SERIAL MEDIATION ON TECHNOLOGY READINESS AND TRUST AS MODERATOR ON STUDENTS' CONTINUANCE INTENTION TO USE COMPUTER-BASED TEST SYSTEM

IBRAHIM BABANGIDA MOHAMMED

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by

IBRAHIM BABANGIDA MOHAMMED

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LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
CB-SEM	Covariance-Based Structural Equation Model
CBA	Computer-Based Assesment
CBAAM	Computer-Based Assessment Acceptance Model
CBT	Computer-Based Test
CFA	Confirmatory Factor Analysis
CMS	Course Management System
CMB	Common Method Bias
CMV	Common Method Variance
CR	Composite Reliability
CVR	Cross Validated Redundancy
ECM	Expectation Confirmation Model
ECT	Expectation Confirmation Theory
GETAMEL	General Extended Technology Acceptance Model for E-Learning
HTMT	Heterotrait-Monotrait
ICIS	International Conference on Information System
ICT	Information and Communication Technology
IDT	Innovation Diffusion Theory
IPMA	Importance Performance Matrix Analysis
IS	Information System
ISS	Information System Success
IT	Information Technology
JAMB	Joint Admission and Matriculation Board
LMS	Learning Management System
MM	Motivational Model
MPCU	Model of PC Utilization

NCC	Nigerian Communications Commission
NITDA	National Information Technology Development Agency
NOUN	National Open University of Nigeria
NUC	National Universities Commission
NUNet	National Universities Network
OLS	Ordinary Least Squares
PBC	Perceived Behavioural Control
PLS-SEM	Partial Least Squares – Structural Equation Modeling
PU	Perceived Usefulness
SCT	Social Cognitive Theory
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
TOE	Technology Organisation and Environmental
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TR	Technology Readiness
TRI	Technology Readiness Index
TTF	Task Technology Fit
UNESCO	United Nations Educational Scientific and Cultural Organization
UTAUT	Unified Theory of Acceptance and Use of Technology
UTME	Unified Tertiary Matriculation Examination
VIF	Variance Inflation Factor
VLE	Virtual Learning Environment

PENGANTARAAN BERSIRI TERHADAP KESEDIAAN DAN KEYAKINAN TERHADAP TEKNOLOGI SEBAGAI PENGANTARA NIAT BERTERUSAN PELAJAR UNTUK MENGGUNAKAN SISTEM UJIAN BERASASKAN KOMPUTER

ABSTRAK

Universiti banyak melabur dalam teknologi berkenaan pendidikan yang berbeza untuk mengejar kemajuan terkini. Pelaburan sedemikian hanya dianggap berjaya apabila para pelajar dapat memanfaatkannya dengan baik. Universiti Nigeria sedang berusaha untuk menyediakan sistem ujian berasaskan komputer (computer-based test-CBT), komponen teknologi e-pembelajaran untuk melengkapkan penilaian berasaskan kertas yang biasa. Walau bagaimanapun, kejayaan jangka panjang sistem tersebut bergantung semata-mata pada niat berterusan pelajar untuk menggunakannya. Kajian lepas banyak bertumpu pada faktor sebelum penerapan tanpa mempertimbangkan pemboleh ubah selepas penerapan. Jelas bahawa tidak banyak atau tidak ada kajian yang menggabungkan indeks kesediaan teknologi (technology readiness index-TRI) 2.0 dan pemboleh ubah model pengesahan jangkaan (expectation confirmation model-ECM) dalam rangka kerja yang sama. Kajian ini bertujuan untuk mengisi jurang kajian tersebut melalui penggabungan yang teliti kedua-dua model ini bersama dengan beberapa pemboleh ubah terpilih untuk mengkaji faktor yang menentukan niat berterusan pelajar untuk menggunakan sistem CBT di Universiti Nigeria. Data empirikal dikumpulkan melalui tinjauan soal selidik daripada siswazah di Universiti Nigeria terpilih yang merupakan pengguna sistem CBT. Sebanyak 367 data maklum balas didapati sah untuk analisis regresi. Sebagai kajian kuantitatif, smart partial least square structural equation model (PLS-SEM) digunakan dalam menganalisis kedua-

dua model pengukuran dan struktur reflektif kajian ini. Hasil berdasarkan hubungan yang diandaikan dalam rangka kerja ini menunjukkan bahawa kedua-dua manfaat tertanggap dan kepuasan sebagai penentu utama niat berterusan pelajar untuk menggunakan sistem CBT. Hasil kajian menunjukkan bahawa optimisme, sifat inovatif dan sistem yang berkualiti mempunyai pengaruh positif langsung yang signifikan terhadap manfaat tertanggap. Sebaliknya, ketidakselesaan didapati mempunyai hubungan positif yang signifikan dengan manfaat tertanggap dan bukannya hubungan negatif. Begitu juga, optimisme, keadaan yang memudahkan dan manfaat tertanggap adalah satu-satunya pemboleh ubah yang didapati mempunyai hubungan langsung positif yang signifikan dengan kepuasan. Kecuali untuk ketidaktentuan, hasil mendedahkan bahawa optimisme, sifat inovatif, ketidakselesaan mempunyai kesan tidak langsung yang signifikan terhadap niat berterusan pelajar melalui pemboleh ubah pengantaraan bersiri manfaat tertanggap dan kepuasan yang mempunyai perkaitan sebab-akibat. Hasil selanjutnya menunjukkan bahawa keyakinan terhadap sistem secara negatif mengantara hubungan antara manfaat tertanggap dengan kepuasan pelajar terhadap CBT. Disimpulkan bahawa keadaan yang memudahkan, kualiti sistem dan keyakinan merupakan pemboleh ubah yang diambil kira oleh pengguna sistem CBT. Kajian ini menyumbang kepada kajian lepas dengan menggabungkan kedua-dua model terkenal dalam rangka kerja yang sama, menguji kesan pengantaraan bersiri serta menganalisis keyakinan terhadap sistem sebagai pemboleh ubah pengantaraan.

SERIAL MEDIATION ON TECHNOLOGY READINESS AND TRUST AS MODERATOR ON STUDENTS' CONTINUANCE INTENTION TO USE COMPUTER-BASED TEST SYSTEM

ABSTRACT

Universities are investing heavily in different educational technologies to catch up with recent advancement. Such investment will only be successful when the students can make good use of it. Nigerian Universities are making an effort towards deploying the computer-based test (CBT) system component of e-learning technologies to complement the conventional paper-based assessment. However, the long-term success of the system solely depends on the students' continuance intention to use the system. Previous research mostly focuses on the preadoption factors without looking at the post-adoption variables. There is an evident lack of or absence of studies integrating technology readiness index (TRI) 2.0 and expectation confirmation model (ECM) variables in the same framework. The current study aimed at filling this research gap through careful integration of these two models, together with some selected variables to examine the factors determining the students' continuance intention to use CBT system in Nigerian Universities. Empirical data was collected through a survey questionnaire from undergraduate students in selected Nigerian Universities who are users of the CBT system. Three hundred sixty-seven responses were found valid for the regression analysis. As a quantitative study, smart partial least square structural equation model (PLS-SEM) was used in analysing both the measurement and structural reflective model of the study. The findings based on the hypothesised relationships in the framework found both perceived usefulness and satisfaction as key determinants of students' continuance intention to use the CBT

system. The result shows that optimism, innovativeness and system quality were found to have a significant direct positive influence on perceived usefulness. On the other hand, the discomfort was found to have a significant positive relationship with perceived usefulness instead of a negative relationship. Similarly, optimism, facilitating condition and perceived usefulness were the only variables found to have a significant positive direct relationship with satisfaction. Except for insecurity, the findings reveal that optimism, innovativeness and discomfort have a significant indirect effect on students' continuance intention through a causally linked serial mediating variables of perceived usefulness and satisfaction. The results further indicate that system trust negatively moderates the relationship between perceived usefulness and students' satisfaction with CBT. It is concluded that facilitating condition, system quality and trust are variables of concern to the users of the CBT system. The study contributed to the literature by integrating the two famous models in the same framework, testing the serial mediation effect as well as conceptualising system trust as a moderating variable.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The proliferation of internet technology and the usage of computer systems and other electronic devices has led to the widespread adoption of e-platforms across the globe. E-commerce, e-business, e-banking, e-finance, e-portfolio, e-training, e-teaching and e-learning studies have become the areas of discussion in the academia and industries. Given the recent technological advancement, the conventional system of learning is gradually metamorphosing into a modern approach where the role of technology is significant. Using the electronic medium in the learning process is slowly becoming indispensable worldwide (Amin, Akter, & Azhar, 2016). Academic institutions have continued to invest heavily in information system (IS) to derive benefits in areas such as knowledge generation, increasing access to education, cost minimisation, improving self-efficacy, learners' flexibility and interactivity (Sinclair, Kable, Levett-Jones, & Booth, 2016).

Therefore, technological innovation in recent years has been the prime driver of educational transformation as it continued to play a significant role in knowledge dissemination. Stakeholders such as students, academic and technical staff widely use web-based applications for knowledge generation and sharing (Alsabawy, Cater-Steel, & Soar, 2016). Similarly, e-learning has also created new ways of learning by enabling instructors to deliver learning instructions via other mediums such as audio, video, animations, images and text, as well as providing online learning spaces and convenient feedback methods which is accessible to students irrespective of geographical location (Abdullah & Ward, 2016).

The world has become a global village as each part of the world is connected. The adoption of e-learning technologies is spreading far into developing and third world countries (El-Masri & Tarhini, 2017). The 2016 Ambient Insights report highlights an astonishing increase in demand for e-learning systems in several regions of the world (Ambient Insight, 2016). A study conducted by a body revealed that Africa would witness a 15.2% annual growth rate of e-learning adoption between 2012 and 2016, while that of Asia will be slightly higher at 17.3% yearly growth rate (Docebo Report, 2014). In Nigeria, the application of technology in teaching and learning in process across Universities is considered new as most institutions have not fully integrated it.

Alsabawy et al. (2016) believed that academic performance, career development, and social value, among others, are the significant benefits of e-learning to the students. They are also considered as the primary stakeholders as the end of users of the e-learning platform. Despite the numerous perceived benefits of e-learning tools, previous studies have shown that the students are not fully utilising its importance (Álvarez, Martín, Fernández-Castro, & Urretavizcaya, 2013; Tarhini, Hone, & Liu, 2013). If the students refuse to make good use of the system, then it will be considered as a failure instead of success (McGill, Klobas, & Renzi, 2014; Scholtz, Calitz, & Whale, 2014).

Course developers, instructional designers, multimedia designers, management, students and lecturers, among others, play a crucial role in the e-learning success. Sugant and Anvekar (2015) affirm that it is the views of the end-users (students), especially their perception in terms of quality and service, that decided the success of the e-learning application. Also, Wong and Huang (2011) also see the e-learning system service quality to be an essential factor in e-learning outcomes or usage.

It is generally believed that learners perceive a higher level of learning through e-learning compared to traditional learning. However, studies have shown that in terms of the effectiveness of e-learning, the results are mixed (Sugant, 2014). Arpaci (2015) also asserts that as the competition among universities increases, the need to minimise cost and attract more students to meet their academic demand, e-learning systems remain the solution.

Institutions are taking advantage of ICT as a strategy of offering an efficient, cost-effective and flexible learning environment for the rapidly growing and diverse learners. Nigeria started the process of implementing its ICT policy in April 2001 after the Federal Government approved the establishment of the National Information Technology Development Agency (NITDA) as the implementing body. The new policy mandates NITDA to collaborate with the private sector to realise the vision of making Nigeria a key player in the information society by the year 2005. This dream has not been achieved and has a long way to be attained (Torruam, 2012). Despite the effort of the Nigerian Communications Commission (NCC) in enhancing the ICT infrastructural development in Nigeria, the country is still far behind in that regard. Despite the challenges, the computer-based test (CBT) system remained as one of the vital e-learning technologies that are recently gaining wide acceptance in Nigeria.

1.2 Problem Statement

McGill et al. (2014) posit that e-learning initiatives are always subject to the rapid rate of change in technology. They continued to shape the structure of the educational systems of most nations. Marshall (2012) believed the reliability and robustness of physical infrastructure are critical to institutions of learning for the successful implementation of e-learning technology at all levels. In an effort towards achieving

success with e-learning in Nigeria, the National Universities Commission (NUC) as the apex regulatory body of Nigerian Universities has initiated the National Universities Network (NUNet) programme. The aim of the project is to enhance the provision ICT infrastructure to all government-owned universities in the country.

Similarly, the National Open University of Nigeria (NOUN) established its core e-learning platform to counter the challenges of providing quality university education for Nigerians irrespective of location and time. These initiatives opened the opportunity for the adoption of e-learning and distance education to many Nigerians (Omotayo & Tiamiyu, 2017). Despite these achievements, e-learning potential has not been fully realised in Nigeria due to several factors.

Nigeria has a total number of 160 Universities that are fully accredited by the National University Commission (NUC) of Nigeria (Aluko, 2017). With about eighty-six (86) public universities and seventy-four (74) private universities among other higher institutions such as Polytechnics and colleges of education that serve as an avenue for higher education. The World Population Review (2018) report that Nigeria is the most populous country in Africa and rank seventh in the world. It has an approximate population of over 190 million people with about sixty-three per cent of the population under the age of 24 and a high average relative growth rate of 3.24 per cent. Ademola, Ogundipe and Babatunde (2014) also emphasise that the number of students at the tertiary level has grown from under 15,000 in 1970 to approximately 1.2 million in 2014.

As a result of high demand and competition for aspiring candidates seeking for admission into tertiary institutions, many are annually missing out on places as there are not enough slots to meet the demand. Statistics have shown that over 1.7 million students registered in the year 2013 for the Unified Tertiary Matriculation Examination

(UTME) conducted by Joint Admission and Matriculation Board (JAMB) competing for the less than five hundred thousand spaces available. It was discovered that there is a steady decline since 2013 when the CBT was introduced. In 2014, the number fell to 1.6 million, while about 1.4 million registered in 2015 examination. However, in the year 2016 and 2017, the number of registered candidates has substantially increased to over 1.5 million and 1.7 million respectively. Impliedly, more than one million qualified Nigerians have left annually without a slot in higher institutions of learning (Oloyede, 2017). Table 1.1 shows the breakdown of the total number of registered candidates.

Table 1.1 UTME Registered Candidate Statistics

Year	**No. of Candidates Registered for UTME**
2013	1,710,021
2014	1,612,013
2015	1,428,379
2016	1,579,027
2017	1,736,571

Source: Extracted from Oloyede, 2017

Nigeria's education sector has also been receiving much lower than the 26% of the national budget, as recommended by the United Nations Educational, Scientific and Cultural Organization (UNESCO). In the year 2017 budget, a paltry amount of USD 1.25 billion (6%) of the entire budgets were allocated to education, contrary to the recommendation by UNESCO. Similarly, USD 1.05 billion (6.01%) was the allocations for the education sector in the year 2016 budget. The global body recommended that a minimum of 26% of the entire budget should go to education to enable nations adequately cater for high rising demands for education by citizens. Although, the Federal Government of Nigerian has continued to state its commitment

to improving education, an analysis of the budgetary allocations by other countries even in Africa shows that the government is not given adequate attention to the sector (Oyedeji, 2016).

Folorunso, Oluwafemi and Sharma (2006) while carrying out an exploratory study of the critical factors affecting the acceptability of e-learning, revealed that the Nigerian universities are left far behind in the adoption of ICT as there is great evidence of a meagre rate of e-learning diffusion and usage. Infrastructure and students' limited access to a computer is among the challenged faced by universities in Nigeria and other developing countries such as Pakistan among others (Ngampornchai & Adams, 2016).

Despite the widespread recognition of the relative benefits of e-learning, many users have discontinued using e-learning technology after the initial acceptance (Lee, 2010). Irregular electricity supply is a perennial problem affecting almost every aspect of the Nigerian economy, including education. Without power, there is hardly any system that can work as the other alternative sources are highly expensive. Electricity problem was believed to be the major setback in terms of Nigeria's technological advancement (Oye, Salleh, & Iahad, 2011). There is a high cost of acquiring and installing hardware and software technologies needed for e-learning which makes internet access cost high as well. Bandwidth in some universities is minimal due to the poor condition of existing telecommunication infrastructure. Also, technophobia, reluctance to change and the nonexistence of affordable specialized e-learning centers coupled with the limited number of technical staff are among the significant issues of concern with regard e-learning application adoption in Nigeria (Aduke, 2008; Ajadi, Salawu, & Adeoye, 2008; Anene, Imam, & Odumuh, 2014; Omotayo & Tiamiyu, 2017).

Despite these challenges, there is an increasing awareness on the use of e-learning in teaching and learning. A growing number of tertiary institutions in Nigeria have been

acquiring ICTs to promote distance education and e-learning, but the number seems very low compared to other parts of the world. These institutions aim to achieve the philosophical goal of the Nigerian National Policy on Education (the Federal Republic of Nigeria, 2004) which state that government shall provide facilities and necessary infrastructure for the promotion of ICT at all levels of education (the Federal Republic of Nigeria, 2013). Given these myriad problems and issues, among others, the study investigates the students' perception of e-learning technologies such as CBT system. It is believed that adoption and continuance intention to use e-learning technologies such as CBT in Nigerian universities will go a long way as a long-term solutions to most of the challenges in the education sector.

Furthermore, trust has been studied across disciplines, including areas related to IS or technology adoption (Kim & Benbasat, 2009). In e-commerce related context, trust is understood in two stages of pre-purchase and post-purchase (Kim, Ferrin, & Rao, 2009; Zhang et al., 2011). In terms of service delivery, it can be described as pre-interaction and post-interaction with the system. Considering that we are looking at users' continuance intention to use CBT system, it is more appropriate to perceived trust as post-usage. That is the users' evaluation in respect of the CBT system based on its actual performance after interaction with the system.

On the otherhand, post-usage (post-interaction) trust differs from initial trust in the sense that, clients with prior experience can decide on whether they will conduct a future interaction (Kim et al., 2009). Users are most likely to reassess their trust perception regarding the system in question base on their previous interaction (Hsu, Chang, Chu, & Lee, 2014). Therefore, repeated interaction can lead to more trust or mistrust (Ba & Pavlou, 2002). It is further argued that in a situation where the level of

the trust exceeds the risk perception of the user risk, end users are likely going to reuse the system (Fang et al., 2014).

Results of previous studies on students' acceptance of computer or web-based examinations are inconsistent (Deutsch, Herrmann, Frese, & Sandholzer, 2012; Fluck, Pullen, & Harper, 2009). Similarly, few studies try to examine the continuance acceptance of computer-based assessment through the integration of user's expectations and perceptions (Terzis, Moridis, & Economides, 2013). It is in view of these arguments; this study investigated the students' continuation intention to use the CBT system in Nigerian Universities.

Technology readiness index (TRI) variables (optimism, innovativeness, discomfort and insecurity) has been widely discussed and linked to other theories such as technology acceptance model (TAM) (Kuo, Liu, & Ma, 2013; Rahman, Taghizadeh, Ramayah, & Alam, 2017; Walczuch, Lemmink, & Streukens, 2007). Others have similarly examined the TRI in relation to the IT continuance model such as expectation confirmation model (ECM) (Chen, Jong, & Lai, 2014; Pereira, Ramos, Gouvêa, & Da Costa, 2015). Furthermore, Chen, Liu and Lin (2013) examined the parallel mediating effect of perceived usefulness and satisfaction on the relationship between TRI and continuance intention. However, this study tested the serial mediation effect of both perceived usefulness and satisfaction on the relationship between TRI 2.0 and students' continuance intention to use CBT system. The serial mediation effect focuses on the causally chained effect of the two variables, perceived usefulness and satisfaction. In order to achieve that, TRI 2.0 (Parasurraman & Colby, 2015) and the ECM (Bhattacharjee, 2001) models were used as underpinning theories in the study.

1.3 Significance of the Study

This study intends to bridge the research gaps identified and makes some significant contributions both theoretically and practically in the following areas.

1.3.1 Theoretical Significance

Few studies have integrated both technology readiness index (TRI) and expectation confirmation model (ECM) to examine user's continuance intention (Chen, Liu, & Lin, 2013; Chen, Jong, & Lai, 2014; Pereira, Ramos, Gouvêa, & Da Costa, 2015). This study goes further to integrate both facilitating conditions, system quality and trust into the frame to examine the students' continuance intention to use the CBT system. Technology infrastructure, which is as facilitating conditions in this framework, is mostly considered as an understudied variable (Alsabawy et al., 2016). It is one of the most untouched aspects of the literature. This study empirically validates the research framework to test the extended theory formulated.

Besides, the study further provides an empirical justification on the need to combine individual personal traits with extrinsic factors to understand the factors that affect users' continuance intention to use the CBT system. Both perceived usefulness and satisfaction will be used together as mediators in this study. This study takes a step further by investigating serial multiple indirect effects of these two mediators on continuance intention. Though other studies have examined the serial multiple mediation effect in other context using different variables (Krieger & Sarge, 2013; Vartanian, Froreich, & Smyth, 2016). This study is among the few if any to have empirically tested the multiple causal indirect effects of TRI variables, system quality and facilitating conditions on continuance intention through the causal serial multiple mediators of perceived usefulness and satisfaction.

Furthermore, it is believed that the most crucial step of advancing a model or theory is by applying it in different cultural settings and context (Alvesson & Karreman, 2007; Viswanath Venkatesh & Zhang, 2010). As highlighted, there has been called by many scholars for e-learning related technologies studies to be carried out mainly from the user perspective in developing countries (Uppal, Ali, & Gulliver, 2017). This study is one of the few to have investigated the students' perception regarding the CBT system continuance intention to use in Nigerian universities. Therefore, this study provides valuable insight and more evidence on the influences of TRI variables on the students' continuance intention to use CBT system in Nigerian universities, which may help to build the scant literature concerning e-learning studies in the Nigerian context.

1.3.2 Practical Significance

It is essential to investigate the factors that influence students to use e-learning system to make it a useful learning technology in university education (Sharma & Chandel, 2013). Studying the learners' (students) perceptions on e-learning technology such as CBT system is of immense benefit as it will assist the top management to have a clear understanding of critical factors that can influence student' continuance intention to use the system. Therefore, this study makes a significant practical contribution to the federal government of Nigeria, education administrators, university management, and other policymakers on education. The study provides recent and relevant information that may enhance the knowledge and understanding of e-learning in Nigeria.

Secondly, this study may be of considerable significance to Nigeria as empirical studies explaining the students' perception of the continuance intention to use e-learning and actual usage in Nigerian universities context are very rare if it exists. Factors affecting students' continuance intention to use e-learning in general and

specifically the CBT system in Nigerian universities are explored. The information provided about the effect of each determinant factor of the students' usage behaviour would be useful in the formulation of government policies and the success of e-learning system. Furthermore, it would enable the government to know the strategies to adapt to accommodate a large number of students who want to further their education in tertiary institutions in Nigeria but could not afford to due to limited slot available in the present conventional educational system.

1.4 Research Questions

Based on the arguments in the previous sections, this research also proposes the following research questions. The main research question is what are the factors or variables that can determine the students' continuance intention to use CBT system in Nigerian Universities. The specific research questions are:

1. Does technology readiness variables (optimism, innovativeness, discomfort and insecurity) and system quality influence students' perceived usefulness of CBT system?
2. Does technology readiness variables (optimism, innovativeness, discomfort and insecurity) system quality, facilitating condition and perceived usefulness influences students' satisfaction with the CBT system?
3. Does perceived usefulness and satisfaction influences students' continuance intention to use CBT system?
4. Does system trust negatively moderates the relationship between students' perceived usefulness and satisfaction with the CBT system?

5. Does perceived usefulness mediate the relationship between technology readiness variables (optimism, innovativeness, discomfort, insecurity) system quality and students' continuance intention to use CBT system?
6. Does satisfaction mediate the relationship between technology readiness variables (optimism, innovativeness, discomfort, insecurity) system quality, facilitating condition and students' continuance intention to use CBT system?
7. Does technology readiness variables (optimism, innovativeness, discomfort and insecurity) and system quality influence students' continuance intention through a serial chain of causally linked mediators of perceived usefulness and satisfaction?

1.5 Research Objectives

Given the problems identified in the previous sections, the following research objectives were set to achieve the goal of the study. The main aim of this study is to gain an in-depth understanding of how the combination of these variables can explain the students' perception of their continuance intention to use CBT system in Nigerian universities context. The specific objectives include:

1. To examine the influence of technology readiness variables (optimism, innovativeness, discomfort and insecurity) and system quality on students' perceived usefulness of CBT system
2. To assess the influence of technology readiness variables (optimism, innovativeness, discomfort and insecurity) system quality, facilitating condition and perceived usefulness on students' satisfaction with the CBT system

3. To determine the effect of perceived usefulness and satisfaction on students' continuance intention to use CBT system
4. To assess the moderating effect of system trust on the relationship between perceived usefulness and students' satisfaction with the CBT system
5. To examine the mediating effect of perceived usefulness on the relationship between technology readiness variables (optimism, innovativeness, discomfort, insecurity), system quality and students' continuance intention to use CBT system
6. To determine the mediating effect of satisfaction on the relationship between technology readiness variables (optimism, innovativeness, discomfort, insecurity), system quality, facilitating condition and students' continuance intention to use CBT system
7. To investigate the serial mediating effect of both perceived usefulness and satisfaction on the relationship between technology readiness variables (optimism, innovativeness, discomfort and insecurity), system quality and students' continuance intention to use CBT system

1.6 Scope of the Study

The scope of the study has to do with the study coverage in terms of geographical area, context and variables. This research was conducted on the Universities in the core northern Nigeria with established CBT system to assess students during an examination. The selected Universities cut across both public and private-owned Universities. Universities without an established CBT system were excluded.

Similarly, it involves only undergraduate students. Postgraduate students were excluded. This is because preliminary investigation shows that almost all the

Universities that have CBT systems were meant to be used for assessing undergraduate students only. Furthermore, the data collected is only on one e-learning technology, that is the CBT system. Other e-learning technologies used in Nigerian Universities were not included in the current research. The justification has to do with the study aims to collect empirical data related to the students' continuance intention to use the CBT system only. It is one of the most leading e-learning technologies available in some of the Universities in Nigeria.

Finally, this study focuses only on the end users (students) instead of the service providers. The focus is on variables that are directly related to the concept under investigation. Therefore, empirical data collected are only on those variables associated with the current study. Variables that are considered not to have any relevance to the current research context were excluded. This limitation is based on the stated research objective, research question, as well as the hypothesised relationships aimed for investigation.

1.7 Definition of Terms

The key terms and construct to be used in this study were defined based on the way they were used in previous studies**.** Table 1.2 provide the list of the key terms as well as their definitions.

Table 1.2 Definition of Key Terms

S/No.	Term	Definition
1	Technology infrastructure	This is referring to a shared technology platform such as computer hardware, software, and networking technologies that are necessary for the successful deployment of new technology innovation in an organisation (Bhattacherjee & Hikmet, 2008)
2	Technical Expertise	This is described as the organisations' level of technical skill available to support the implementation and adoption of new technology (Lin & Lin, 2008).
3	Technical Compliance	It refers to the degree to which technological innovation is perceived as being consistent with existing operating practices, beliefs and values, past experiences, and needs (Rogers, 1995).
4	Technology Readiness	This is defined as people's propensity to embrace and use new technologies for accomplishing goals in home life and at work (Parasuraman, 2000).
5	Optimism	Refers to a positive view of technology and a belief that it offers people increased control, efficiency, and flexibility in their lives (Parasuraman & Colby, 2015)
6	Innovativeness	This is defined as the tendency for an individual to be an early adopter of technology and opinion leader (Parasuraman & Colby, 2015)
7	Discomfort	This is the perceived lack of control over technology and a feeling of being overwhelmed by it (Parasuraman & Colby, 2015)
8	Insecurity	This is the distrust of technology, as a result of scepticism about its ability to work properly and concerns about its potential harmful consequence (Parasuraman & Colby, 2015)
9	System Quality	This is the technical aspects of a system, such as the convenience of access, system functionality, reliability, response time, sophistication, ease of use, and flexibility, among others (Petter et al., 2013)
10	Perceived Usefulness	This is defined as the degree to which an individual believes that using a system would enhance his/her job performance (Davis, 1989)
11	Satisfaction	This refers to the extent to which users believe that their needs, goals, and desires about a particular system have

		been fully met (Sanchez-Franco, Ramos, & Velicia, 2009)
12	Continuance Intention	This is referring to the users' intention to continue to use an information system based on prior experience (Bhattacherjee, 2001)
13	E-learning	This is an online system that adapts with the traditional learning (face-to-face) components; planning, specific content and methodology, interaction, support and assessment (Dorobat, 2014).
14	Computer Based Test System	Computer-based test or computer-based assessment is a method of administering tests or examination to students in which the responses are electronically recorded and instantly assessed (Alabi et al., 2012).
15	System Trust	Electronic trust is defined as the degree of users confidence in relation to interaction with a system via an electronic or online platform (Ribbink, van Riel, Liljander, & Streukens, 2004)
16	Serial Mediation	Serial mediation is a process where there is a causal chain linking the mediators, with a specified direction of causal flow (Hayes, 2012).

1.8 The Organisation of the Thesis

This section highlighted the general organisation of the current research work. The thesis is organised into five chapters, with each chapter having themes and sub-themes. The first chapter labelled as introduction captures the general overview of the entire research. It contains sections such as the background of the study, problem statement, research objectives and questions as well as significance and scope of the study. It is the preamble that introduces the thesis and highlights the motivation behind the research.

The second chapter is called a literature review. As the name implies, this chapter reviewed recent literature related to the variables of the study. It provides an in-depth

discussion of previous studies related to the current research. The literature highlighted what has been done and what needs to be done in the area under investigation. The basic concept associated with e-learning technology or technology adoption in general and CBT system specifically were discussed. Furthermore, the chapter reviewed the major theories or models underpinning this study. These theories or models were critically reviewed and related to the variables under investigation. Similarly, a link was established specifically to the context of the current research.

Chapter three elaborates on the methodology adopted in carrying out the research. Each research must identify a method to follow in tackling the identified research problem. The chapter included the discussion on the specific research paradigm, philosophy or research worldview approach chosen to address the research problem. Other aspects of the methodology included research design, population and sample size, sampling and sampling technique, questionnaire measurement, design and administration, operationalisation of the construct and items, among others. Therefore, this section provides a detailed discussion of the methodology approach of the current study.

The fourth chapter shows the result of the analysis carried out. A full display of all the findings of the tested hypotheses was shown in this section. The validity and reliability of the measurement model were analysed. A concept related to convergent validity, internal consistency and the demographic result was demonstrated in this chapter. Similarly, the structural model analysis consisting of collinearity issues, effect size, path coefficient, coefficient of determination and predictive relevance of the model were displayed. Tables and figures were used to support the analysed result of the study. It is one of the most important chapters as empirical findings of the research were shown here.

Finally, the fifth chapter focuses on the main findings of the research based on the results obtained. It is the concluding chapter and therefore, major conclusions, and recommendations for future research was made. Chapter five presents the results and analysis of the research data in which descriptive statistics, factor analysis and multiple regression analysis were employed. Lastly, the full discussion of the result findings from which the theoretical and practical implications and contributions of the study were explained.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The previous chapter highlights the background of the study by introducing the research motivation, problem and issues as well as the research objectives and questions. This section reviews the literature relevant to the aim of the study. This chapter elaborate on the general e-learning concept, forms and types, factors affecting the continuance intention to use e-learning as well as the technology adoption theories related to the study. Variables and constructs related to the study were also discussed.

2.2 E-learning Concept

Garrison (2011) said that the term e-learning emerged in the mid-1990s when the world wide web (www) began to gather momentum and gain relevance. The process of learning through the internet, popularly known as e-learning is gradually becoming indispensable. The effectiveness of using e-learning tools such as Modular Object-Oriented Dynamic Learning Environment (Moodle), Google Classroom, Blackboard, Learning Management Systems (LMS), Virtual Learning Environment (VLE), Course Management System (CMS), and Multi-Agent Adaptive Instruction (MAgAdI), CBT system among others to support the basic needs of administration and higher education teaching has been studied by several scholars (Álvarez et al., 2013; Amin et al., 2016). The technologies have become part and parcel of educational system especially in tertiary education.

Despite the existing literature on e-learning, opinion differs when it comes to the definition of e-learning. E-learning can be defined as a dynamic and immediate learning environment through the use of the internet to improve the quality of learning by providing students with access to resources and services, together with distant exchange and collaboration (Dominici & Palumbo, 2013; Jeong, Hong, Jeong, & Hong, 2013). Clark and Mayer (2011) used a more comprehensive caption by broadly defining it as any educational media that is delivered in an electronic form. Terms such as computer-assisted learning, online learning, web-based learning and e-learning are often used, which all reflect information delivery via an electronic device. This broad definition allows for a range of multimedia to be used in the learning process for the purpose of lecture preparation, delivery and student's assessment.

Dorobat (2014) stated that e-learning is an online system that adapts with the traditional learning (face-to-face) components; planning, specific content and methodology, interaction, support and assessment. The e-learning system helps the learning process to be flexible. However, blended learning (combined, hybrid, integrative) is achieving the learning objectives through the applications of specific technologies to customise the act of learning and to transfer knowledge and skills to the right person at the right time (Masa, Tarhini, Mohammed, & Maqableh, 2016). This concept of e-learning is closer to the context of this research. As mentioned earlier, the application of e-learning in Nigerian universities has not been fully utilised. Most of the universities have an online portal where some information is shared.

Some universities have implemented CBT as a means of conducting examination, especially for general studies courses due to a large number of students for easy assessment. Some universities use digital electronic boards for lecture delivery and

presentation. Similarly, some lecturers utilised projectors in lecture delivery and request students to forward their assignment through e-mail. Students can also register their courses and check their semester result via the university portal. In institutions like National Open University of Nigeria (NOUN), students can download course materials, write exams online and offers open and long-distance learning. Therefore e-learning in the context of this study has to do with CBT system used for writing exams in some Nigerian Universities. Khan and Badii (2012) believed that all e-learning technologies could be classified into two types of e-learning distribution, that is either synchronous (real-time) or asynchronous (flex time).

2.2.1 Computer Based Test System

CBT also is known as computer-based assessment (CBA) or e-exam is a method of administering tests or examination to students in which the responses are electronically recorded and instantly assessed (Alabi, Issa, & Oyekunle, 2012). It is a form of self-assessment where students make judgments about their work by evaluating their strength and weaknesses (Kaklauskas et al., 2010). Usually, multiple-choice questions are used for the CBT system, which can be assessed quickly online. CBT is gradually replacing the paper-based system in some Nigerian Universities, mostly for general studies courses with a large number of students. However, the adoption of this new mode of assessment in Nigerian Universities faces a lot of challenges such as economic factor, security, technology infrastructure, inadequate information and communication technology (ICT) culture, policy and implementation, power failure among others (Abubakar & Adebayo, 2014).

The e-examination system offers a lot of benefits such as flexibility, instant assessment and feedback, minimise malpractice and low staff requirement which may lead to

lower running cost in the long run (Cantillon, Irish, & Sales, 2004). Despite the numerous advantages, the adoption of ICT in the higher education system is still low due to some factors (Birch & Burnett, 2009). Therefore, a successful implementation strategy of such technological innovations needs to consider the students' acceptance. Terzis and Economides (2011) developed the Computer-based assessment acceptance model (CBAAM), which uses variables mostly from the well-established technology adoption models and introduces two new variables. The two variables added were goal expectancy and content.

2.2.2 Mobile Learning

Mobile learning is seen by many as a component of the general e-learning concept. Althunibat (2015) argues that recently mobile devices such as iPad, smartphones, PDAs contribute more in learning environment than traditional or desktop computers. Mobile learning can be defined as a flexible learning tool using mobile handheld devices in the context of learning and education (Abachi & Muhammad, 2014). Similarly, Lan and Sie (2010) see mobile learning as the integration of mobile handheld devices together with wireless network technologies to enhance the learning and education by facilitating students' access to the learning materials anywhere and anytime.

The usage of mobile learning technology in universities has become crucial due to the significant benefits it has offered. Al-Emran, Elsherif, and Shaalan (2016) added that when mobile learning is integrated into higher education, it provides many advantages for both students and educators such as learning at any time and anywhere, assisting lecturers in delivering information and in performing their learning activities more comfortably and flexibly.

The growing use of social networks platforms such as Facebook, YouTube and WhatsApp among students, has encouraged some universities to take advantage of such opportunity. This motivates the students to engage with different learning tools because the effectiveness of educational practices is directly related to students' engagement (Moghavvemi, Paramanathan, Rahin, & Sharabati, 2017). Recently, studies have taken into consideration some of the factors affecting students' acceptance of mobile learning like social, culture, cost, availability, facilitating conditions, perceived usefulness and perceived ease of use (Abu-Al-Aish & Love, 2013; Almaiah, Jalil, & Man, 2016; Althunibat, 2015; Mohammadi, 2015). In Nigeria, mobile learning has the prospect of becoming the most predominant form of e-learning due to the high growth rate of mobile penetration and the infrastructure challenges of e-learning faced by universities.

2.2.3 Factors Influencing Students' Intention to Use E-learning

Users' acceptance of a new information system or technology has become a prerequisite for the successful implementation of an information system (Almaiah et al., 2016). Scholars across the globe conducted several studies to understand the perception of e-learning users. Factors such as social, organisational, individual and cultural were identified as significant drivers of e-learning intention to use by students and other stakeholders alike. The variables were drawn mainly from the well-established information system (IS) adoption theories and models.

Almarashdeh, Sahari, Zin and Alsmadi (2010) assessed the success of learning management systems among distance learning students in Malaysian universities. They identified information quality, system quality, service quality, perceived usefulness and perceived ease of use influential towards intention to use. The result

reveals that all the variables have a strong and positive relationship with intention to use e-learning except for information quality having an insignificant relationship. Similarly, Li, Duan, Fu and Alford (2012) studied the behavior of e-learners in rural China and argued that among the factors that directly influence the intention of users towards using an e-learning system include service and course quality, perceived usefulness, perceived ease of use in addition to self-efficacy.

Farahat (2012) while conducting a study among undergraduate university students in Egypt on the determinants of students' acceptance on online learning and how these determinants can shape students' intention to use online learning. The study shows that perceived ease of use, perceived usefulness, attitude and social influence have a significant impact on intention to use online learning. Chen and Liu (2013) in their study on the effectiveness of IT in reducing the rural-urban knowledge divide in Taiwan found technology policy, information integrity, information accessibility, perceived ease of use, perceived usefulness and system support to have a relationship with intention to use. Tarhini et al. (2013) identified the factors affecting students' acceptance of e-learning in developing countries. They collected data on 569 undergraduate and postgraduate students in Lebanon. They realised that perceived usefulness, perceived ease of use, social norms and quality of work-life as significant determinants of students' behavioural intention to use e-learning. While behavioural intention as the determinant of actual e-learning use.

Similarly, Mohammadi (2015) investigate users' (students) perspectives on e-learning using an integrated model of TAM and Delone & McLean ISS model in an Iranian public university. He discovered, service quality, technical system quality, content and information quality and perceived usefulness to have a relationship with the intention