An investigation of Mobile learning readiness for Post-School Education and Training in South Africa using the Technology Acceptance model

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Abstract:

Mobile learning is learning that is delivered through mobile technologies. The study shows that this mode of knowledge dissemination has potential to improve both structured and unstructured learning. However, acceptance of mobile learning largely depends on the individual perception of learners towards this innovation. In this study personal context was the major focus of investigation in which the role of learners' readiness towards mobile learning was assessed based on the Technology Acceptance Model (TAM). TAM is usually used by researchers seeking to investigate the acceptance of new or novel technologies. The sample size (n =186) was selected from only one post school training institution using non-random methods. A structured questionnaire was used for data collection. The final results of study were based on 180 valid responses. The study findings show that learners' readiness and psychological readiness strongly impact on ease of use (PEOU) and perceived usefulness (PU) of mobile learning, as well both of these variables positively impacted on the behavioural intention to use mobile learning.

Keywords: Mobile learning adoption, Technology in post school training, Technology acceptance model.

Introduction

The current developments in mobile technology have rapidly enhanced and broadened the domain of knowledge acquisition even in the informal learning environment; this is through flexibility and on-time access to electronic materials. It is also acknowledged by (Cheon et al., 2012) that mobile learning can highly contribute to the benefits of formal learning. Mobile learning (m-learning) advantages have been overly stated from a range of benefits, including but not limited to, study aids, cost savings, location-based services, and ubiquitous communications. For instance the South African government is advising schools at all levels to make a shift from paper based to digital study materials, this is more evident in the higher education environment where learners are encouraged to obtain study resources using the available online services. The U.S government implemented this by encouraging educational institutions to change from paper-based to digital textbook (Hefling, 2012). Communication between students and their tutors can easily be done through text messages.

Mobile technology applications can as well be employed as learning aids to enable learners to access knowledge any-time anywhere (Young, 2011). Additionally learners, can access appropriate

premises based information concerning proxy infrastructure (buildings or land marks) with the assistance of geolocation tools. To have full utilization of all these mentioned advantages, the learners ought to first embrace m-learning. The presence of mobile technologies does not necessarily imply their usage for educational purposes; it is advisable that students' readiness must first be explored for mobile learning (Keller, 2011). Regardless of the prominence of the adoption of m-learning, still little research has been conducted regarding the aspects that affect learners' readiness to utilize m-learning in post school education and training, particularly in South Africa.

To examine the learners' readiness for adoption of mobile learning, the technology acceptance model (TAM) is employed as the bench mark model in the study. The two major constructs of TAM have been investigated and their validity confirmed by a number of information systems scholars and researchers (Iqabal. and Bhatti, 2015). These are perceived usefulness (PU) and perceived ease of use (PEOU) in predicting the individuals' acceptance of different information technologies. For the research concerning adoption, the TAM framework is the most widely employed model to carry out research on adoption of new technologies. This is because TAM is regarded as a parsimonious and powerful theory by the information systems (IS) society. (Lucas & Spitler, 1999; Venkatesh & Davis, 2000) as cited by (Iqbal. and Bhatti, 2015). Regardless of the merits of the TAM framework as stated; TAM has a weakness of not being capable to explain the external factors that affect users' perceived usefulness and perceived ease of use (Korpelainen, 2011; Legris, Ingham & Collerette, 2003). The external variables implied here are immensely dependent on the technology, applicants and application environment. Having inclined the research on mobile learning, it is there important that the factors impacting on PU and PEOU, be chosen in relation to the phenomenon under study (mobile learning). The TAM framework has been protracted by incorporating learners' readiness as the aspect that is affecting PU and PEOU of learners and their intention to adopt mobile learning in the post school and training setting.

Research problem

Learners' readiness for mobile learning has been investigated by several scholars (Cheon et al., 2012, Hussin, Manap, Amir & Krish 2012). However, (Iqbal and Bhatti, 2015) state that the phenomenon of learners' readiness towards mobile learning is still developing. From related studies on mobile learning in post school education, there is a clear indication of the absence of well-structured research tools to explore learners' readiness for mobile learning in post school education and training environments (Khaddage & Knezek, 2013). In this work, factors that affect the learners' readiness for mobile learning are examined and discussed.

Contribution of the study

This work adds more knowledge to already existing literature concerning mobile learning education in two folds. First, the psychological readiness of learners for mobile learning is explored. Secondly, Learners' readiness toward adoption of m-learning (Skills) is presented and discussed.

For this work, the measure for the learners' readiness is adapted from (Hussin et al., 2012) who employed basic readiness, psychological readiness, skills readiness, and budget readiness as the explanatory variables to the learners readiness. It is known that basic readiness and budget readiness are good predictors of smart phone ownership (Iqbal and Bhatti, 2015). This study puts more

emphasis on the psychological readiness and Learners' readiness (skills) as the factors influencing the readiness of learners for mobile learning.

This paper is organized as follows. First, the m-learning literature is reviewed followed by a discussion of the research framework for the current study. Next, the research methodology is presented, including a discussion of the sample and the variables and their measurement. Finally, the results are presented, followed by a discussion of the findings, limitations, and directions for future research.

Review of related work

Mobile learning

Naismith et al. (2004); Yuen and Yuen, (2008) define mobile learning as being a particular form of learning model that employs mobile technology and electronic learning (e-learning) is a form of learning experience which enhances personal learning with different types of computer technologies (Clark & Mayer, 2008). In that respect mobile learning encompasses several elements of e-learning such as multimedia contents and communications with other learners, however it uniquely presents itself with regard to flexibility of time and premises (Peters, 2007). The characteristics of mobile devices are three fold: (a) portability: mobile gadgets are easily relocated to various premises, (b) instant connectivity: mobile gadgets are used to gain access to a wealth of information anytime, anywhere, and (c) context sensitivity: mobile gadgets can be applied to locate and collect real or simulated data (Churchill & Churchill, 2008). The mentioned three characteristic features of mobile learning constitute a unique learning experience (Traxler, 2010; Wang & Higgins, 2006) advanced mobile hardware such as camera, accelerometer and the different software as accessibilities designed to provide support, organize, manipulate and generate information for teaching and learning (Kerskin & Metcalf, 2011).

Considering the element of mobile learning, there are four forms of learning techniques that mobile technologies are able to enhance these include; personalised learning, situated learning, collaborative learning, and informal learning (Cheon et al., 2012). Firstly, mobile learning enhances personalised learning by enabling learners to take up learning at their own pace. Secondly, the localized learning is achieved as learners are able to employ mobile technologies to acquire knowledge within a real context. For example, learners can acquire computational skills through playing with mathematical games like mathsplayground, a computer program designed to help learners figure out mathematically logical patterns. Thirdly, mobile learning enhances collaborative learning when learners apply mobile technologies to readily interact and communicate amongst themselves. Lastly, informal learning is understood when learners acquire knowledge out of the class setting at their convenience.

However, some particular studies done by scholars indicate that learners are likely not to use mobile learning technologies owing to limitations that are inherent with mobile learning. (1) There are given technical limitations that have been documented (Park, 2011; Wang & Higgins, 2006; Wang, Wu, & Wang, 2009), like low resolution, small keyboard, memory space that is small, generalized compatibility. (2) Users' psychological limitations have also been pointed out (Park, 2011; Wang et al., 2009). For instance, learners are less likely to use the mobile technologies for academic purpose but rather more for entertainment and social media relations, listening to music, watching videos

and all that (Park, 2011; Wang et al., 2009). (3) There are educational limitations (Corbeil & Valdes-Corbeil, 2007; Park, 2011; Wang et al., 2009). For example, using mobile devices during class sessions may turn out to be distracting and hence learners lose concentration. To mitigate some of the limitations observed above, some studies have suggested that instructions appropriate for mobile learning should be adapted to the tiny screen size (Cheon et al., 2012). Also the guidelines should be provided in granular style as there is little time to access the resources on a mobile technological tool (Cheon et al., 2012).

Mobile learning in post school education

The TAM framework has been used in a number of studies that focused on adoption of mobile learning. Tan, W.H., Ooi, K.B., Sim, J.J., & Phusavat, K. (2012) applied subjective norms and individual differences as external variables in combination with the constructs of the original TAM in order to assess the adoption of mobile learning in Malaysia. Phuangthong and Malisawan, (2005) employed TAM as a bench mark model to assess the factors that impact on the adoption of mobile learning in Thailand, based on the third generation (3-G) technology. Almasri (2014) presents an adoption model proposed for university learners and this model is an extension of TAM which features two external characteristics, i.e. mobile readiness and perceived interaction. Learners' readiness has been researched (Cheon et al., 2012; Hussin et al., 2012), however, all these studies have differently defined learners' readiness. For instance, Hussin et al. (2012) defined student readiness in terms of psychological readiness and skills readiness, and no documentation on how these factors impact on the learners' PU & PEOU; which are the two major constructs for the much celebrated TAM model.

The concept of readiness to use or apply a given technological innovation is meant to imply that users employ the new innovation to accomplish required tasks either at work places or otherwise (Iqbal and Bhatti, 2015). Eight factors are said to be important for e-learning adoption (Chapnick, 2000), these are; psychological, technical, financial, sociological, human resource, equipment, and content readiness. Having conceptualised that mobile learning is a consequence of e-learning it thus follows that the same factors that affect e – learning can be regarded to be influential for mobile learning as well.

Research Model and Hypotheses Development

The theory of reasoned action (TRA) was advanced (Fishbein and Ajzen, 1975) and it is considered to be a very important model in explaining and predicting human behaviour in various areas (Iqbal and Bhatti, 2015). The technology acceptance model was employed by (Liu et al. 2010) when they researched on factors of mobile learning adoption with learners from China. They concluded that perceived usefulness and personal innovation have an influence on the adoption of mobile learning. TAM explains how people accept a new system (Davis, 1989).

The TAM proposes that attitude towards using a new technology is positively influenced by the belief that it is friendlier to use (perceived ease of use - PEOU) and its adoption will result in improved productivity (perceived usefulness PU). PU is the degree to which an individual believes that using a particular system would enhance his or her job performance (Davis, 1989). Many researchers have found a positive relationship between PU and BI to use a new technology (Chan, 1996). Therefore, the following hypotheses have been developed for this study:

H1: *PU has a significant positive effect on BI to use m-learning.*

PU is the degree to which an individual believes that using a technology will be free of effort (Davis, 1989). Past research confirms a positive relationship between PU and BI (Venkatesh, 2000) as cited by (Iqbal and Bhatti, 2015).

H2: *PEOU has a significant positive impact on users' BI to use m-learning.*

With reference to TAM, there exists a positive significant relationship between PEU and PU. It is further stated that if any user finds a technology easier to use she or he will have a positive attitude towards its usefulness.

H3*: PEOU has a positive impact on PU.*

Attitudes towards usage (AT) and behavioural intention to use (BI) are common with TRA and TAM; Even though some studies based on TAM, direct influence of PU and PEOU on BI is also put under consideration for investigation. In this work the direct influence of PU and PEOU on BI is assessed. BI is the likelihood that a person will adopt a certain technology Davis (1989). In TAM the researchers (Davis, 1989) postulated that BI would lead to actual usage of a certain technology (Iqbal and Bhatti, 2015). For this study, BI is defined as a post school learners' intention to adopt m-learning.

Learners' Readiness

Some of the studies carried out on learners' readiness (Muse, 2003, Iqbal and Bhatti, 2015) indicate that individual satisfaction and achievement in the online learning environment (OLE) largely depend on various individual qualities (Iqbal and Bhatti, 2015). The four individual qualities which are necessary for the adoption of a new technology are: technical skills, learning preferences, attitude towards technology, and computer self-efficacy (Iqbal and Bhatti, 2015). Students having acquired technical skills can better engage themselves in the use of a new technology than those who do not have those skills. As pointed out by (Erlich et al., 2005), the students well familiar with the use of computers before registering for an online course reported less anxiety and frustration compared to those not familiar with using a computer.

H4: *Learners' Readiness (LR) towards m-learning has a positive impact on perceived usefulness (PU) of m-learning.*

H5: *Learners' Readiness (LR) towards m-learning has a positive impact on perceived ease of use (PEU) of m-learning.*

Proposed Research Model

In line with the preceding discussion, a model is proposed, which is typically an extension of the TAM comprising of learners' readiness as a novel construct impacting on PU and PEOU:
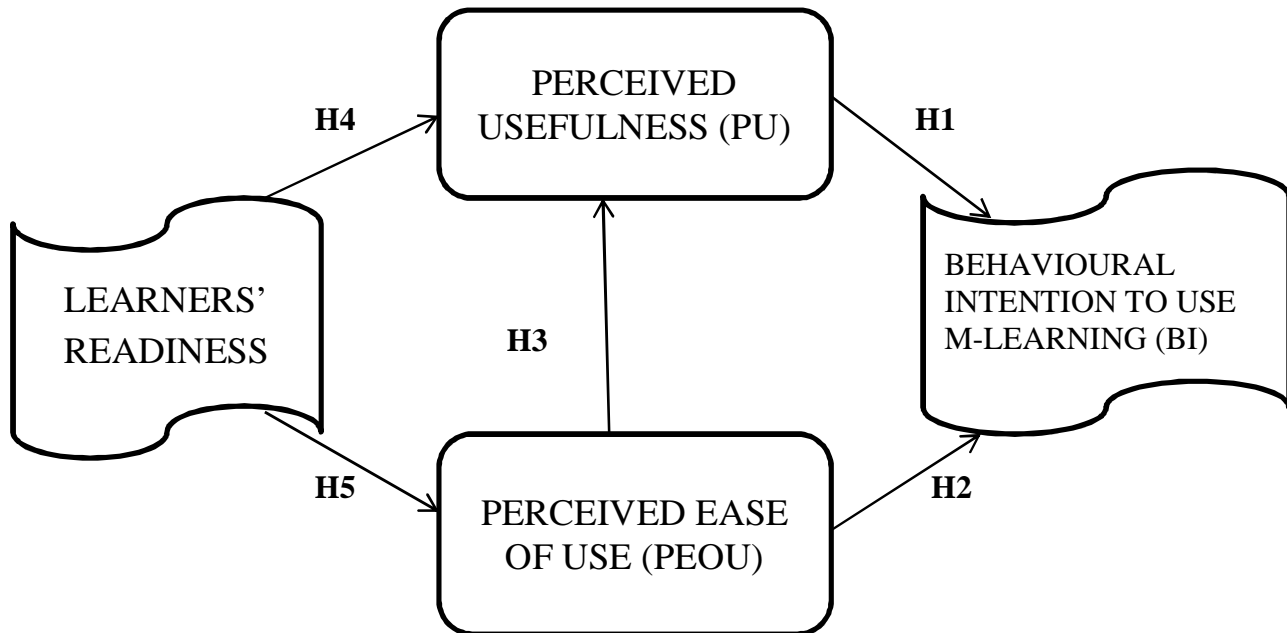

Figure 1: Proposed research model for m-learning adoption among post school learners.

Methodology

Participants

A non- random sampling method (Creswell, 2012, William, 2016) was adopted for this study in order to collect data. The participants in this study were 186 students attending at a post school education and training institute located in Gauteng Province, Johannesburg, Republic of South Africa. They were offering a course Technical support in the domain of Information technology leading to the award of a tertiary Certificate. The respondents on a voluntary basis agreed and signed up for a module that involved technology associated research participation.

Owing to missing or non-response data from 6 participants, 180 participants are reported. There were 84 males and 96 females, with different cores. From the participants, 164 learners possessed a smartphone (iPhone: 38, 21.11%; other types of smartphones: 126, 70%) and 14 learners had a web enabled mobile device other than a smartphone (7.78%), making a total 178 of learners (98.89%) with a mobile device. Two learners did not have a mobile device.

Data collection

A questionnaire adapted from the previous studies on this topic was employed with some modifications. The questionnaire consisted of three parts: Part I recorded the demographic information related to age, study program, education, gender, and smart phone ownership. Part II gathered the information related to current usage of smartphones for educational purposes. Part III

gathered information with respect to the variables discussed above on a seven-point Likert scale. The construct of PU, PEOU, and BI were adopted from the previous studies of (Davis 1989, 1993 and Moon & Kim, 2001). Learners' readiness consisted of 12 items that were adopted from various studies done by (Hussin et al., 2012; Shih et al., 2010). A pilot study was carried out on the designed questionnaire using 18 (10%) learners and the goal was to ensure the content validity of the instrument. The outcomes of the pilot study indicated that some questions were ambiguous and hence re-stated so as to ensure clarity and others that made little meaning were dropped. In the end a 22 items questionnaire was used.

Data analysis

For this study, a two-step modelling approach, recommended by Anderson and Gerbing (1988) and McDonald and Ho (2002) was adopted. Using STATA version 15, exploratory factor analysis (EFA) was firstly performed to provide an assessment of convergent and discriminant validity and determine the number of variable to be used in the model. Principal components extraction with varimax rotation was applied on the suggested variables (constructs). From the analysis nearly all the suggested constructs loaded on a single component save for learners' readiness. The rotated information or component matrix for learners' readiness showed two distinct factors; skills readiness and psychological readiness.
One item in learners' readiness scale was dropped on account of cross-loading. Secondly, Confirmatory factor analysis (CFA) was conducted using AMOS v.17 to assess the validity and reliability of the data. The proposed model included 21 items describing five latent constructs; skills readiness, psychological readiness, perceived usefulness, perceived ease of use, and behavioural intention to use mobile learning.

Measurement Model

The measurement model was assessed using STATA v15 with the maximum likelihood estimation (MLE) in terms of individual item loadings, reliability of measures, convergent validity and discriminant validity. MLE allows computation of assorted indices of goodness-of fit and the testing of the significance of loadings and correlations between factors, but requires the assumption of multivariate normality. Fornell and Larcker (1981) suggested three criteria for verifying convergent validity: the factor loading for individual items is more than 0.50, the average variance extracted (AVE) are above 0.50 and the composite reliability (CR) of all the constructs is above 0.80. Table 1 shows that all three criteria are met and therefore, convergent validity of the measurement model is verified. For confirmation of validity of data Cronbach's Alpha is computed and as shown in Table 1, the Cronbach alpha's value for all the constructs is above 0.90, well above the minimum acceptable value of 0.60 Nunnally and Bernstein (1994) as cited by (Iqbal and Bhatti, 2015)

Results

Table 1 shows a summary of the Cronbach's alpha, standardized factor loadings, composite reliability, and variance extracted estimate. Cronbach's alpha reflects the internal consistency reliability among indicators of a construct. As observed in Table 1, all values of the Cronbach's alpha are more than 0.7, indicating satisfactory reliability for all the five constructs. Fornell and Larcker (1981) proposed three measures for assessing convergent validity of the measurement items;

> ➢ item reliability of each measure,
> ➢ composite reliability of each construct, and
> ➢ the average variance extracted.

On the reliability of the items, the standardized loading values exceeded 0.7 that are between 0.754 - 0.942, the recommended threshold by Gefen, Straub, and Boudreau (2000), hence signifying convergent validity at the item level. For composite reliability, all values exceeded 0.7 that are ranging from 0.78 to 0.90, the recommended threshold by Nunnally and Bernstein (1994). Lastly, on the average variance extracted, all values exceeded 0.5 that are ranging from 0.71 to 0.87. Given the satisfaction of three criteria, the convergent validity for the proposed constructs of the measurement appears to be adequate.

For the discriminant validity, the square root of the average variance extracted (AVE) for a given construct was compared with the correlations between the construct and other constructs (Fornell & Larcker, 1981). If the square root of the AVE of a construct is greater than the off-diagonal elements in the corresponding rows and columns, this indicates that a construct is more closely related with its indicators than with the other constructs. In Table 2, the diagonal elements in the matrix are the square roots of the AVE. Since the square roots of the AVE are higher than the values of its corresponding rows and columns, discriminant validity appears satisfactory for all constructs.

Table 1
Results for the measurement model

Construct	Standardized factor loading (>0.70)	Cronobach's alpha(>0.70)	Composite reliability (>0.70)	Variance extracted estimate (>0.50)
Learners' Readiness (skills)				
LR1	0.932	0.940	0.902	0.870
LR2	0.921			
LR3	0.931			
LR4	0.944			
Psychological Readiness				
PR1	0.930			
PR2	0.942	0.947	0.901	0.878
PR3	0.939			
PR4	0.943			
Perceived Usefulness				
PU1	0.867			
PU2	0.871	0.885	0.795	0.725
PU3	0.816			
PU4	0.823			
PU5	0.817			
Perceived Ease of Use				
PEOU1	0.969			
PEOU2	0.981	0.958	0.926	0.900
PEOU3	0.963			
PEOU4	0.961			

Behavioural Intention				
BI-1	0.847			
BI-2	0.934	0.913	0.855	0.802
BI-3	0.921			
BI-4	0.914			

Table 2
Discriminant Validity for the Measurement Model

Construct	LR	PR	PU	PEOU	BI
LR	0.921				
PR	0.852	0.933			
PU	0.567	0.771	0.852		
PEOU	0.721	0.863	0.771	0.993	
BI	0.495	0.652	0.618	0.623	0.976

Structural Equation Modelling

Structural model
In this work, structural equation modelling (SEM) was employed to test the model by assessing the relationships among the study variables and the standardized path coefficients for confirmation of the stated hypotheses. The advantage of SEM is that it singularly takes into account both the evaluation of the measurement model and the estimation of the structural coefficient. If the considered indicators for a construct do not measure that construct, the testing of the structural model will be meaningless (Jöreskong & Sörbom, 1998). As presented in Table 3, the measurement model test presented a good fit between the data and proposed measurement model.

Table 3
Model Fit indices

Fit indices	Recommended value	Observed value
Comparative fit index (CFI)	≥0.90	0.955
Goodness of fit index (GFI)	≥0.90	0.972
Non-normal fit index	≥0.90	0.984
Normed fit index (NFI)	≥0.90	0.981
Root mean square error approximation (RMSEA)	≤0.05 or ≤0.08	0.026
Root mean square error residual (RMSR)	≤0.05	0.036

Hypotheses Testing

The standardized path coefficients and the statistically significant structural associations or relationships between the constructs
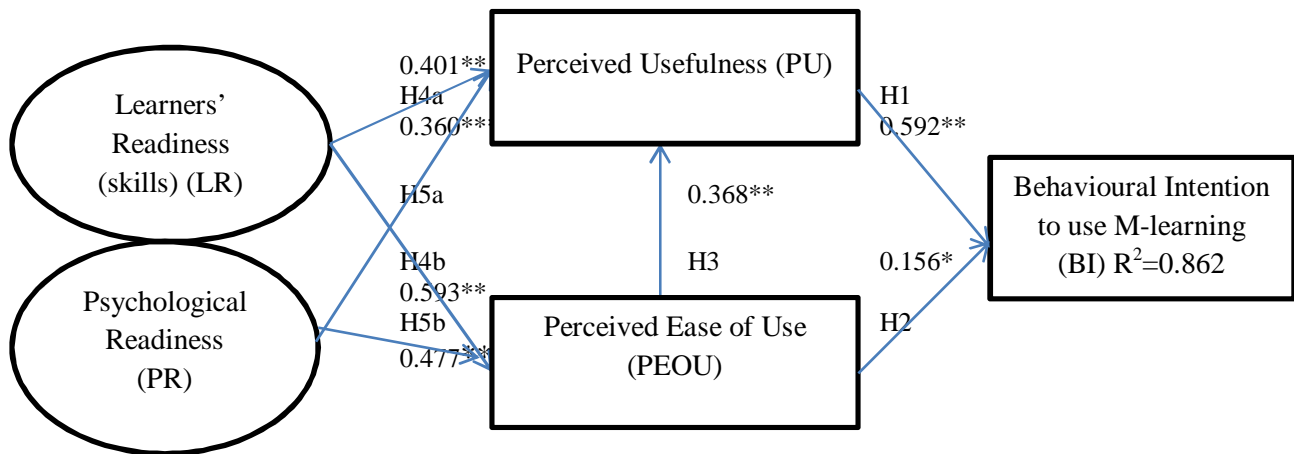
Figure: 2. Path coefficients of the research model

Figure: 2 represents a graphical description of the outcomes of the path coefficients. PU has a significant positive impact on BI to use M-learning ($\beta = 0.592$), hence hypothesis H1 cannot be rejected at 0.001 significance level. The impact of PEOU on BI to use M-learning was found significance at $p < .05$ ($\beta = 0.156$), hence H2 cannot be rejected at 0.05 significance level. A statistically significance positive impact of PEOU is observed on PU ($\beta = 0.368$), hence H3 cannot be rejected at 0.001 level of significance. Learners' readiness (skills) (LR) has a significance positive impact on both PU ($\beta = 0 .401$) and PEOU ($\beta = 0 .593$), therefore H4a and H4b cannot be rejected at 0.001 significance level. H5a and H5b are statistically significance (PU $\beta = 0.360$) and (PEOU $\beta = 0.477$) respectively, on PR, therefore both hypotheses cannot be rejected at 0.001 significance level and it is then concluded that PR has a positive significant impact on PU and PEOU.

Observing the R-squared value, Figure 2, it can be concluded that, 86.2% of behavioural intention to adopt m-learning can be explained by all perception constructs (i.e., perceived usefulness and perceived ease of use)

Discussion

This study investigated the factors affecting post school learners' adoption of mobile learning based on TAM. An extension of TAM was employed and the only external variable used in the study was the learners' readiness. The outcome of the study showed that post school learners' intention to adopt m-learning is positively affected by their perceived usefulness. Based on the R-squared value, 86.2% of behavioural intention to adopt m-learning in post school education and training environment in South African can be explained by perception constructs or components of an extended TAM. It is important for practitioners, scholars and researchers to comprehend what leads to the end-users of a technology to accept or resist the technology in question, in this case m-

learning and how to improve its user acceptance. The study findings also showed that adoption of an innovation largely relies on the intended users' perception that the consequence of the innovation will lead to improved performance.

The findings established a strong effect of learners' readiness on both PU and PEOU. It can be said that, if the intended end-users (learners) are well prepared with the necessary skills to use the new technology, it will enhance their perception regarding usefulness and ease of use of that technology. Therefore, end users' training can lead to increased system acceptability. In case of m-learning, the learners own and are already familiar with the various m-learning related resources of smartphones, they own the skills required for m-learning adoption which creates a positive perception regarding usefulness and ease of use of m-learning. Smartphones are just like mobile computers carried by users in their pockets offering them access to learning material anywhere anytime (Iqbal and Bhatti, 2015), thus resulting in an overall increase in users' productivity (PU) and convenience (PEOU).

Limitations and directions for future research

The major limitation of the study is that only one institution was considered and the sample was entirely drawn from here. Secondly, the non-random sample selection procedure is more likely to give biased results. Thirdly, a sample size of only 186 participants cannot reflect or be representative for the entire learners' population in South Africa. It is thus recommended that scientific methods for sample size selection be used in future. Also to consider an increase on the sample size which will give a proper representation for the learners' population in South Africa. The scope in terms of number of post education institutions could be increased and be selected from different parts of the country on the basis of scientific methods.

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