

Table 5

Coefficient of Determination Result R^2

exogenous construct	endogenous construct	R^2	Cohen (1988b)	Chin (1998)	Hair et al., (2013)
INS, DIS, OPT, INN	ATT	0.57	Substantial	Moderate	Moderate
ATT	LI	0.39	Substantial	Moderate	Moderate
ATT. LI	ITU	0.68	Substantial	Substantial	Moderate

Note: ATT: Attitude; DIS: Discomfort; INN: Innovativeness; INS: Insecurity; ITU: Intention To Use; LI: Lecturer Interaction; OPT: Optimism.

Effect Size f^2

This study also assessed the effect size (f^2). An effect size (f^2) determines whether an exogenous latent construct has a substantial, moderate, or weak impact on an endogenous latent construct (Gefen & Rigdon, 2011). Hair et al. (2017) recommended to test the change in R^2 values while Cohen (1988) suggested a guideline to measure the magnitude of f^2, which is 0.35 (large effects), 0.15 (medium effects), and 0.02 (small effects). Table 6 shows the results of f^2.

Table 6

Effect Size f^2

Exogenous construct	endogenous construct ATT	endogenous construct LI	endogenous construct ITU
OPT	0.58		
INN	0.06		
INS	0.03		
DIS	0.02		
ATT		0.64	0.57
LI			0.25

Note: ATT: Attitude; DIS: Discomfort; INN: Innovativeness; INS: Insecurity; ITU: Intention To Use; LI: Lecturer Interaction; OPT: Optimism.

Predictive Relevance (Blindfolding) Q2

This study examined the power of the proposed model in terms of predictive relevance. As recommended by Hair et al. (2017), the blindfolding procedure should be applied on the endogenous constructs with a reflective measurement. If the value of Q^2 is greater than 0, then the predictive relevance of the proposed model exists for a certain endogenous construct (Fornell & Cha, 1994; Hair et al., 2017; Sarr & Ba, 2017). Table 7 shows that all the values of Q^2 ranged from 0.300 to 0.521, indicating an adequate predictive relevance to the proposed model. For the Q^2 values, Hair et al. (2017) suggested 0.35 (to be large), 0.15 (to be medium), and 0.02 (to be small), as relative measures of predictive relevance. Then, the results of this study showed that all exogenous constructs have large predictive relevance.

Table 7

Predictive Relevance (Blindfolding) Q^2

endogenous construct	Q^2
ATT	0.44
Li	0.30
ITU	0.52

Note: ATT: Attitude; DIS: Discomfort; INN: Innovativeness; INS: Insecurity; ITU: Intention To Use; LI: Lecturer Interaction; OPT: Optimism.

DISCUSSIONS

To fulfil the objective, this study analysed the cause-and-effect relationships between TRI constructs, attitude, and intention to use. Studies have often considered TRI individually or with TAM, with the exclusion of attitude to demonstrate students' acceptance of technology from perceived usefulness and ease of use. However, our results revealed that the impact of TRI on students' attitude was different where discomfort was less significant, though the context was emotion-aware VLE. Apart from that, the mediation role of lecturer interaction showed a significant influence on students' attitude and intention to use. The results have mostly supported the research model (Figure 1) along with several hypotheses (H_1, H_3, H_5, and H_6). The results have further confirmed the significant mediation effects of lecturer interaction thereby supporting hypothesis H2.

In both models (unmediated and mediated), we found that the insecurity of TRI had a negative influence on intention to use. However, compared with other positive factors (innovativeness and optimism), it had less impact on attitude. On the other hand, the second negative TRI factor, discomfort, had an insignificant effect on attitude. The low impact of negative factors, particularly discomfort, is probably the outcome of the changes in students' perspective of showing emotions and sharing them with others (lecturers in particular). A likely reason for the insignificant influence of discomfort could be the familiarity of the study respondents with VLE, which diminished their feelings of discomfort. The students have been interacting with the system for a long time, which probably reduced the sensitivity towards technology, though they knew it might capture their emotions. Furthermore, insecurity, in contrast to discomfort, was found to influence attitude, although the impact was less powerful compared with other influential factors. This showed that the students did consider the negative impact of emotion-aware VLE. Yet,

it did not stop them from using the technology. Overall, respondents tended to be neutral with all indicators of insecurity. With regards to the positive factors, optimism had more influence compared to innovativeness. In terms of their effects on attitude, f^2 of optimism was 0.58 while f^2 of innovativeness was 0.06. According to Cohen (1988), the f^2 value of optimism is classified as having a large effect, whereas f^2 value of innovativeness is classified as having a small effect.

The mediated model showed that TRI dimensions and attitude have an inseparably close association. This finding is in line with studies investigating the impact of emotions and the role of lecturers on students' attitude (Arguedas et al., 2016; Hernández-Amorós & Urrea-Solano, 2017; Krithika & Priya, 2016; Uziak et al., 2018). Furthermore, lecturer interaction towards students' emotions contributes significantly and positively to students' attitude change towards the use of emotion-aware VLE. This finding confirms the suggestions of Nortvig et al. (2018); Uziak et al. (2018) who advocated the role of lecturers in influencing students' perception. Empirically, this study found a strong mediation role of lecturer interaction in advancing students' attitude towards the intention to use emotion-aware VLE. As such, this study has empirically supported the findings of Hernández-Amorós and Urrea-Solano (2017) indicating that lecturer interaction with students' emotions has a high probability of encouragement for students to engage in the education process.

As for insecurity, this study concluded that it has a negative impact on attitude. Education institutions could enhance the quality of VLE and motivate lecturers to interact more with it, to be on par with students. This, in turn, could make the students feel more secure in using VLE. It was noticed that discomfort is not a serious threat due to its insignificant impact on attitude. Apart from that, a large contribution of optimism on attitude was found (the mean value of innovativeness was 3.49, while the mean value of optimism was 3.72). This indicates that innovativeness, which is more related to technical skills and competency, is not a major concern. Underestimating innovativeness was high across the sample, probably because students have adequate technical skills required to use any technology employed in their education effectively. Optimism, which measures students' expectations of the contribution quality of emotion-aware VLE, is more important for the students. This could be interpreted to conclude that students are more interested in technology, which makes a difference in their education process.

Finally, the mediation role of lecturer interaction towards students' attitude to use emotion-aware VLE was notable. This indicates that students take into consideration the role of lecturers in building their motivation to use emotion-

aware VLE. This high dependence on the role of lecturer interaction emphasises the fact that students realise there is no value to interact with the system and show real emotions when those emotions are not considered. This means that emotion-aware VLE needs to accommodate two-way involvement whereby students and lecturers must participate equally. This is where students could show emotions to lecturers who, in turn, could consider students' emotions in developing curriculum content, teaching approach, and assessment strategies.

CONCLUSION

Intelligent VLE with capabilities to recognise emotions is being widely investigated as a means to reveal students' emotions toward lecturers. The intelligent VLE compensates for the missing face-to-face interaction in an online environment by delivering emotions, while assisting students who remain reluctant in showing emotions in face-to-face interactions. At the same time, it provides lecturers with emotions record for every student which can assist them in adjusting teaching approaches that fit specific student groups.

Presently, electronic learning, along with blended learning environment, is witnessing constant growth. Such changes have prompted researchers to introduce improvements in VLE systems in terms of understanding students' emotions. Nevertheless, lack of studies evaluating students' perception, attitude, and intention of using emotion-aware VLE, particularly the negative perception regarding technology, remain an obstacle to the plans of integrating emotion recognition tools with VLE. Therefore, to bridge the gaps in the body of knowledge, this paper examined the associations amongst dimensions of TRI, attitude, intention to use, and lecturer interaction. Thus, this empirical study examined the direct effects of identified constructs and the indirect effects of using lecturer interaction as a mediator.

We developed a novel integrated framework and used quantitative primary data to find that insecurity had a significant negative influence on attitude, while innovativeness and optimism had a significant positive influence on attitude, which, in turn, had a significant effect on intention to use. Furthermore, an examination of the mediating effect using the mediated model indicates that lecturer interaction partially mediated the effect of attitude on intention to use VLE. From the results of the unmediated and mediated effects of attitude on intention to use, we concluded that while there was a positive relationship between attitude and intention to use, this linkage was also mediated by lecturer interaction in an emotion-aware VLE. Therefore, efforts made by universities to increase lecturer interaction with VLE may improve students' interactions with the software, and consequently increase their intention to use.

In terms of contribution, we provided new and interesting insights into the theoretical intersections amongst TRI, attitude, lecturer interaction, and intention to use. Unlike other research, this research found certain components of TRI as inhibitors of students' attitudes. Insecurity was found to have a negative effect on attitude, and attitude was found to significantly and positively impact intention to use. The findings further revealed that the relationship between attitude and intention to use was mediated significantly by lecturer interaction in the context of an emotion-aware VLE. In addition, this research contributed knowledge to the lack of conceptualisation in the intersections between TRI, attitude, and intention to use within the context of emotion-aware VLE. It contributed by confirming the mediating role of lecturer interaction between attitude and intention to use, which was barely investigated in previous studies. Consequently, this research found a strong positive relationship between attitude and intention to use with and without the mediation of lecturer interaction.

Furthermore, negative components of TRI (i.e., insecurity and discomfort) were found to have a negative influence on students' intention to use (discomfort had insignificant negative influence). This provided significant new insights on the effects of personal dimensions of students with technology (which is TRI), rather than that of technology features (such as ease of use and usefulness). Personal fear towards interacting with technology with regards to students' emotions was found to have diminished compared to the past (since Parasuraman (2000) developed the TRI scale). Students no longer perceive VLE usage as a problem, though they are aware that it may capture their emotions, recognise them, and deliver them to lecturers.

On top of the above, this study has provided practical suggestions for education management in universities that use VLE for blended and/or online learning. The mediating role of lecturer interaction in the relationship between students' attitude and intention to use has suggested that the use of VLE by students can increase by encouraging lecturers to increase their interactions with VLE. This helps to perceive students' emotions, consider them, and adjust teaching strategies and materials accordingly. This should improve students' attitude to use VLE, which will eventually boost their intention to use it.

Based on the findings, we recommend that education institutions need to ensure that their VLEs are integrated with emotion-capturing tools, particularly those that capture emotions via facial recognition (as the majority of respondents voted highly for this technology in comparison with other tools). In addition, the role of lecturer interaction is equally essential for students' intention to use emotion-aware VLE. Students perceive this as significant, hence, it can enhance

their attitude towards VLE and increase their intention to use it effectively. From a managerial perspective, to increase students' positive attitude towards the intention to use emotion-aware VLE, an education institution may consider ways to train and motivate lecturers to deal with students' emotions to increase their involvement in VLE. Additionally, practitioners should make efforts to mitigate the inhibitors of TRI (discomfort and insecurity) in order to enhance students' attitude to engage more with VLE. As an alternative to improve VLE use, institutions could reduce insecurity (as it has a negative impact on attitude) by making VLE and their online platforms secure and safe for students.

Regarding limitations, the first shortcoming in this study was the use of respondents from a specific area (Kuala Lumpur, Malaysia). Although statistically sound, this could make our results less generalisable. Hence, it is recommended that future research could include a broader and more diversed sample to overcome this limitation. Secondly, the research model may have neglected other antecedents (apart from lecturer interaction), which could influence the use of VLE. Although the findings showed that the intention to use emotion-aware VLE was significantly determined by lecturer interaction, the dependent variable could be affected by other factors such as university support and students' performance, which may also be correlated with lecturers' interaction. Future research could integrate other relevant constructs into this study model to improve its predictive power. Furthermore, this study failed to consider other factors of TAM, such as usefulness and ease of use, which could be accommodated by future research to explain the intention to use VLE by employing an exhaustive list of factors.

ACKNOWLEDGEMENT

This work was supported by the STRG grant of UniKL, Malaysia, strg17025, 2017.

REFERENCES

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS Quarterly*, 227-247.

Ahmed, A., Abdulahi, Zakaria, N. H., & Elmi, A., Hussein. (2012). An evaluation of virtual learning environment readiness in Higher Education Institutions (HEIs). *Journal of Information Systems Research and Innovation*, 86-94.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Al-Hujran, O., Al-Debei, M. M., Chatfield, A., & Migdadi, M. (2015). The imperative of influencing citizen attitude toward e-government adoption and use. *Computers in Human Behavior, 53*, 189-203.

Alateyah, S., Crowder, R. M., & Wills, G. B. (2013). Factors affecting the citizen's intention to adopt e-government in Saudi Arabia. *International Journal of Social, Human Science and Engineering, 7*(9), 80-85.

Alenezi, A. R., Abdul Karim, A. M., & Veloo, A. (2010). An empirical investigation into the role of enjoyment, computer anxiety, computer self-efficacy and Internet experience in influencing the students' intention to use e-learning: A case study from Saudi Arabian governmental universities. *The Turkish Online Journal of Educational Technology, 9*(4), 22-34.

Alharbi, N. S. S. (2016). *The role of security and its antecedents in e-government adoption.* University of Plymouth.

Almarabeh, T. (2014). Students' perceptions of E-Learning at the University of Jordan. *iJET, 9*(3), 31-35.

Alotaibi, R., Sandhu, K., & Houghton, L. (2014). A study of service users' attitudes towards e-government initiatives in the Kingdom of Saudi Arabia. *IJCSIT) International Journal of Computer Science and Information Technologies, 5*(6), 6892-6901.

Alzahrani, Alharthi, A., Alassafi, M., Albugmi, M., Walters, R., & Wills, G., B. (2018). A framework for gamified e-learning systems acceptance in Saudi Arabian universities: Gamified e-learning systems. *International Journal of Advances in Electronics and Computer Science, 5*(4), 33-37.

Ambali, A. R. (2009). E-government policy: Ground issues in e-filing system. *European Journal of Social Sciences, 11*(2), 249-266.

Anderson, J., C, & Gerbing, D. W. (1992). Assumptions and comparative strengths of the two-step approach: Comment on Fornell and Yi. *Sociological Methods & Research, 20*(3), 321–333.

Arguedas, Daradoumis., & Xhafa. (2016). Analyzing the effects of emotion management on time and self-management in computer-based learning. *Computers in Human Behavior,* (63), 517-529.

Artino Jr, A., R. (2012). Emotions in online learning environments: Introduction to the special issue. *Internet and Higher Education,* (137–140), 137–140.

Astuti, N. C., & Nasution, R. A. (2014). Technology readiness and e-commerce adoption among entrepreneurs of SMEs in Bandung City, Indonesia. *Gadjah Mada International Journal of Business, 16*(1), 69-88.

Baron, R., M, & Kenny, D., A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *J. Pers. Soc. Psychol, 51*, 1173–1182.

Berdykhanova, D., Dehghantanha, A., & Hariraj, K. (2010). *Trust challenges and issues of e-government: E-tax prospective* [Paper presentation]. International Symposium on Information Technology (ITSim), 2010, Kuala Lumpur, Malaysia.

Bessadok, A. (2000). Classification of student's belief based on their technology readiness for an e-learning system.

Bhattacherjee, A. (2001a). An empirical analysis of the antecedents of electronic commerce service continuance. *Decision Support Systems, 32*(2), 201-214.

Bhattacherjee, A. (2001b). Understanding information systems continuance. An expectation-confirmation model. *MIS Quarterly, 25*(3), 351-370.

Boon-itt, S. (2015). Managing self-service technology service quality to enhance. *International Journal of Quality and Service Sciences Managing, 7*(4), 373-391. https://doi.org/10.1108/IJQSS-01-2015-0013

Buenaventura-Vera, G. (2017). The impact of leader self-efficacy on the characteristics of work teams. *Intangible Capital, 13*(4), 824-849. https://doi.org/10.3926/ic.938

Buyle, R., Compernolle, M., Van, Vlassenroot, E., Vanlishout, Z., Mechant, P., & Mannens, E. (2018). "Technology readiness and acceptance model" as a predictor for the use intention of data standards in smart cities. *Media and Communication, 6*(4), 127–139.

Caballé, S. (2015). *Towards a multi-modal emotion-awareness e-learning system* [Paper presentation]. International Conference on Intelligent Networking and Collaborative Systems, Taipei, Taiwan.

Caison, A. L., Bulman, D., Pai, S., & Neville, D. (2008). Exploring the technology readiness of nursing and medical students at a Canadian University. *Journal of Interprofessional Care, 22*(3), 283-294.

Chatzoglou, P., D, Sarigiannidis, L., Vraimaki, E., & Diamantidis, A. (2009). Investigating Greek employees' intention to use web-based training. *Computers & Education* (53), 877-889.

Chen, G., Wang, F., & Zhang, C. (2009). Collaborative filtering using orthogonal nonnegative matrix tri-factorization. *Information Processing & Management, 45*(3), 368-379.

Claudy, M., C, Peterson, M., & O'Driscoll, A. (2013). Understanding the attitude-behavior gap for renewable energy systems using behavioral reasoning theory. *Journal of Macromarketing, 33*(4), 273-287. https://doi.org/10.1177/0276146713481605

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage Publications.

Dahlan, N., Ramayah, T., & Mei, L. L. (2002). *Readiness to adopt data mining technologies: An exploratory study of telecommunication employees in Malaysia.* [Paper presentation]. International Conference on Practical Aspects of Knowledge Management, Vienna, Austria.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982-1003.

Demet, K., Cigdem, A. G., & Fethi, C. (2011). Factors affecting the intention to use a web-based learning system among blue-collar workers in the automotive industry. *Computers in Human Behavior,* (27), 343-354.

Dorasamy, M., Marimuthu, M., Jayabalan, J., Raman, M., & Kaliannan, M. (2010). Critical factors in outsourcing of accounting functions in Malaysian Small Medium-Sized Enterprises (SMEs). *Kajian Malaysia: Journal of Malaysian Studies, 28*(2).

El-Kasheir, D., Ashour, A. S., & Yacout, O. M. (2009). Factors affecting continued usage of internet banking among Egyptian customers. *Communications of the IBIMA, 9*, 252-263.

Endratno, H. (2018). *Technology Readiness Model (TRM) dan Technology Acceptance Model (TAM) Dalam memprediksi niat individu dalam menggunakan e-learning* [Paper presentation]. Conference In Business, Accounting, and Management (CBAM).

Erdog˙mus, Nihat., & Esen, M. (2011). An investigation of the effects of technology readiness on technology acceptance in e-HRM. *Procedia Social and Behavioral Sciences, 24*, 487–495.

Feidakis, M. (2016). A review of emotion-aware systems for e-learning in virtual environments. In *Formative Assessment, Learning Data Analytics and Gamification* (pp. 217-241). Elsevier.

Feidakis, M., Daradoumis, T., Caballé, S., & Conesa, J. (2014). Embedding emotion awareness into e-learning environments. *iJET, 9*(7), 39-46.

Feidakis, M., Daradoumis, T., & Caballé, S. (2011). *Endowing e-learning systems with emotion awareness* [Paper presentation]. 2011 Third International Conference on Intelligent Networking and Collaborative Systems, Fukuoka, Japan.

Fornell, C., & Bookstein, F. L (1982). Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research*, 440-452.

Fornell, C., & Cha, J. (1994). Partial Least Squares. *Advanced Methods of Marketing Research, 407* 52-78.

Fornell, C., & Larcker, D. F. (1981a). Evaluating structural equation models with unobservable variables and measurement error. *J. Marketing Res, 18*(1), 39–50.

Fornell., & Larcker, D. F. (1981b). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 382-388.

Godoe, P., & Johansen, T., S. (2012). Understanding adoption of new technologies: Technology readiness and technology acceptance as an integrated concept. *Journal of European Psychology Students,* (3), 38-52.

Gómez-Díaz, M., Delgado-Gómez, M., Soledad, & Gómez-Sánchez, R. (2017). Education, emotions and health: Emotional education in Nursing. *Procedia - Social and Behavioral Sciences,* (237), 492 – 498.

Guhr, N., Loi, T., Wiegard, R., & Breitner, M. H. (2013). *Technology readiness in customers' perception and acceptance of m (obile)-payment: An empirical study in Finland, Germany, the USA and Japan* [Paper presentation]. Wirtschaftsinformatik.

Gunawan, H., Sinaga, B., Langgu., & WP, S., Purnomo. (2019). Assessment of the readiness of micro, small and medium enterprises in using e-money using the Unified Theory of Acceptance and Use of Technology (UTAUT) Method. *Procedia Computer Science* (161), 316–323. https://doi.org/10.1016/j.procs.2019.11.129

Hair., Hult., Ringle., & Sarstedt. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM) (2nd ed.)*. Sage.

Hallikainen, H., & Laukkanen, T. (2016). *How technology readiness explains acceptance and satisfaction of digital services in b2b healthcare sector?* [Paper presentation]. PACIS 2016 Proceedings.

Harley, J. M., Lajoie, S. P., Frasson, C., & Hall, N. C. (2015). An integrated emotion-aware framework for intelligent tutoring systems. In C. C. e. al (Ed.), *AIED 2015, LNAI 9112* (pp. 616–619). Springer International Publishing.

Harley, J. M. (2015). Measuring emotions: A survey of cutting-edge methodologies used in computer-based learning environment research. In S. T. M. Gartmeier (Ed.), *Emotions, Technology, Design, and Learning* (pp. 89-114). Academic Press, Elsevier.

Hayes, B. E., Perander, J., Smecko, T., & Trask, J. (1998). Measuring perceptions of workplace safety: Development and validation of the work safety scale. *Journal of Safety Research, 29*(3), 145-161.

Hayes, R., & Carr, C. (2015). Does being social matter? Effects of enabled commenting on credibility and brand attitude in social media. *Journal of Promotion Management, 21*, 371–390.

Hernández-Amorós, M. J., & Urrea-Solano, M. E. (2017). Working with emotions in the classroom: Future teachers' attitudes and education. *Procedia - Social and Behavioral Sciences* (237), 511 – 519.

Hinkin, T., R, Tracey, J. B., & Enz, C., A. (1997). Scale construction: Developing reliable and valid measurement instruments. *Journal of Hospitality & Tourism Research, 21*(1), 100-120.

Hong., & Cha, H. (2013). The mediating role of consumer trust in an online merchant in predicting purchase intention. *International Journal of Information Management,* (33), 927–939.

Hüer, L. (2015). *Influence of technology readiness and age on a physician's intention to prescribe the artificial pancreas.* University of Twente.

Hui, T., Xue. (2017). The effect of source credibility on consumers' purchase intention in Malaysia online community. *Journal of Arts & Social Sciences, 1*(1), 12-20.

Hung, W.-H., Chang, L.-M., Lin, C.-P., & Hsiao, C.-H. (2014). E-readiness of website acceptance and implementation in SMEs. *Computers in Human Behavior,* (40), 44–55. https://doi.org/10.1016/j.chb.2014.07.046

Igbaria, M., Zinatelli, N., Cragg, P., & Cavaye, A. L. (1997). Personal computing acceptance factors in small firms: A structural equation model. *MIS Quarterly*, 279-305.

Jan, P.-T., Lu, H.-P., & Chou, T.-C. (2012). The adoption of e-learning: An institutional theory perspective. *OJET: The Turkish Online Journal of Educational Technology, 11*(3), 326-343.

Kaliannan, M., Raman, M., & Dorasamy, M. (2010). Assessing e-government services: The case of e-filing of personal income tax in Malaysia, *Citizens and E-Government: Evaluating Policy and Management, 17.*

Krithika, L. B., & Priya, L. G. G. (2016). Student Emotion Recognition System (SERS) for e-learning improvement based on learner concentration metric. *Procedia Computer Science,* (85), 767 – 776.

Kuo, K.-M., Liu, C.-F., & Ma, C.-C. (2013). An investigation of the effect of nurses' technology readiness on the acceptance of mobile electronic medical record systems. *BMC Medical Informatics and Decision Making, 13*(1), 88.

Larasati, N., Widyawan, & Santosa, P. (2017). Technology readiness and technology acceptance model in new technology implementation process in low technology SMEs. *International Journal of Innovation, Management and Technology, 8*(2), 113-117.

Lee, H., & Doh, Y. Yim. (2012). *A study on the relationship between educational achievement and emotional engagement in a gameful interface for video lecture systems* [Paper presentation]. 2012 International Symposium on Ubiquitous Virtual Reality, Daejeon, South Korea.

Lee, H., Hsieh, Y., C., & Ma, C. Y. (2011). A model of organizational employees' e-learning systems acceptance. *Knowledge-Based Systems,* (24), 355-366.

Lee, H., Yoon, J., O., & Lee, I. (2009). Learners' acceptance of e-learning in South Korea: Theories and results. *Computers & Education,* (53), 1320-1329.

Lee, H., M., C. (2010). Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation-confirmation model. *Computers & Education,* (54), 506-516.

Lehman, B., D'Mello, S., & Graesser, A. (2012). Confusion and complex learning during interactions with computer learning environments. *Internet and Higher Education,* (15), 184–194.

Lin, A., & Chen, N., -C. (2012). Cloud computing as an innovation: Perception, attitude, and adoption. *Int. J. Inf. Manag, 32*(6), 533–540.

Lin, J. S. C., & Hsieh, P. L. (2007). The influence of technology readiness on satisfaction and behavioral intentions toward self-service technologies. *Computers in Human Behavior, 23*(3), 1597-1615. https://doi.org/10.1016/j.chb.2005.07.006

Liu, I. F., Chen, M. C., Sun, Y. S., David, W. C., & Kuo, C. H. (2010). Extending the TAM model to explore the factors that affect intention to use an online learning community. *Computers & Education, 54*(2), 600-610.

Marchand, G. C., & Gutierrez, A. P. (2012). The role of emotion in the learning process: Comparisons between online and face-to-face learning settings. *Internet and Higher Education,* (15), 150–160.

Mariethoz, G., Renard, P., & Straubhaar, J. (2010). The direct sampling method to perform multiple-point geostatistical simulations. *Water Resources Research, 46*(11).

Marto, A., Gonc¸alves, A., Martins, J., & Bessa, M. (2019). *Applying UTAUT model for an acceptance study alluding the use of augmented reality in archaeological sites* [Paper presentation]. VISIGAPP 2019, Prague, Czech Republic.

Massey, A. P., Khatri, V., & Ramesh, V. (2005). *From the web to the wireless web: Technology readiness and usability* [Paper presentation]. HICSS'05: Proceedings of the 38th Annual Hawaii International Conference on System Sciences, Big Island, Hawaii.

Mohamed Noh, N., Mustafa, H. M., Ahmad., & Che Ahmad, C. N. (2014). Predictive relationship between technology acceptance readiness and the intention to use Malaysian eduwebTV among library and media teachers. *Procedia - Social and Behavioral Sciences,* (116), 144 – 148. https://doi.org/10.1016/j.sbspro.2014.01.182

Napitupulu, D. (2017). A Conceptual Model of E-Government Adoption in Indonesia. *International Journal on Advanced Science, Engineering and Information Technology, 7*(4), 1471-1478.

Nassr, R., M, Saleh, A., Hadi, Dao, H., & Saadat, M. N. (2019). Emotion-aware educational system: The lecturers and students perspectives in Malaysia. In I. R. Lee S., Choo H. (Ed.), *Proceedings of the 13th International Conference on Ubiquitous Information Management and Communication (IMCOM) 2019. IMCOM 2019. Advances in Intelligent Systems and Computing* (Vol. 935). Springer.

Ndubisi, N. O., Jantan, M., & Richardson, S. (2001). Is the technology acceptance model valid for entrepreneurs? Model testing and examining usage determinants. *Asian Academy of Management Journal, 6*(2), 31-54.

Nortvig, A.-M., Petersen, A., Kristine., & Balle, S., Hattesen. (2018). A literature review of the factors influencing e-learning and blended learning in relation to learning outcome, student satisfaction and engagement. *The Electronic Journal of e-Learning, 16*(1), 46-55.

Nugroho, M. A. (2015). Impact of government support and competitor pressure on the readiness of SMEs in Indonesia in adopting the information technology. *Procedia - Procedia Computer Science,* (72), 102-111. https://doi.org/10.1016/j.procs.2015.12.110

Nugroho, M., Adhi., & Fajar, M., Andryzal. (2017). Effects of technology readiness towards acceptance of mandatory web-based attendance system. *Procedia Computer Science,* (124), 319–328. https://doi.org/10.1016/j.procs.2017.12.161

Nunnally, J. C., & Bernstein, I. H. (1994). The assessment of reliability. *Psychometric Theory,* (3), 248-292.

Ong, C. S., Lai, J. Y., & Wang, Y. S. (2004). Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. *Information & Management,* (41), 95-804.

Parasuraman, A., & Colby, C. L. (2015). An updated and streamlined technology readiness index: TRI 2.0. *Journal of Service Research, 18*(1), 59-74.

Parasuraman, A. (2000). Technology Readiness Index (TRI) a multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research, 2*(4), 307-320.

Parasuraman, A., & Colby, C. L. (2007). *Techno-ready marketing: How and why your customers adopt technology*. The Free Press.

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology & Society, 12*(3), 150-162.

Pekrun, R. (2010). Academic emotions. In T. Urdan (Ed.), *APA educational psychology handbook* (Vol. 2). American Psychological Association.

Petrovica, S., Anohina-Naumeca, A., & Ekenel, H., Kemal. (2017). Emotion recognition in affective tutoring systems: Collection of ground-truth data. *Procedia Computer Science,* (104), 437 – 444.

Pires, P. J., da Costa Filho, B. A., & da Cunha, J. C. (2011). *Technology Readiness Index (TRI) factors as differentiating elements between users and non users of internet banking, and as antecedents of the Technology Acceptance Model (TAM)* [Paper presentation]. International Conference on ENTERprise Information Systems, Beijing, China.

Preacher, K. J., & Hayes, A. F. (2004a). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior research methods, instruments, & computers, 36*(4), 717-731.

Preacher, K. J., & Hayes, A. F. (2004b). SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behavior Research Methods. *Instruments, & Computers, 36*(4), 717-731.

Qureshi, I., & Compeau, D. (2009). Assessing between-group differences in information systems research: A comparison of covariance-and componet-based SEM. *MIS Q, 33*(1), 197–214.

Raaij, E. M., & Schepers, J. J. L. (2008). The acceptance and use of a virtual learning environment in China. *Computers & Education, 50*(3), 838-852.

Ramayah, T., & Aafaqi, B. (2004). Role of self-efficacy in e-library usage among students of a public university in Malaysia. *Malaysian Journal of Library & Information Science, 9*(1), 39-57.

Rojas-Méndez, J. I., Parasuraman, A., & Papadopoulos, N. (2017). Demographics , attitudes , and a cross-cultural analysis and model validation. *Marketing Intelligence & Planning, 35*(1), 18-39. https://doi.org/10.1108/MIP-08-2015-0163

Rowe, A. (2011). The personal dimension in teaching: Why students value feedback. *International Journal of Educational Management, 25*(4), 343 - 360.

Roy, S., Kumar, Balaji, M., S, Quazi, A., & Quaddus, M. (2018). Predictors of customer acceptance of and resistance to smart technologies in the retail sector. *Journal of Retailing and Consumer Services,*(42), 147–160. https://doi.org/10.1016/j.jretconser.2018.02.005

Sagayadevan, V., & Jeyaraj, S. (2012). The role of emotional engagement in lecturer-student interaction and the impact on academic outcomes of student achievement and learning. *Journal of the Scholarship of Teaching and Learning, 12*(3), 1 – 30.

Sarr, F., & Ba, M. (2017). The capability approach and evaluation of the well-being in Senegal: An Operationalization with the structural equations models. *Modern Economy,* (8), 90-110.

Syamsuddin, I., & Hwang, J. (2010). The use of AHP in security policy decision making: An open office calc application. *JSW, 5*(10), 1162-1169.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education,* (2), 53-55. https://doi.org/10.5116/ijme.4dfb.8dfd

Tian, F., Gao, P., Li, L., Zhang, W., Liang, H., Qian, Y., & Zhao, R. (2014). Recognizing and regulating e-learners' emotions based on interactive Chinese texts in e-learning systems. *Knowledge-Based Systems,* (55), 148–164.

Uziak, J., Oladiran, M., Tunde, Lorencowicz, E., & Becker, K. (2018). Students' and instructor's perspective on the use of blackboard platform for delivering an engineering course. *The Electronic Journal of e-Learning, 16*(1), 1-15.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly,* (27), 425–478.

Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, 115-139.

Walczuch, R., Lemmink, J., & Streukens, S. (2007). The effect of service employees' technology readiness on technology acceptance. *Information & Management,* (44), 206-215.

Wetzels, M., Odekerken-Schroder, G., & Oppean, C. V. (2009). Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration *MIS Q, 33*(1), 177–195.

Woody, E. (2011). An SEM perspective on evaluating mediation: What every clinical researcher needs to know. *Journal of Experimental Psychopathology, 2*(2), 210–251. https://doi.org/10.5127/jep.010410

Yoo, Y., & Alavi, M. (2001). Media and group cohesion: Relative influences on social present, task participation, and group consensus. *MIS Q, 25*(3), 371–390.

Yu. (2006). An empirical study of web-based learning adoption in the behavioral and cognitive styles. *Journal of Education & Psychology, 29*(4), 687-717.

Yu, Chen, I. J., Yang, K. F., Wang, T., F, & Yen, L., L. (2007). A feasibility study on the adoption of elearning for public health nurse continuing education in Taiwan. *Nurse Education Today, 27*(7), 755-761.

Appendix A:
Survey Instrument

Construct	Code	Item	Source
Attitude	ATT1	Using emotion-aware VLE is a good idea	Chatzoglou et al., 2009; Davis et al., 1989; Demet et al., 2011; M. Lee, C, 2010; Park, 2009; Venkatesh et al., 2003
	ATT2	I would feel that using emotion-aware VLE is pleasant	
	ATT3	In my opinion, it would be desirable to use emotion-aware VLE	
	ATT4	In my view, using emotion-aware VLE is a wise idea intention	
Intention to use	IN1	I would continue to use emotion-aware VLE for my learning needs	Bhattacherjee, 2001a, 2001b; Chatzoglou, Sarigiannidis, Vraimaki, & Diamantidis, 2009; Demet, Cigdem, & Fethi, 2011; Lee, Hsieh, & Ma, 2011; Lee, Yoon, & Lee, 2009; Liu, Chen, Sun, David, & Kuo, 2010
	IN2	Continuing to emotion-aware VLE for handling my academic related duties is something I would do in the future	
	IN3	I would continue to see myself using emotion-aware VLE for handling my academic-related duties.	
Lecturer Interaction	LI1	When lecturer interacts positively to student's emotions; it encourages students to use emotion-aware VLE system	
	LI2	When lecturers interact with student's emotions in preparation of the online class, assignment, quiz and exams, it encourages students to use emotion-aware VLE system	
	LI3	When lecturers interact with emotion-aware VLE regularly and review emotions reports, it encourages students to use emotion-aware VLE system	
Insecurity	INS1	Students will be too dependent on this technology (emotion-aware) to deliver their emotion to lecturers	Parasuraman and Colby (2015)
	INS2	Too much of this technology (emotion-aware e-learning) distracts students to a point that is harmful	
	INS3	This technology (emotion-aware) lowers the quality of relationships between students and lecturers by reducing personal interaction	
	INS4	I do not feel confident that emotion recognition tools integrated with e-learning will be as effective as physical interaction with lecturers	

Discomfort	DIS1	I feel that I am weak and exposed when my emotions are recognised by VLE system and delivered to my lecturers	Parasuraman and Colby (2015)
	DIS2	Integrating emotions recognition with e-learning does not make a difference as the technical support lines are not helpful and they don't explain things in terms that I understand	
	DIS3	Sometimes, I think this technology (emotion-aware e-learning system) is not designed for use by ordinary students	
	DIS4	There is no such thing as a manual for a high-tech product or service such as emotion-aware VLE that's written in plain language	
Optimism	OPT1	Emotion-aware VLE contributes to better quality of education	Parasuraman and Colby (2015)
	OPT2	Emotion-aware VLE gives me more freedom of mobility	
	OPT3	Emotion-aware VLE gives people more control over their academic lives	
	OPT4	Emotion-aware VLE makes me more productive in my academic life	
Innovativeness	INN1	Other students may come to me for advice regarding this emotion-aware VLE system	Parasuraman and Colby (2015)
	INN2	In general, I think I will be amongst the first in my circle of friends to use emotion-aware VLE when it appears	
	INN3	I can usually figure out new high-tech products and services (including emotion-aware e-learning) without help from others	
	INN4	I keep up with the latest technological developments in my areas of interest	