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Acceptance of ICT: Applicability of the Unified Theory of Acceptance and Use of Technology (UTAUT) to South African Students

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Acceptance of ICT: Applicability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model to South African Students

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ABSTRACT

We are told that university students are Digital Natives and the diffusion of digital technologies into education holds prospective advantages. However, will students in Africa be prepared to engage with and accept the technology? This study aimed to determine the applicability of the Unified Theory of Acceptance and Use of Technology (UTAUT) model within a South African higher education setting and to clarify the factors that are influencing students' intentions to make use of two digital technologies: an eBook and SLMS. 738 ICT students completed a questionnaire to gauge their responses to Performance expectancy (PEx), Effort expectancy (EfEx), Facilitating conditions (FC), Self-efficacy (SE), Anxiety (Anx), Attitude towards using technology (ATT) and Behavioural intention (BI). Statistical analysis was used to develop and assess a model of the factors that are affecting BI. Structural equation modelling was used and the goodness-of-fit test indicated that the model was supported by the data. PEx, FC and EfEx showed high practically significant relationships with BI. SE and ATT as mediators of the model are confirmed, however gender as moderator did not reflect the original findings of UTAUT.

Keywords

Educational technology, Technology acceptance, UTAUT.

INTRODUCTION

A good deal of literature tell us that we are currently seeing a new generation of young people, who were all born after the time when digital technologies were invented and became commonplace in everyday life. These youngsters, being used to a life with the Internet, are said to have an innate aptitude and high skill levels when it comes to the use of new technologies. It is easy to see that this generational shift has had profound consequences for teaching-learning approaches (Jones, Ramanau, Cross and Healing, 2010). Students are making sense of advances in technology in ways unique to their histories and cultures. The diffusion of digital technologies into education and the consequent realisation of its potential advantages will be subject to whether students at universities are eager to engage with and accept the technology (Venter, Van Rensburg and Davis, 2012).

For the most part African universities depend on research published in Western journals and there is a lack of ICT articles with a focus on the realities within the African context (Mbarika and Meso, 2008). A review of the literature shows that the model for the Unified Theory of Acceptance and Use of Technology (UTAUT) has received only limited validation in educational settings, especially within the African context. This limitation is what lead to the study, in order to verify the applicability of the UTAUT model within an African environment and to statistically explain the factors that are influencing students' intentions to use two different digital technologies, namely an eBook and a Specialised Learning Management System (SLMS).

BACKGROUND

Students and Technology

We are currently seeing a new generation of young people who grew up with the Internet and digital technologies and don't know a life without it (Howe and Strauss, 2000). This new generation of young people are called the Net generation, Generation Y, the Millennial Generation or Digital Natives. These youngsters have a natural aptitude and high skill levels pertaining to the use of new technologies, even more so for those who were born in the U.S. and Canada from the early 1980s to the late 1990s (Oblinger, Oblinger and Lippincott, 2005). Their inclination to certain types of entertainment, certain learning styles, social choices, modes of communication and overall styles, are characterised by their early and pervasive exposure to technology (Saiedian, 2009). When it comes to learning preferences, Digital Natives favour receiving information quickly, they are really good at quickly processing information, they choose to multi-task, they have a preference for non-linear access to information, they dislike traditional lectures, favour active rather than passive learning, they depend largely on communications technologies in order to access information and perform social and professional interactions, they expect to be occupied by their environment with participatory, sensory-rich, investigative activities (physical or virtual), are more concerned with visual media opportunities for input, they favour learning by doing, instead of telling or reading, and they like to discover rather than being told (Jones and Shao, 2011; Oblinger, 2003; Oblinger, 2008; Prensky, 2001; Prensky and Berry, 2001).

One should not make the mistake of describing all of today's students as the Net generation, because not all of them had or still have access to state-of-the-art, omnipresent technology. In Africa, Internet penetration for households in 2015 was a mere 15.4%, therefore African students do not fit the description of the Net generation. With 50.5% of South African households using the Internet (25.5% in 2012), South Africa was ranked 41th amongst developing countries. There was a significant rise in Internet use in South Africa and it can be rationalised by the rise of mobile broadband subscriptions

from 26 per 100 inhabitants in 2012 to 59.5 per 100 inhabitants in 2015 (UN Broadband Commission, 2013; UN Broadband Commission, 2016). A project at a South African University assessing computer skills on over 4000 first-year students in 2009, found that a lot of students entering South African universities for the first time are not sufficiently equipped with the computer skills that are needed during their first year of study. Furthermore, African students are most vulnerable of being disadvantaged, because of their lack of former skills (Nash, 2009). The claim that drastic changes need to be made by educators as well as universities, because of students' completely different approach to learning is not new and it continues to have an ongoing significance. However, there is a need for a more carefully critical and nuanced understanding of the outcomes of new technologies on the habits and subject positions of learners and teachers in higher education (Bayne and Ross, 2011) and according to Jones and Shao (2011) "There is no evidence that there is a single new generation of young students entering Higher Education and the terms Net Generation and Digital Native do not capture the processes of change that are taking place".

Theoretical Framework

Several models have emerged out of research pertaining to user acceptance and intention to use new technology. Venkatesh, Morris, Davis and Davis (2003) evaluated and compared eight prominent models. The first one was the theory of reasoned action (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975) and an extension was the theory of planned behavior (TPB) that specifies that attitudes and subjective norms have an influence on behavioural intention, which in turn influences actual behaviour (Ajzen, 1991). TAM/TAM2 is used extensively in the field of IS for explaining the acceptance of IT tools. Drawing heavily from the theory of reasoned action (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975), Davis, Bagozzi and Warshaw (1989), in the technology acceptance model (TAM), identified and measured a set of generic beliefs that apply across a range of IT tools with two primary direct determinants of intention: ease of use and usefulness. Thompson, Higgins and Howell (1991) developed a model to predict PC utilization (MPCU) for IS contexts. Davis, Bagozzi and Warshaw (1992) in their motivational model (MM), applied motivational theory originating from research in psychology to understand the use and adoption of new technologies. Taylor and Todd (1995) developed a hybrid model by combining the predictors of the TPB with perceived usefulness of TAM. The diffusion of innovation (DOI) theory (Rogers, 1995) states that the decision to accept or reject an innovation is based on the beliefs that users form about the innovation. The theory of Rogers (1995) has been used to study a variety of innovations (e.g. World Wide Web, spreadsheets, and teaching methods). Compeau and Higgins (1995) applied and extended the social cognitive theory (SCT) of Bandura (1986) to the context of computer utilization. TAM2, an extension of TAM, added the constructs subjective norm and voluntariness as predictors of intention to use technology (Venkatesh and Davis, 2000).

Resulting from the evaluation and comparison of the above models, Venkatesh, *et al*. (2003) formulated a unified model, named the Unified Theory of Acceptance and Use of Technology (UTAUT). This study tested the UTAUT in order to determine the applicability of this model in an educational setting. UTAUT was developed with four core determinants of intention and four moderators of key relationships. The four determinants are performance expectancy, effort expectancy, social influence and facilitating conditions. Gender, age, voluntariness of use, and experience with technology are the four moderators. Furthermore, self-efficacy, anxiety and attitude towards using technology are the mediators and therefore not direct determinants of behavioural intention. Baron and Kenny (1986) clarify the terms mediator and moderator as follows: A mediator variable serves to explain the nature of the relationship between the independent and dependent variable. A mediator implies that the independent variable

influences the mediator variable, which in turn influences the dependent variable. A moderator variable is a third variable that affects the direction and/or strength of the relationship between a dependent and independent variable. A discussion of the determinants, moderators and mediators follows below.

Performance expectancy (PEx) can be seen as the degree to which a person believes that using the system will help him/her to better his/her performance and therefore enhance the quality of his/her work (Venkatesh et al., 2003). Davis et al. (1989) state that individuals form intentions towards behaviours which they believe will increase their performance and further assert that beliefs have an influence on attitudes, which lead to intentions and therefore cause behaviours. Effort expectancy (EfEx) is defined as the degree of ease that is associated with the use of a certain system (Venkatesh et al., 2003). Davis et al. (1989) refer to this as perceived ease of use and claims that it refers to the degree to which an individual believes using a particular system would be free of effort. People will more likely use an application that is perceived as easier to use than others and is more likely to be accepted by other users. Social influence (SI) refers to the degree to which a person experiences interpersonal influence to use a system from important people within his/her social environment. Facilitating conditions/Compatibility (FC) is defined as "the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003). Rogers (1995) defined Compatibility as "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters".

In terms of the mediators: Self-efficacy is defined by psychologist Albert Bandura (1995) as a person's belief in their own ability to succeed in a specific situation or accomplishing a task. Anxiety is a sense of worry, nervousness, or unease about something with an uncertain outcome (Oxford English Dictionary, 2014). Attitude towards using technology can be seen as a person's overall affective reaction to using a system (Venkatesh et al., 2003).

The moderators gender, age and experience with technology need no further explanation, but voluntariness of use is defined as "the degree to which use of the innovation is perceived as being voluntary, or of free will" (Moore and Benbasat, 1991).

Behavioural intention is the dependent variable in this study and refers to a student's intention to use digital technologies in the future, whether or not he or she is currently using it. According to Ajzen (1991) "Intentions are assumed to capture the motivational factors that influence a behaviour; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour. As a general rule, the stronger the intention to engage in a behaviour, the more likely should be its performance".

A number of studies tested UTAUT in various settings. Venkatesh and Zhang (2010) extended research on technology adoption and use by discussing the generalizability of UTAUT in two different cultural contexts, i.e., China and the U.S. Their study found that culture does play a significant role in affecting technology adoption. Im, Hong and Kang (2011) examined, in a comparative study, how the relationships of the constructs in the UTAUT model are affected by culture by using data from Korea and the U.S. They examined two technologies: the MP3 player and Internet banking and found that the UTAUT model applies well to their data. Olasina (2015) investigated the factors impacting Nigerian academics' use of SMS-based mobile banking and found a positive correlation between type of bank, customer service, and perceived ease of use and the use of m-banking. Lin, Lu and Liu (2013) proposed a model, EduBIM (Education Behavioral Intention Model) that enhances the UTAUT model by incorporating cognitive individual differences to synthesize the effects of the demographic moderator. EduBIM focuses on the degree of correspondence between students' perceived learning and teaching

styles, which together directly moderate the intention and usage of e-learning systems. Attuquayefio and Addo (2014) determined the strength of predictors for students' intention to accept and use ICT for learning and research in Ghana by using the UTAUT model and found that effort expectancy was a significant predictor of behavioural intention to use ICT. Marchewka, Liu and Kostiwa (2007) applied the UTAUT model for understanding student perceptions using course management software, but mixed support for the model was found in terms of the reliability of the scale items representing the UTAUT constructs and the hypothesized relationships. Although the students agreed that the course management software is a good concept and use it regularly, most of the software's features are not being used to their full potential. Moran, Hawkes and Gayar (2010) examined students' acceptance of tablet personal computers using a modification of the UTAUT in order to identify the variance of selected acceptance elements that contribute to the overall behavioural intent to use Tablet PCs. In the milieu of their study, the variables of performance expectancy, effort expectancy, attitude toward using technology, and self-efficacy were key components of behavioural intention. Social influence and anxiety did not appear to contribute much towards behavioural intention.

Chen (2011) stresses that researchers should consider technological expectancy as well as educational compatibility (the unique learning expectancies of students) while studying technology acceptance in educational settings, since he found in his study that educational compatibility had a greater total effect on e-learning acceptance than technological expectancy.

A number of studies in South Africa researched technology acceptance in various settings. Mulero and Adeyeye (2013) extended TAM to predict consumer acceptance of online social network marketing (SNM) and the results indicated that user intentions towards the use of SNM are strongly and positively correlated with user acceptance of using SNM systems. Empirical results proved that perceived credibility and perceived usefulness are the strongest determinants in predicting user intentions to use SNM systems. Cohen, Bancilhon and Jones (2013) drew on the UTAUT model and literature on user trust in technology in order to develop and test a model of the factors that influence South African physicians' acceptance of e-prescribing technology. Results indicated that physicians' performance expectancies and perceptions of facilitating conditions had a substantial direct effect on acceptance, whilst trust and effort expectancy had important indirect effects. Kyobe (2011) investigated the influence of three factors (i.e. capacity to adopt and use ICT, exposure to international environment and state policies) in South Africa on ICT adoption and found that the capacity to adopt and use ICT has the most significant influence on ICT adoption in South Africa, followed by exposure to the international environment. The effect of state policies was surprisingly not significant.

Venter et al. (2012) observed the determinants of usage of an online learning management system (LMS) in a South African open and distance learning institution, using an extension of TAM as a theoretical basis. The findings suggest that perceived usefulness and perceived ease of use are confirmed and study relevance and facilitating conditions are also confirmed. However, other elements of the TAM2 model were not confirmed by the research, while the relationship between behavioural intention and LMS use were significant, but not particularly strong.

The claims that young people are Digital Natives need closer scrutiny in a developing country like South Africa. This study therefore aimed to determine the applicability of the UTAUT model in South Africa and to statistically explain the factors affecting students' intentions to use different digital technologies.

EMPERICAL INVESTIGATION

In this section the demographics of the participants will first be explained, followed by the data collection and analysis and finally the results will be discussed.

Settings and Participants

A cross-sectional survey design was used to conduct this study at the North-West University in South Africa. A convenience sampling technique was applied and the participants were four groups of students, all taking a first-year ICT course called "Introduction to Computers and Programming".

Two types of digital technologies were introduced at the beginning of the semester, namely an eBook and a specialised learning management system (SLMS). The eBook served as their textbook for the course, making this the first course at the university to introduce an eBook as a textbook. The SLMS is an interactive, online learning environment that helps students to master Microsoft Excel and other computer concepts. Students use technology to observe live applications, then practice these applications and thereafter apply their skills in short questions and projects. Projects can be scheduled with deadlines for submissions and a variable number of resubmissions as determined by the lecturer are allowed. An auto-grading system grades the projects and a reporting tool gives immediate feedback, providing the students with an opportunity to make corrections and resubmit.

Four months after the digital technologies had been introduced, an announcement with the link to the anonymous online questionnaire was sent via the e-learning system to the 978 students taking the course. A total of 738 usable responses were received, indicating an overall response rate of 75.5%. Table 1 provides a summary of the biographic data.

Table 1. Profile of Respondents (n=738)

Criteria	Categories	Number (%) of students
Gender	Male	492 (66.7%)
	Female	246 (33.3%)
IT[1] as school subject	Yes	132 (17.9%)
	No	606 (82.1%)
Access to a computer since Grade 1	Yes	307 (41.6%)
	No	431 (58.4%)
Wireless Internet (Wi-Fi) access at home	Yes	397 (53.8%)
	No	341 (46.2%)

[1]*Information Technology (IT) is a subject that can be taken from Grade 10 to Grade 12 in South African schools, focusing primarily on programming skills.*

The gender profile is typical of most ICT classes with only 33.3% of the respondents being women. More than 80% of the group did not have prior knowledge of the subject by having taken IT as a school subject. These students cannot be seen as the typical Net generation, because only 41.6% of them had access to a computer from a relatively young age. Moreover, only about half of the students have wireless Internet (Wi-Fi) access at home.

Data Collection, Instrument and Analysis

A pilot study was conducted in the previous academic year with only the eBook as digital technology (Liebenberg, 2015) and the questionnaire of the pilot study was adapted from Hardgrave, Davis and

Riemenschneider (2003). For this study the pilot questionnaire was refined and further items from UTAUT (Venkatesh et al., 2003) were added. The items on the eBook were then duplicated and adapted to include the SLMS, resulting in a list of 60 questions.

The first section of the questionnaire gathered information on the biographic data of the respondents as shown in Table 1. The rest of the questionnaire was divided into two sections – one section containing 30 questions regarding the eBook and the other 30 questions on the SLMS. All the questions were accompanied by a five-point Likert response scale from 1 (Strongly disagree) to 5 (Strongly agree).

Venkatesh et al. (2003) and Hardgrave et al. (2003) constructed questionnaires by using measurement scales from previous research and the three determinants of Behavioural intention (BI) considered in this study are: Performance expectancy (PEx), Effort expectancy (EfEx) and Facilitating conditions (FC). In the pilot study (Liebenberg, 2015) it emerged that social influence was not a determinant and thus the construct was not included in this study. The mediators of behavioural intention that is: Attitude towards using technology (ATT), Self-efficacy (SE) and Anxiety (Anx) were also investigated in this educational setting. Only one of the four moderators of UTAUT, namely Gender, was applicable in this setting. Since the majority of students were 18 to 19 years old, age could not have an influence on behavioural intention. The use of the eBook and the SLMS was mandatory therefore voluntariness of use as a moderator was excluded. None of the students had used an SLMS before and since the use of an eBook as a textbook was the first to be introduced at the university, we thus excluded experience with technology as a moderator.

The 738 responses were examined using the seven variables. A Cronbach's α coefficient was calculated for each of the seven factors and it was found (as shown in Table 2) to be reliable ($α ≥ 0.60$) for all seven factors.

Table 2. Factors* (With Reliability Coefficients)

Factor	Cronbach's alpha (α)	Mean	Std. Deviation
Performance expectancy (PEx)	0.900	3.61	0.79
Attitude towards using technology (ATT)	0.896	3.54	0.86
Effort expectancy (EfEx)	0.860	3.91	0.71
Anxiety (Anx)	0.760	2.58	0.81
Facilitating conditions (FC)	0.749	3.58	0.69
Behavioural intention (BI)	0.724	3.49	0.98
Self-efficacy (SE)	0.643	3.81	0.61

* See Appendix for the items in each factor

Analysis of data was done in SPSS Version 24: Reliability coefficients by calculating Cronbach's alpha (α); Pearson correlation analysis; Regression analysis for testing Moderation. Soble's p-value for testing mediation of all the mediators separately for all determinants; Structural equation modeling (SEM) in AMOS Version 24 for testing mediation in the separate and full models.

Results and Discussion

In Table 3 the results of the correlation between the three determinants and behavioural intention is shown. Performance expectancy showed the highest practically significant relationship with Behavioural

intention, explaining 64% of the variance. Therefore, students with a high performance expectancy, also have a high intention to use the technologies. Facilitating conditions and Effort expectancy also showed a high practically significant relationship with Behavioural intention, explaining 45.6% and 25.5% of the variance respectively. Therefore, students who believe that using the technologies are free of effort and that the organisational and technical infrastructure exists to support the use of the technologies, intend to use the technologies to a high degree.

Table 3. Pearson Correlation Coefficients with BI

Determinant	Correlation coefficient	p
PEx	0.800	p<0.001
EfEx	0.505	p<0.001
FC	0.675	p<0.001

When considering the moderating effect of Gender on Behavioural intention, the following prevailed. We scaled the data by subtracting the mean of all variables and gender was dummy coded. The cross-product of gender and the determinants were calculated and included in the regression and there was a statistical interaction effect in only one instance. However, the contribution of the interaction term to R squared was only 0.5% which is not of any importance in practise. Therefore, the third variable gender did not affect the strength of the relationship between the dependent variable (BI) and the independent variables (PEx, EfEx and FC) and was not included as moderator.

The effect of the different mediators were tested separately with Sobel's test for statistical significance in SPSS and AMOS and the results are shown in Table 4, indicating that Anxiety did not act as mediator for any determinant and was therefore not included as mediator in the full model.

Our research model is illustrated in Fig. 1. Consistent with UTAUT, our study's criterion variable is students' acceptance of digital technologies, which is defined as the students' behavioural intention to make use of an eBook and an SLMS, given the opportunity.

As suggested by UTAUT, the model identifies Performance Expectancy (PEx), Effort expectancy (EfEx) and Facilitating conditions (FC) as direct determinants of Behavioural intention (BI). The model further proposes that Self-efficacy (SE) and Attitude towards using technology (ATT) are mediators of the effects of Performance expectancy, Effort expectancy and Facilitating conditions on Behavioural intention.

The research model was tested using the entire dataset, using SEM. In SEM the comparative fit index (CFI) and root mean square error approximation (RMSEA) are commonly used as goodness of fit indices. A model is considered appropriate when its CFI is greater than 0.9 and its RMSEA is less than 0.1 (Blunch, 2012; Hancock and Mueller, 2010; Mueller 1999). Both goodness of fit indices of the model in this study were acceptable: CFI = 0.87, RMSEA = 0.090 with a 90% confidence interval (CI) of [0.088;0.093].

The % mediation of the three determinants on BI were calculated by using the following formula: Standardized Indirect Effect/Standardized Total Effect $\times$100. The % mediation results were as follows: PEx = 50.8%; FC = 57.4%; EfEx = 105%. Due to suppression effects the % mediation for the relationship of EfEx to BI is >100%. Despite the fact that there is a strong relationship between EfEx and BI, it seems that the relationship between EfEx and BI is mainly routed through the two mediators,

namely SE and ATT. The Mediation effect is therefore stronger on EfEx than on the two other determinants of PEx and FC.

Table 4. Mediation Results of SEM and Sobel's Test

Paths	SRW*	p	CFI	RMSEA	Sobel's p
PEx → BI	1.158	<0.001			
PEx → SE	0.78	<0.001	0.900	0.111	0.669
SE → BI	-0.212	<0.001			
PEx → BI	0.992	<0.001			
PEx → Anx	-0.251	<0.001	0.935	0.089	0.149
Anx → BI	-0.003	0.879			
PEx → BI	0.395	<0.001			
PEx → ATT	0.982	0.09	0.907	0.132	<0.001
ATT → BI	0.617	0.879			
EfEx → BI	0.031	0.821			
EfEx → SE	0.902	<0.001	0.913	0.096	<0.001
SE → BI	0.679	<0.001			
EfEx → BI	0.668	<0.001			
EfEx → Anx	-0.484	<0.001	0.951	0.07	0.895
Anx → BI	0.06	0.099			
EfEx → BI	-0.132	<0.001			
EfEx → ATT	0.705	<0.001	0.943	0.097	<0.001
ATT → BI	1.097	<0.001			
FC → BI	0.873	<0.001			
FC → SE	0.741	<0.001	0.827	0.131	<0.010
SE → BI	0.067	0.146			
FC → BI	0.914	<0.001			
FC → Anx	-0.266	<0.001	0.935	0.077	0.658
Anx → BI	-0.015	0.538			
FC → BI	0.141	0.014			
FC → ATT	0.888	<0.001	0.941	0.097	<0.001
ATT → BI	0.876	<0.001			

SRW – Standard Regression Weight
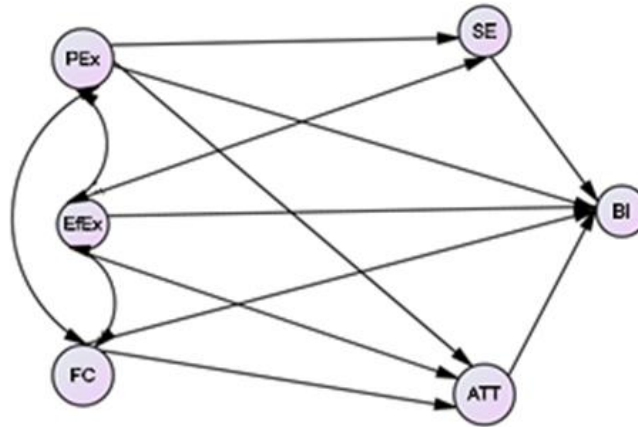
Figure 1. Research Model

Table 5. Mediation Results of Research Model

Paths	SRW	p
EfEx → SE	0.688	<0.001
EfEx → ATT	0.035	0.087
FC → ATT	0.145	<0.001
PEx → ATT	0.827	<0.001
PEx → SE	0.297	<0.001
EfEx → BI	0.007	0.929
SE → BI	-0.246	0.013
ATT → BI	0.673	0.003
FC → BI	0.072	0.197
PEx → BI	0.466	0.026

In summary, the results show that all three determinants; PEx, EfEx and FC had statistically positive effects with regard to the intention to use the eBook and SLMS. The dominant determinant of BI is PEx. This implies that if students believe that their performance will improve and the quality of their work will be enhanced, they will see value and benefit in using the technologies. FC has a significant influence on students' intention to use digital technologies. This indicates that if students believe that the supporting organisational and technical infrastructure exist, they will more likely use the technologies.

The importance of EfEx has been demonstrated by the present study and is consistent with prior findings (Im et al., 2011). This means students that perceive the technologies as easy to use will more likely accept the use of these technologies. Contrary to the findings in Ghana of Attuquayefio and Addo (2014) that EfEx is the dominant determinant of BI, this study found EfEx to not be the dominant determinant.

Additionally, this study investigated the mediating effects of SE and ATT on the relationship between the three determinants and BI. The findings revealed that SE and ATT have stronger mediating effects on EfEx than on the two other determinants of PEx and FC.

CONCLUSION

The result of the goodness-of-fit test shows that the model used in this study was confirmed and validated by the data. The findings suggest that PEx, EfEx and FC as core aspects of the UTAUT model are confirmed. SE and ATT as mediators of the model are confirmed, however gender as moderator did not reflect the original findings of UTAUT.

This model contributes to the growing body of research on technology acceptance and use in higher education and provides a convenient tool for educators who need to measure the probability of success for the introduction of an eBook and an SLMS. The model aids in understanding the drivers of acceptance in order to proactively design interventions like training and targeting students that may be less inclined to accept and use new technologies. It is evident, then, that timely training in the use of an eBook and the SLMS should be provided to students in order to demonstrate the advantages of the use of these technologies.

When considering the profile of the students in this study, with only about half of them having access to a computer from an early age and limited Wi-Fi access at home, this model is especially useful in the African context since a large proportion of African students may be less inclined to accept new technologies like the eBook and an SLMS.

The model not only highlights the core individual-level determinants of technology acceptance, but also pinpoints the factors that would strengthen or restrict the effects of these determinants. However, this model only considers technological expectancy as a predictor of technology acceptance and educational compatibility as proposed by Chen (2011) is not taken into consideration. This raises a potential research issue for future researchers who could usefully conduct studies to explore and understand the combined effect of this model and educational compatibility on the acceptance of new technologies.

REFERENCES

Ajzen, I. (1991) The theory of planned behaviour. *Organisational Behaviour and Human Decision Processes,* 50, 2, 179-211.

Ajzen, I. and Fishbein, M. (1980) *Understanding attitudes and predicting social behaviour*, Prentice-Hall, Englewood Cliffs.

Attuquayefio, S. N. and Addo, H. (2014) Using the UTAUT model to analyze students' ICT adoption. *International Journal of Education and Development using Information and Communication Technology,* 10, 3, 75.

Bandura, A. (1986) *Social foundations of thought and action: A social cognitive theory*, Englewood Cliffs, NJ, US: Prentice-Hall, Inc.

Bandura, A. (1995) *Self-efficacy in changing societies*, Cambridge University Press.

Baron, R. M., and Kenny, D. A. 1986. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology,* 51, 6, 1173-1182.

Bayne, S. and Ross, J. (2011) 'Digital Native' and 'Digital Immigrant' discourses, in Ray Land & Sian Bayne (Eds.), *Digital difference: Perspectives on online learning,* 159-169, Sense Publishers, Rotterdam.

Blunch, N. (2012) Introduction to structural equation modeling using IBM SPSS statistics and AMOS. Sage, London.

Chen, J.-L. (2011) The effects of education compatibility and technological expectancy on e-learning acceptance. *Computers & Education,* 57, 2, 1501-1511.

Cohen, J. F., Bancilhon, J.-M. and Jones, M. (2013) South African physicians' acceptance of e-prescribing technology: An empirical test of a modified UTAUT model. *South African Computer Journal,* 50, 1, 43-54.

Compeau, D. R. and Higgins, C. A. (1995) Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 189-211.

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

Davis, F. D., Bagozzi, R. and Warshaw, P. (1992) Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of applied social psychology*, 22, 14, 1111-1132.

Fishbein, M. and Ajzen, I. (1975) Belief, attitude, intention, and behavior: An introduction to theory and research*, Addison-Wesley, Reading, MA.

Hancock, G. R. and Mueller, R. O. (2010) The reviewer's guide to quantitative methods in the social sciences, Routledge, New York.

Hardgrave, B. C., Davis, F. D. and Riemenschneider, C. K. (2003) Investigating determinants of software developers' intentions to follow methodologies. *Journal of Management Information Systems,* 20, 1, 123-151.

Howe, N. and Strauss, W. (2000) Millennials rising: The next greatest generation, Vintage Books, New York.

Im, I., Hong, S. and Kang, M. S. (2011) An international comparison of technology adoption: Testing the UTAUT model. *Information & Management,* 48, 1, 1-8.

Jones, C., Ramanau, R., Cross, S. and Healing, G. (2010) Net generation or Digital Natives: Is there a distinct new generation entering university? *Computers & Education,* 54, 3, 722-732.

Jones, C. and Shao, B. (2011) The net generation and digital natives: implications for higher education, Higher Education Academy, York.

Kyobe, M. (2011) Investigating the key factors influencing ICT adoption in South Africa. *Journal of Systems and Information Technology,* 13, 3, 255-267.

Liebenberg, J. (2015) Determinants of ICT students' intentions to use e-books. *Proceedings of the ISTE International Conference on Mathematics, Science and Technology education*, 25 - 29 October, Mopani Camp, Kruger National Park, South Africa, Unisa Press, 513-521.

Lin, P.-C., Lu, H. and Liu, C. (2013) Towards an education behavioral intention model for e-learning systems: An extension of UTAUT. *Journal of Theoretical and Applied Information Technology,* 47, 3, 1120-1127.

Marchewka, J. T., Liu, C. and Kostiwa, K. (2007) An application of the UTAUT model for understanding student perceptions using course management software. *Communications of the IIMA,* 7, 2, 93-104.

Mbarika, V. and Meso, P. (2008) Editorial: Information Systems Research for Africa: A Renewed Focus. *The African Journal of Information Systems,* 1, 1, 1.

Moore, G. C. and Benbasat, I. (1991) Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research,* 2, 3, 192-222.

Moran, M., Hawkes, M. and Gayar, O. E. (2010) Tablet personal computer integration in higher education: Applying the unified theory of acceptance and use technology model to understand supporting factors. *Journal of Educational Computing Research,* 42, 1, 79-101.

Mueller, R. O. (1999) Basic principles of structural equation modeling: An introduction to LISREL and EQS, Springer Science & Business Media, New York.

Mulero, O. and Adeyeye, M. (2013) An empirical study of user acceptance of online social networks marketing. *South African Computer Journal,* 50, 1, 6-14.

Nash, J. (2009) Computer skills of first-year students at a South African university*,* in John McNeill and Shaun Bangay (Eds.) *Proceedings of the 2009 Annual Conference of the Southern African Computer Lecturers' Association (SACLA 09)*, 29 June-1 July, Eastern Cape, South Africa, ACM Press, 88-92.

Oblinger, D. (2003) Boomers, Gen-Xers & Millennials. Understanding the new students. *EDUCAUSE Review,* 38, 4, 37-47.

Oblinger, D. (2008) Emerging technologies for learning. *Becta,* 3, 11-29.

Oblinger, D., Oblinger, J. L. and Lippincott, J. K. (2005) Educating the net generation, EDUCAUSE, Boulder, Colo.

Olasina, G. (2015) Factors influencing the use of m-banking by academics: case study sms-based m-banking. *The African Journal of Information Systems,* 7, 4, 4.

Oxford English Dictionary. (2014) Anxiety. Retrieved November 30, 2016 from http://oxforddictionaries.com/ definition/english/anxiety

Prensky, M. (2001) Digital natives, digital immigrants part 1. *On the Horizon,* 9, 5, 1-6.

Prensky, M. and Berry, B. D. (2001) Do they really think differently? *On the Horizon,* 9, 6, 1-9.

Rogers, E. (1995) *Diffusion of Innovations*, Free Press, New York.

Saiedian, H. (2009) Software engineering challenges of the "Net" generation. *Journal of Systems and Software,* 82, 4, 551-552.

Taylor, S. and Todd, P. (1995) Assessing IT usage: the role of prior experience. *MIS Quarterly*, 561-570.

Thompson, R. L., Higgins, C. A. and Howell, J. M. (1991) Personal computing: toward a conceptual model of utilization. *MIS Quarterly*, 125-143.

UN Broadband Commission. (2013) *The state of broadband 2013: universalizing broadband. A report by the Broadband Commission*. Retrieved September 29, 2013 from http://www.broadbandcommission.org/documents/bb-annualreport2013.pdf

UN Broadband Commission. (2016) *The State of Broadband: Broadband catalyzing sustainable development*. Retrieved March 1, 2017 from http://www.broadbandcommission.org/Documents/reports/bb-annualreport2016.pdf

Venkatesh, V. and Davis, F. D. (2000) A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science,* 46, 2, 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003) User acceptance of Information Technology. *MIS Quarterly,* 27, 3, 425-478.

Venkatesh, V. and Zhang, X. (2010) Unified theory of acceptance and use of technology: US vs. China. *Journal of Global Information Technology Management,* 13, 1, 5-27.

Venter, P., Van Rensburg, M. J. and Davis, A. (2012) Drivers of learning management system use in a South African open and distance learning institution. *Australasian Journal of Educational Technology,* 28, 2, 183-198.

APPENDIX

Measurement items

All items were measured on a five-point Likert scale (1 = `strongly disagree' to 5 = `strongly agree').

Constructs	Item number	Item
Performance expectancy (PEx)	1a	The eBook is useful in my studies.
	1b	SAM is useful in my studies.
	3a	Using the eBook enhances the quality of my work.
	3b	Using SAM enhances the quality of my work.
	4a	The advantages of using the eBook outweigh the disadvantages.
	4b	The advantages of using SAM outweigh the disadvantages.
	8a	Using the eBook enables me to accomplish tasks more quickly.
	8b	Using SAM enables me to accomplish tasks more quickly.
	10a	Using the eBook improved my academic achievement.
	10b	Using SAM improved my academic achievement.
	16a	Using the eBook increased my productivity.
	16b	Using SAM increased my productivity.
Effort Expectancy (EfEx)	5a	Learning to use the eBook was easy for me.
	5b	Learning to use SAM was easy for me.
	6a	Using the eBook does not require a lot of mental effort.
	6b	Using SAM does not require a lot of mental effort.
	7a	I find the eBook easy to use.
	7b	I find SAM easy to use.
	9a	Using the eBook does not require a lot of effort.
	9b	Using SAM does not require a lot of effort.
	12a	I think the eBook is clear and understandable.
	12b	I think SAM is clear and understandable.
Attitude towards using technology (ATT)	17a	Using the eBook is a good idea.
	17b	Using SAM is a good idea.
	18a	The eBook makes the course more interesting.
	18b	SAM makes the course more interesting.
	19a	Working with the eBook is fun.
	19b	Working with SAM is fun.
	20a	I like working with the eBook.
	20b	I like working with SAM.
Facilitating	13a	Using the eBook fits well with the way I study.

conditions (FC)	13b	Using SAM fits well with the way I study.
	14a	The eBook is compatible with the way I use textbooks.
	14b	SAM is compatible with the way I study.
	21a	I always have the resources necessary to use the eBook.
	21b	I always have the resources necessary to use SAM.
	22a	I have the knowledge necessary to use the eBook.
	22b	I have the knowledge necessary to use SAM.
	23a	Assistance is available when difficulties with the eBook occur.
	23b	Assistance is available when difficulties with SAM occur.
Self-Efficacy (SE)	11a	I was able to complete a task using the eBook if I had a lot of time to complete the task.
	11b	I was able to complete a task using SAM if I had a lot of time to complete the task.
	24a	I was able to complete a task using the eBook even if there was no one around to tell me what to do as I progress.
	24b	I was able to complete a task on SAM even if there was no one around to tell me what to do as I progress.
	25a	I was able to complete a task using the eBook if I could call someone when I got stuck.
	25b	I was able to complete a task using SAM if I could call someone when I got stuck.
	30a	I am confident that I can deal with the eBook efficiently.
	30b	I am confident that I can deal with SAM efficiently.
Anxiety (Anx)	26a	I feel anxious about using the eBook.
	26b	I feel anxious about using SAM.
	27a	It scares me to think that I could lose a lot of information by hitting the wrong key.
	27b	It scares me to think that I could lose a lot of information by hitting the wrong key on SAM.
	28a	I hesitate to use the eBook for fear of making mistakes I cannot correct.
	28b	I hesitate to use SAM for fear of making mistakes I cannot correct.
	29a	The eBook is somewhat intimidating to me.
	29b	SAM is somewhat intimidating to me.
Behavioural intention (BI)	2a	Given the opportunity, I would use eBooks in my studies.
	2b	Given the opportunity, I would use SAM in my studies.
	15a	I predict I would use other eBooks, not only the ITRW112 textbook.
	15b	If I become aware of packages similar to SAM that are available for other modules, I predict I would use them.