

BEHAVIOURAL INTENTION TO USE ICT IN TEACHING SCIENCE AMONG
LECTURERS IN NIGERIAN POLYTECHNIC

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DEDICATION

This research work is dedicated to the Almighty God who has given me strength, ability and wisdom to complete this study.

To my dear parents, Sarkin Yakin Dass Garba Bundot and my dearest mother Salamatu Garba for their love and care.

To my dearest and lovely wife, Ruth Joshua Yohanna.



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ABSTRACT

Nigeria is investing in information and communication technology (ICT) to improve students' learning outcome and the quality of education. However, based on research literature, the use of computer in the teaching of science by lecturers is underutilised. Therefore, the study was conducted to investigate the intention to use computer in teaching science among lecturers in North Eastern Polytechnic. The study aimed at examining the relationship between perceptions, attitude, and other factors responsible for lecturer's behavioural intention towards the use of computer in teaching science. A quantitative design followed by supporting interview was used to execute the study and address the research objectives. Two hundred and sixty-nine (269) lecturers were selected from a population of 715 lecturers. Quantitative data were obtained from the Technology Acceptance Model (TAM) inventory and the validated questionnaire was used in the study. The data were analysed using Structural Equation Modelling (SEM). Qualitative data were obtained using semi-structured interview protocol to facilitate interviews with five participants who were purposefully selected for this phase of the study. The qualitative phase of the study aimed at exploring important factors responsible for the intention to use ICT in science teaching. The findings showed the significance of perceived ease of use on perceived usefulness, perceived ease of use, and perceived usefulness are significant on attitude while perceived usefulness and attitude are significant on behavioural intention. Perceived ease of use was moderately significant towards behavioural intention against the TAM model. The moderators such as gender, age, and teaching experience showed influence on perceived ease of use, perceived usefulness, and attitude toward behavioural intention. Suggestions were made to provide incentives for lecturers who practise ICT and Trainings, workshops, and professional development courses should be provided to train lecturers on incorporating ICT in their teachings.

ABSTRAK

Nigeria telah melabur dalam teknologi maklumat dan komunikasi (ICT) bagi meningkatkan hasil belajar pelajar dan memacu pendidikan yang berkualiti. Walaubagaimanapun, dari kajian literatur penggunaan komputer amat kurang digunakan bagi tujuan pendidikan. Oleh itu, kajian ini dijalankan bagi mengkaji tingkah laku dalam kalangan pensyarah pengajian tinggi di Nigeria untuk menggunakan komputer bagi pengajaran sains. Tujuan utama kajian ini ialah untuk mengetahui hubungan antara persepsi, sikap dan faktor-faktor lain yang bertanggungjawab terhadap tingkah laku penggunaan komputer. Kaedah penyelidikan kajian ini menggunakan kaedah kuantitatif yang disokong oleh temubual untuk menjalankan kajian dan memenuhi objektif kajian ini. Seramai dua ratus enam puluh sembilan (269) pensyarah dipilih daripada tujuh ratus lima belas (715) populasi pensyarah di beberapa institusi yang menawarkan kursus sains. Data kuantitatif diperolehi melalui Model Penerimaan Teknologi (*the Technology Acceptance Model, TAM*) oleh dan borang soalselidik yang telah disahkan. Analisis dibuat dengan menggunakan *Structural Equation Modeling (SEM)*. Data kualitatif pula diperolehi melalui protokol semi struktur yang digunakan bagi menjalankan temubual kepada lima orang yang dipilih khas untuk kajian ini. Fasa kuantitatif kajian ini bertujuan untuk mengkaji faktor penting yang bertanggungjawab terhadap motivasi penggunaan ICT dalam pengajaran sains. Kajian mendapati bahawa perasaan atau rasa mudah digunakan dalam penggunaan komputer adalah signifikan terhadap perasaan keberkesanan penggunaan komputer, perasaan atau rasa mudah digunakan dalam penggunaan komputer dan perasaan keberkesanan penggunaan komputer adalah signifikan terhadap sikap penggunaan komputer, manakala perasaan keberkesanan penggunaan komputer serta sikap penggunaan computer adalah signifikan terhadap tingkah laku penggunaan computer. Perasaan mudah digunakan sedikit sebanyak memberi signifikan terhadap tingkah laku dan bertentangan model TAM. Kesemua moderator seperti jantina, umur dan pengalaman mengajar menunjukkan pengaruh terhadap perasaan atau rasa mudah digunakan dalam penggunaan computer, perasaan keberkesanan penggunaan komputer dan sikap terhadap tingkah laku penggunaan komputer. Kajian menunjukkan bahawa masalah-masalah berkaitan penggunaan ICT adalah kekurangan polisi persediaan kemudahan ICT, kekurangan modul untuk ICT dalam kurikulum, kekurangan kesedaran pensyarah terhadap ICT dan lain-lain masalah yang mereka hadapi di dalam organisasi untuk menggunakan ICT dalam proses pengajaran. Antara cadangan-cadangan untuk mengatasi masalah tersebut adalah pemberian insentif kepada pensyarah yang mengamalkan ICT, serta kehadiran ke latihan dan bengkel pembangunan ICT yang professional bagi melatih pensyarah menggunakan ICT dalam proses pengajaran.

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LIST OF ABBREVIATIONS

<i>AT</i>	Attitude
<i>BI</i>	Behavioural Intention
<i>CAI</i>	Computer Aided Instructions
<i>CBL</i>	Computer Based Learning
<i>CD</i>	Compact Disc
<i>CFA</i>	Confirmatory Factor Analysis
<i>CFI</i>	Comparative Fit Index
<i>CR</i>	Critical Ratio
<i>DIT</i>	Diffusion of Innovation Theory
<i>DTPB</i>	Decomposed version of theory of planned behaviour
<i>DVD</i>	Digital Versatile Disc
<i>ETF</i>	Educational Trust Fund
<i>FME</i>	Federal Ministry of Education
<i>GFI</i>	Goodness of Fit Index
<i>HEIs</i>	Higher Educational Institutions
<i>HIs</i>	Higher Learning Institutions
<i>HR</i>	Human Resource
<i>ICT</i>	Information and Communication Technology
<i>IDT</i>	Innovation Diffusion Theory
<i>IWB</i>	Interactive White Board
<i>MC</i>	Motivation to Comply
<i>MOU</i>	Memorandum of Understanding
<i>MPCU</i>	Model of Pc utilisation
<i>NB</i>	Normative beliefs
<i>NBTE</i>	National Board for Technical Education

<i>NFI</i>	Normed fit index
<i>NITDA</i>	Nigerian Information Technology Development Agency
<i>NITEF</i>	National Information Technology Education Framework
<i>NYSC</i>	National Youth Service Corps
<i>PBC</i>	Perceived behavioural control
<i>PCs</i>	Personal Computers
<i>PEU</i>	Perceived ease of use
<i>PIL</i>	Partners in Learning
<i>PTDF</i>	Petroleum Technology Development Endowment Fund
<i>PU</i>	Perceived usefulness
<i>RMSEA</i>	Root mean square error of approximation
<i>SEM</i>	Structural Equation Model
<i>SCT</i>	Social Cognitive Theory
<i>SN</i>	Subjective Norms
<i>SN</i>	Social Norms
<i>STOC</i>	Stage Theory of Organisational Change
<i>TAM</i>	Technology Acceptance Model
<i>TPB</i>	Theory of Planned Behaviour
<i>TLI</i>	Tucker-Lewis Index
<i>TRA</i>	Theory of Reasoned Action
<i>TTAP</i>	Teachers Thought and Action Process
<i>TVET</i>	Technical and Vocational Education
<i>TV</i>	Television
<i>USA</i>	United States of America
<i>UTAUT</i>	Unified Theory of Acceptance and Use of Technology

CHAPTER 1

INTRODUCTION

1.1 Introduction

The transformation of the world to digital media and information has increased the criticality of information and communication technology (ICT) in education. Higgins, Beauchamp & Miller (2007) affirmed that its importance would continue to grow and progress in the 21st century. Therefore, most nations strive to benefit from this technological advancement in enhancing their educational programmes. Most developed nations have taken advantage of this computer age and have improved their educational curriculum structure which in turn also transformed their academic landscape for economic development (Fairlie & Robinson, 2013).

The use of ICT in education requires several organisations to restructure their operations to commensurate with modern technology (Griffin, 2003). To catch up with the rest of the world and narrow the digital divide, most governments among the developing countries have responded to this challenge by initiating national programmes to introduce computers in various organisations and ministries (Venkatesh & Sykes, 2013).

The Nigeria government has acknowledged the importance of technology in the teaching and learning process and has come up with policies and programmes on how to harness ICT adoption at all levels of education, particularly at the tertiary level (Agabi, Agbor, & Ololube, 2015). To use technology, the 21st century lecturer is therefore challenged to acquire basic expertise, update his pedagogy and possess

positive attitude to teach students of Higher Learning Institution (HLIs) the knowledge and skills required in this current knowledge age (Acedo & Hughes, 2014; Dawson, Heathcote, & Poole, 2010; Jimoyiannis & Komis, 2007; Tinio, 2003b). On the part of students, Donahoo and Whitney (2006) reported that HLIs' curriculum should cover all the necessary tools, skills, and competence required for students to function favourably in an environment similar to which they will encounter in the real world. Therefore, institutions must provide an enabling environment for students to acquire the fundamental employability skills required for a highly competitive economy, particularly in technical and vocational education if they are to compete favourably in the global labour market. In this regard, effective utilisation of ICT in the HLIs's for technical and vocational training could develop learners' capacity in the highly competitive labour market. In fact, Skryabin, Zhang, Liu, and Zhang (2015) stressed that technical and vocational students of HLIs with well-equipped ICT facilities and progressive lecturers are likely to have high rating employment opportunities than those without it upon graduating.

Technology can be utilised to illustrate and simulate real-life object activities for science students who often engage in learning scientific concepts that are usually abstract and not easily comprehended. Their interactions with ICT will enhance their understanding of science and result in meaningful learning experience instead of rote learning. The use of ICT will better equip these science students with skills for national and global employment. Therefore, lecturers should possess adequate competency, positive attitude, and behavioural intention toward technology adoption in the 21st century (UNESCO, 2008). All these form the basis for this research.

1.2 Background of the study

The background of this study aims to highlight the importance of ICT usage in education. Delen & Bulut (2011) highlighted ICT usage in Higher Educational Institutions (HEIs) to improve learning outcome, specifically in a profession that is technologically driven. However, recent literature reports varied research findings on the impact of ICT in the HEIs on students' achievement. On the one hand, the majority of past research studies indicated positive outcome ((Delen & Bulut, 2011; Skryabin *et al.*, 2015; Tüzün, Yılmaz-Soylu, Karakuş, İnal, & Kızılkaya, 2009). In

contrast, some scholars revealed insignificant outcome (Eickelmann, Drossel, Wendt, & Bos, 2012; Fairlie & Robinson, 2013). The possible reasons for the variation in the research outcomes may be attributed to methodological limitations.

Another contributing factor is the researcher's inability to differentiate the direct effects of ICT on students' achievement from other variables that might affect students' abilities to use ICT in learning concepts (Karamti, 2016).

Nevertheless, Tinio (2003a) posits that ICT is a new age tool that can be used to transform education by supporting teaching and learning in several ways. Firstly, it can increase learner motivation and engagement. Secondly, it can facilitate an effective and efficient acquisition of basic skills for students of HLIs. Lastly, the availability of ICT, accessibility, and utilisation in HEIs could enhance lecturers' teaching and learning outcomes, and enhance professional development.

Similarly, Hassan (2008) observed that development of ICT in education had varied the nature of people's way of learning. In this study, the researcher used a Computer Based Learning (CBL) course software material which was adapted to particular learning styles. Lecturers can apply different contexts of learning challenges to improve learning difficulties and preferences to cater for students' individuality.

Technology acceptance inquiries within the arena of information structures have been limited in its application to teaching in Nigeria. Hence, there is a need to develop and advance experimental backing for technology acceptance within higher education and to look into and address acceptance and application issues amongst lecturers. There is a scarcity of data relating to acceptance and utilisation of ICT amongst lecturers which will eventually be obtainable in their workspaces (Agbetuyi & Oluwatayo, 2012). The TAM is used because the technology is at inception stage, even though ICT has been there for several decades now. TAM model is easy and parsimonious to use against other models. The constructs in other models are similar to TAM (Venkatesh, Morris, Davis, & Davis, 2003)

This study further recognises the importance of the moderating effect of gender, age, and teaching experience on the relationship between the determinants and behavioural intention. The differences in the strength of the path coefficients might bring additional insight into the conventional views regarding gender, age, and

teaching experience as moderators, especially in developing countries like Nigeria. Also, the differences between genders, age, and degree of teaching experience could vary across cultures (Gefen & Straub, 1997).

The reason for including gender, age, and teaching experience as moderating variables was to identify how individual difference can help towards a better understanding of the use of ICT among lecturers in the northeast of Nigeria. Most studies have used the Technology Acceptance Model (TAM) in determining the relationship between perceived ease of use, perceived usefulness, and attitudes towards behavioural intention (Venkatesh, Morris, and Ackerman, 2000). Tsai & Tsai, (2010) and Drabowicz, (2014) emphasised the relevance of gender. These particular studies also consider the use of gender as an important moderating variable as Nigeria (the case study) treats gender equality as a sensitive issue.

The north-eastern Nigerian women are regarded as very passive members of society. Therefore, the women look unto men for any other work, hence, have affected their perception of technology and might reduce their desire for self-usage. Hence, this is the main reason for choosing gender as a moderating variable. The success of computer education intervention is dependent, to a considerable extent, on student acceptance and use of the technology. As such, it becomes imperative for practitioners and policymakers to understand the factors affecting user's acceptance to enhance students and teacher learning experience (Tarhuni, Hone & Liu, 2014; Khechine *et al.* 2014). The ability and attitude to learn and teach computer have been found to be a considerable factor, hence, the reason for using age as a moderating variable (Hong, Lui, Hahn, Moon, and Kim, 2013).

Several studies have also established the relevance of lecturer's experience with ICT in pedagogical ways that can influence pre-service teachers' intention to use ICT for teaching and learning (Valtonen, *et al.* 2015; Kreijns *et al.* 2013; Teo, 2010). Consequently, this current study attempts to verify this by establishing teaching experience as a moderating variable.

In the Nigerian context, the availability and application of ICT for teaching as instructional models is still in its infancy (Iloanusi *et al.*, 2009). In fact, Anyanwu and Ossai-Onah (2011) recorded that Nigerian HLIs do not have adequate ICT infrastructure to utilise the opportunities offered by the ICT exposition for educational transformation comprehensively. They reported that the Nigerian

government provides both hardware and software (Personal Computers - PCs) in most Nigerian tertiary institutions. Despite that, the students' accessibility to them remains a critical issue. They concluded that the average student to computer ratio in Nigeria is 1 to 40.

Agbetuyi and Oluwatayo (2012) stated that apart from poor students' ratio accessibility, inadequate infrastructural facilities such as electricity and the Internet are some of the significant impediments to the integration of ICT. The utilisation and implementation in the Nigerian academic community should also be stressed since the software required for practical teaching and assessment are not readily available. Human resources with computer expertise is another area of challenge (Mac-Ikemenjima, 2005). Olarongbe & Ibrahim (2009) and Oye, Salleh, & Iahad (2011) opined that although the internet connection is present in some Nigerian Polytechnics. The issue is that the bandwidth speed of access is entirely too small to enable or facilitate any meaningful academic work (Achimugu, Oluwagbemi, & Oluwaranti, 2010). As a result of the above issues, notable scholars have researched on the impediments to the use of ICT in Nigerian polytechnics (Haliso, 2011; Igbiosa & Aristarkus, 2015).

The improvement of infrastructure for e-learning in recent times is a welcome development for the Nigerian government. The support of non-governmental organisations (NGOs), banks, and several private sectors have equipped secondary schools and HLIs with sufficient infrastructure (Agbetuyi & Oluwatayo, 2012). Reports by Ahmad, Abubakar, and Dabo (2013) and Matthew, Joro, and Manasseh (2015) revealed that the Petroleum Technology Development Endowment Fund (PTDF) provided more facilities including additional computer labs, cables, and wireless internet services, and also e-libraries for learners to HLIs.

The Nigerian Information Technology Development Agency (NITDA) also installed internet facilities and solar-powered devices for stable electricity to most HLIs that paved the way for ICT, capacity building and facilitation of lecturers as well as student's technology utilisation for the development of teaching and learning. Despite the support, most technical and vocational lecturers still conduct lectures through conventional teaching approaches (Adegbija, 2011).

Koh, Chai, & Tsai (2014) strongly recommended the integration and utilisation of ICT in education for the transformation of teaching and learning. The

use of technology supports constructivists approach. Hence, there is a need for a paradigm shift from the traditional lecturer-centred approach to a more meaningful learner-centred approach with which ICT plays an active role in a variety of learning process. The study concluded that lecturers' role in teaching and learning was indispensable for any academic environment to contribute towards the move to technological and real-life economic transformations.

Similarly, according to Newhouse (2002), lecturers would always have a critical role in directing what, why, and how students learn whether by controlling the instruction or providing the learning situations. To efficiently commence and implement ICT in HLIs' programmes, it practically depends on the lecturers' competence and capacity for ICT utilisation. Also, lecturers' perceived usefulness, perceived ease of use, and their attitude and behaviour toward ICT usage determine its application for their pedagogical approaches. Notable studies have shown that lecturers' perceptions, attitudes, and behavioural intention toward technology are paramount to the successful integration of ICT in teaching and learning (Albirini, 2006; Ertmer et al., 2012; Hernández et al., 2014).

Buabeng-Andoh (2012) reiterated that if lecturers do not perceive technological application in their profession as satisfying, then their goal in learning or helping their students to learn is rather unlikely. It is more likely that they will not integrate technology into teaching and learning. The study concluded that lecturers with a positive attitude about technology were more likely to provide insights about the adoption of ICT in teaching and learning.

Agyeman (2007) observed that effective and efficient integration of ICT in Nigeria's technical and vocational polytechnics is practically dependent on availability and accessibility, type of ICT resources, and developing lecturers attitudinal shift toward the use ICT for their pedagogical and strategic teaching and learning. He concluded that there was the need for more research in the area of polytechnic lecturers' attitude toward the use of ICT for teaching development of their learners.

It is often said that "a journey of one thousand miles begins with a step". The scope of ICT usage varies from one country to another. In the past, various life objects were used as teaching aids. This was followed by the use of Computer Aided Instructions (CAI) and virtual laboratories recently. Each country is obliged to utilise the minimal ICT resources available. Laferrière, Breuleux, and Bracewell (1999)

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