

**EXAMINING COMPUTER-BASED TECHNOLOGY
SKILL AND ACADEMIC PERFORMANCE OF
STUDENTS IN NIGERIAN UNIVERSITIES**

By

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ABSTRACT

The introduction of blended learning into face-to-face classroom teaching and learning has made traditional education more simple, flexible and customised to students' expectations. This study examined computer-based technology (CBT) skills levels among undergraduate students in federal universities in the South West geopolitical zone, Nigeria. Specifically, the study sought to find out which CBT skills levels are mostly displayed by the undergraduates; examine those skills levels that correlated positively with the academic performance of students; and identify factors that contribute to CBT learning in conjunction with face-to-face traditional education in Nigerian universities.

The study discusses the Will, Skill and Tool model (WST), which is used as the conceptual framework of this study. The study used a mixed method approach. Questionnaires were used to collect quantitative data while focus group interviews were used for qualitative data. Normative ontological assumptions enabled the study to use both quantitative and qualitative reports from different perspectives to draw conclusions. The study was conducted in six federal universities in South West in Nigeria and two thousand, three hundred and thirty-seven (2,337) questionnaires were used to collect the quantitative data. An open-ended interview schedule was used for the eighteen (18) focus group interviews. The focus group interviews were conducted with a sample of the same students who completed the questionnaire. All participation was voluntary. Microsoft Excel and SPSS version 22 were application software used for the quantitative coding.

Quantitative data were analysed using descriptive and inferential statistics, while qualitative data were analysed thematically. The results show that six CBT skill-level variables (called core skills) – general computer use, word processing, internet, PowerPoint, synchronous and asynchronous chats – correlated most positively with the students' academic performance, though they were weakly correlated. Factors that negatively affected the use of CBT tools to augment face-to-face education included unstable power supply, poor network connectivity due to lack of internet access, unstable bandwidth, lack of equipped computer laboratories and excessive cost of internet data bundles.

The results revealed a low availability and accessibility of CBT tools in computer laboratories for regular use by the undergraduate students in selected universities. Hence, most students depended on their personal computers, smartphones or cybercafés. It is recommended that more emphasis be placed on Blended learning, which is the combination of traditional learning and online learning experiences. It is also recommended that university administrations, attempt to ensure that all students have access to personal computers and a reliable internet connection. If this can be done, preferably from the first year of study, students will be able to become conversant with the technologies needed for blended learning with a view to enhance academic performance. Finally, it is recommended that government subsidies for CBT devices and facilities would also help in promoting CBT usage and blended learning. Government policy in this respect should ideally involve all stakeholders, such as university management, lecturers and student representative bodies; as well as potential ICT funding partners.

Keywords: Computer-based technology, Will, Skill and Tools Model, Blended learning, Students' academic performance, CBT in education

DECLARATION

I hereby declare that this dissertation entitled, “Examining *Computer-Based Technology Skill and Academic Performance of Students in Nigerian Universities*” is my own work and that all the sources quoted have been acknowledged by means of completed references and it has not otherwise been submitted in any form for any degree or diploma to any University.



Student - Aderinsola E. Kayode

04th December, 2019

Date



Supervisor – Prof. D. W. Govender

05 December, 2019

Date

ETHICAL CLEARANCE



26 August 2016

Mrs Aderinsola E Kayode 215081971
School of Education
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Dear Mrs Kayode

Protocol reference number: HSS/1298/016D
Project title: Examining Computer-based Technology Skill and Academic Performance of Students in Nigeria Universities.

Expedited Approval

In response to your application dated 17 August 2016, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. Please note: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

A handwritten signature in black ink, appearing to read "Shenuka Singh".

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Dr Shenuka Singh (Chair)

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DEDICATION

I dedicate this thesis to:

1. My husband – Pastor George Ayodele Kayode
2. My children – Blessing and Praise George-Kayode

They are the backbone of this work.

And:

To the loving memories of:

1. My late parents – High Chief Julius Alarapon and Dns. Adefunke Abigail ADEBOWALE
2. My late mother-in-law – Mrs. Juliana Olaribiyun OKE-KAYODE

Whose dreams were for me to attain a high level of education in life, but departed this world too soon.

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ABBREVIATIONS AND ACRONYMS

100Level:	1st year of study
200Level	2nd year of study
300Level	3rd year of study
400Level	4th year of study
A Level	Advanced Level
BL	Blended Learning
CBA	Curriculum-Based Assessment for Students
CBT	Computer-Based Technology
CD-ROM	Compact disc used as a read-only optical memory device
CGPA	Cumulative Grade Point Average
EFL	English as a Foreign Language
FGI	Focus Group Interview
FRN:	Federal Republic of Nigeria
FUNAAB	Federal University of Abeokuta
FUOYE	Federal University of Oye
FUTA	Federal University of Technology, Akure
ICT	Information and Communication Technology
IT	Information Technology
IWB	Interactive White Board
JAMB	Joint Admission and Matriculation Examination
NCE	Nigeria Certificate of Education
NUC	National Universities Commission
OAU	Obafemi Awolowo University
PC	Personal computer
PNU	Payame Noor University
PPMC	Pearson Product Moment Correlation

SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
SSCE	Senior School Certificate
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UI	University of Ibadan
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNILAG	University of Lagos
UNISA	University of South Africa
USAID	United State Agency for International Development
UTME	Unified Tertiary Matriculation Examination
WWW	World Wide Web

CHAPTER ONE:

INTRODUCTION AND BACKGROUND

1.1 Introduction

The integration of computer-based technology (CBT) into traditional face-to-face education has significantly affected many aspects of education systems worldwide. Technology is human innovation in action, and CBT skills are the new literacy for a technology-empowered learning environment (Nayar, 2018). Computer literacy includes the ability of students to use a personal computer for their learning (Techataweewan & Prasertsin, 2018). Advances in computer applications have affected the educational sector positively and technology is changing the nature of the social, political and economic life of nations globally (Thai, De Wever & Valcke, 2017).

Today Nigerian universities need CBT to enhance teaching and learning services rendered to students, especially undergraduate students. This will enable these institutions to offer students adequate skills training in the use of CBT in order to enhance their academic performance. Technology adoption in Nigeria is still in its infancy, but the educational sector in Nigeria cannot be left out of any developments that may lead to quality education.

Many institutions globally have accepted the use of CBT to enhance teaching and learning, as these technologies have been shown to have a positive influence on students' performance (Sung, Chang & Liu, 2016; Sung, Chang & Yang, 2015; Yao-Ting et. al., 2016). Universities in Nigeria are becoming aware of this, with the adoption of these technological innovations on their campuses, which are being increasingly used in academic work and administration. CBT, as used by students in Nigerian tertiary institutions, has enhanced their academic performance, and their knowledge of the outside world in general (Joda, 2013). Furthermore, different forms of technology are constantly being developed around the world, and are being used to enhance the academic performance of students (Jena, Bhattacharjee, Gupta, Das & Debnath, 2018).

The world is now in a global age that has been transformed from the “Industrial Age” to the “Knowledge Age” (sometimes called the “Fourth Industrial Revolution” or 4IR).

Universities in Nigeria have recently introduced CBT to support face-to-face classroom lectures. For example, CBT is used for online courses, assignments, and for the evaluation of students; as

well as to reduce paper-based examinations and for easy marking and assessment of students. Most universities in Nigeria are making this shift via the internet, telecommunications and networks (Tejumaiye, Simon & Obia, 2018; Nnadozie, 2018; Popoola, 2017). The current study attempts to identify the factors that influence the use of CBT in students' learning. Increasingly, students are expected to be CBT literate and to learn and adopt new technology to enhance their academic performance (Anshari, Almunawar, Shahrill, Wicaksono & Huda, 2017).

Computer and related technologies provide powerful tools to meet the new challenges of designing and implementing assessment methods that go beyond the conventional practices; and to facilitate the recording of a broader repertoire of cognitive skills and knowledge (Mubashrah, Tariq & Shami, 2012). Computer-based technology encompasses the effective use of equipment and software, storage and audio-visual systems that enable users to access, retrieve, convert, store, organise, manipulate and present data and information (Solaipriya & Suresh, 2019; Wondemtegegn, 2018; Ojo & Akhademe, 2018). Computer-based technology is also used to facilitate networking, electronic storage and exchange of information through email; and to support e-learning through Skype, YouTube, e-conferencing, join.me, searching and much more (Das, Kuruvilla, Dash & Singh, 2018).

The use of CBT to enhance traditional teaching-and-learning methods is often referred to as "blended learning". Blended learning combines online digital tools with traditional classroom methods as a way of using computers connected to the internet to support face-to-face delivery in teaching and learning in the classroom. Blended learning offers the option of allowing lecturers and students to interact using e-learning on an online platform. Gopalan (2016) stresses that the general adoption and availability of digital learning technologies has led to increased levels of integration of computer-based technology into face-to-face learning experiences.

The researcher is of the view that the acquisition of new skills in the use of technological tools in education, if used correctly, will contribute positively to the learning and research work of students. From the researcher's experience, it has been observed that the application of new software, hardware, podcasting, keyboarding, spreadsheets, internet use, synchronous and other tools is on the increase in teaching and learning in most universities in Nigeria.

However, students need CBT skills development programmes as part of their academic courses to support their learning even while away from school or university premises.

From cell phones and texting to instant messaging on their laptops, browsing the school web platform, and related activities, the use of technology has become habituated behaviour among students, and these CBT skills can also enhance smooth communication and learning between students and their lecturers. Today's students require an education that incorporates and enhances their technological skills, and lecturers need to teach in such a way that students can use CBT to find relevant information and materials (Ugwuadu & Joda, 2013).

The use of technology in higher education institutions has become a priority in Nigerian universities (Federal Republic of Nigeria, 2006). Computer-based technology is used as part of the student platform with blended tools for teaching and learning, such as the submission of assignments and participation in online group discussions. For these students, technology has opened up access to global knowledge and skills (Beránek, Feuerlicht, Kovár, Petkovová & Vacek, 2016; Burnett, 2015). Computer-based technology is available in various forms and has been used widely in delivering instruction and assessment to students in their academic pursuits; as it allows trainers and teachers to plan and report on surveys, quizzes, tests and examinations (Alabi et al., 2012). Proper application and use of these technologies facilitate learning (Sung, Chang & Liu, 2016). With the use of these technologies, both teachers and students have witnessed excellent performance in their academic activities (Ugwuadu & Joda, 2013). These authors found that students taught with computer-mediated learning performed better in class than students taught with conventional methods.

1.2 Background and Rationale of the Study

One significant objective of the New Partnership for Africa's Development (NEPAD) is to find ways to improve development through the installation and use of information and communication technology (ICT) infrastructures (NEPAD, 2002); and to join every rural community with urban areas via telecommunication networks such as landline, mobile telephone services and the internet. Driven by the conjunction of computers, telecommunications and traditional media, NEPAD considers ICT crucial for a knowledge-based economy; and that Africa should use ICT to bridge the huge development gap between Africa and the rest of the developed economies of the world.

Additionally, Manaligod (2012) argues that the benefits of ICT have not been fully realised in the context of classroom learning in Nigerian universities. The researcher concurs that the use of blended learning could assist in improving the academic performance of undergraduate students in tertiary institutions in Nigeria.

There are many challenges in the Nigerian educational sector that pose difficulties for the full adoption of blended learning for university students. Some of these challenges are lack of electricity; inadequate ICT tools; low bandwidth; and limited access to communication infrastructure, all of which lead to difficulties in developing skills in the use of CBT. These difficulties affect students' academic performance, critically affecting the academic success of students and their career achievements.

Researchers reveal that the introduction of technology in education, especially CBT, is an effective and positive way to enhance teaching and learning (Nyambane & Nzuki, 2014). The use of CBT enables cooperation in education and collaboration between groups; and is a vital tool in supporting new skills development in teaching and learning in the classroom.

Computer-based technology is playing an important role globally in teaching and learning; and in assessing students' performance, as it helps students, parents, teachers and management to take decisions on students' learning. Computer-based technology has become a necessary, and perhaps imperative, component of life and living in modern society. Training and retraining, therefore, has to be fashioned towards CBT skills improvement (Kayode, 2016).

While CBT is becoming increasingly acceptable in Nigeria, the overall academic performance of students in most universities in Nigeria is still poor and declining (Ebenuwa-Okoh, 2010). Some researchers have said that despite increased awareness of CBT, there are still challenges in the use of these technologies (Fasae & Adegbilero-Iwari, 2016; Ossai-Ugbah, 2010). According to Aina and Olanipekun (2014) students are still underperforming in Nigerian universities because of these challenges.

This could be attributed to students' CBT skills levels not being adequate. However, there is a dearth of local research on the effectiveness of technology skills when using CBT, and the effect

of these skills on academic performance. This is the knowledge gap that this study will pay attention to.

Today's students necessitate an education that integrates and enhances their technological skills and lecturers need to teach in such a way that students can use CBT to find relevant information and materials with their face2face education (Ugwuadu & Joda, 2013). The present study therefore, hopes to address this gap in knowledge by examining computer literacy and other necessary skills required in the use of CBT for effective academic performance of students in selected Nigerian universities.

1.3 Research Problem

Much research has been undertaken in the area of ICT, and IT in the area of education (for example: Fabunmi, 2012; Manaligod, 2012; Govender, 2006). However, as mentioned, there is a dearth of local research on the relationship between CBT skill and academic performance among undergraduate students. Thus, this research was carried out with the following aim and objectives in mind:

1.4 Aims & Objectives of the Study

The aim of this study is to examine computer literacy and other necessary skills required on the use of CBT for effective academic performance of students in selected Nigerian Universities. The objectives are as following:

1. To determine the availability of CBT resources on the different campuses;
2. To identify the frequency of use of CBT applications by students for their learning;
3. To ascertain the CBT skill level that students have and believe are necessary to contribute to their academic performance in universities;
4. To identify the CBT core skills that contribute positively to student academic performance in universities;
5. To find out how CBT skills affect students' academic performance in the universities in South West Nigeria;
6. To ascertain if the effective use of CBT in learning can help to improve academic performance.

1.5 Research Questions

The above objectives were addressed with the following specific research questions:

1. What CBT tools are available in selected universities in Nigeria?
2. What is the frequency of usage of CBT applications in these universities?
3. What is the level of CBT skill among students in these universities?
4. Which CBT skills affect the academic performance of students in these universities?
5. How are the CBT skills of students affecting their academic performance?
6. How can we ensure the effective use of CBT in learning with a view to improving academic performance?

1.6 Significance of the Study

Much research has been done on ICT and CBT as factors affecting academic performance of students, but little research on CBT skills used in blended learning among traditional on-campus undergraduate students in Nigerian universities. The frequency of use of CBT, in addition to traditional face-to-face education, is of fundamental relevance to all academic communities in tertiary universities (Todd & Kuhlthau, 2016; Wollscheid, Sjaastad & Tømte, 2016; Kubiak & Vickova, 2010). Thus, the results generated could be of benefit in the following ways:

1. The findings from this study could help institutions to find strategies that could promote greater use of CBT to augment face-to-face teaching and learning.
2. The study could contribute significantly to the current literature on ICT and CBT and their effects on academic achievement.
3. The results and recommendations of this study could provide curriculum insights for the Nigerian Computer Association and Schools of Information Sciences.
4. Lastly, this study may assist the Ministry of Education and The National Council on Communication Technology, which enacts policies for teaching and learning in the use of technology in tertiary institutions.

1.7 Limitations of the Study

This study is based on the usage of CBT skills among undergraduate students in selected Nigerian universities. The research was carried out in federal universities in the South West region of Nigeria. There are six geopolitical regions in Nigeria – South West, South South, South East, North

East, North West and North Central. The South West has the greatest number of federal universities (six), which was the reason for choosing this region for this study. As well as federal universities, Nigeria has state universities and privately owned universities. Hence, this research could not include these different tertiary contexts due to the large numbers involved, as well as the high cost of data collection.

In addition, the researcher was of the view that federal universities would, at least, have relatively adequate CBT tools, in contrast to state or privately owned universities, since they are financed by federal government. Therefore, any generalisation from this study would have to be made with caution. However, the large sample used and the in-depth socio-demographic data collected does improve the applicability of the findings to other similar contexts.

1.8 Methodology and Framework

This study employed a mixed-methods research design using both quantitative and qualitative data. Descriptive and inferential analysis was used for the quantitative data; and theming was used for the qualitative data, following one of the methods recommended by Saldaña (2015). The qualitative data was used to support the quantitative results, as recommended by Creswell (2014).

As discussed in the previous section, the sample was purposively selected (Creswell, 2014) and included undergraduates from six federal universities in the South West region in Nigeria. Two thousand, three hundred and thirty-seven (2,337) questionnaires were used to collect the quantitative data. An open-ended interview schedule was used for the eighteen (18) focus group interviews.

Will, Skill and Tool (WST) theoretical model was used as a conceptual framework with which to interpret the findings. This model was used to explain findings with regard to willingness (Will); the competence of students in using technology (Skill); the infrastructure available for the use of CBT (Tool); and the relationship of these factors to academic achievement.

1.9 Outline of the Study

The following is an outline of the different chapters making up the study:

Chapter One: Introduction

The chapter presents a general introduction to, and background of, the study and the context; explaining the rationale, research problem, research questions, objectives, methodological choices, significance, limitations and research outline.

Chapter Two: Literature Review

In this chapter, literature from previous studies that relate to CBT skills and academic performance of students is introduced and discussed. The literature review provided background information that was used to guide and structure this study; and to identify gaps in the literature, which this study attempts to fill.

Chapter Three: Research Design and Methodology

This chapter explains the research design and the methods used in collecting and analysing the data. It includes a discussion of statistical procedures used; and a description and explanation of the data collecting instruments used.

Chapter Four: Theory and Conceptual Framework

This chapter presents and discusses relevant theories used in IT and models related to CBT use in education. The chapter describes the WST model and its use as a conceptual framework for this study.

Chapter Five: Discussion of Socio-Demographic Data

This chapter presents a socio-demographic analysis of the sample in order to describe and confirm the representability of the sample.

Chapter Six: Results and Discussion of Research Questions One, Two and Three

This chapter presents and discusses the findings that address research questions one, two and three.

Chapter Seven: Results and Discussion of Research Question Four

This chapter presents results on CBT usage core skills and how they affect students' academic performance.

Chapter Eight: Results and Discussion of Research Questions Five and Six

The presentation of the qualitative data was used according to the themes that emerged from the responses of the participants to explain the attitude of the students to the use of CBT.

Chapter Nine: Interpreting Results according to the WST Model

This chapter provides an interpretation of results according to the conceptual framework adopted for this study.

Chapter Ten: Summary, Conclusions and Recommendations

This chapter presents a summary of findings and the conclusions of the study, including recommendations based on the research questions.

1.10 Conclusion

This chapter explained the underpinnings of the current study and gave a brief discussion of factors relating to the CBT skills of students and their academic performance. In addition, the discussion included background information, rationale, research problems, objectives of the study, research questions, significance, limitations of the study, methodology and the conceptual framework.

The next chapter, Chapter Two, reviews literature related to the current study.

CHAPTER TWO: **REVIEW OF RELATED LITERATURE**

2.1 Introduction

The purpose of this chapter is to provide a review of literature on the relationship between CBT skills and academic performance. Following the suggestion of Creswell and Creswell (2017), this chapter reviews various studies that had been done in the literature on the relationship between CBT skills and academic performance. Traditional learning, learning in the digital age, blended and e-learning in education among others, are discussed in this chapter. The literature gap is also identified and discussed in the last paragraph of this chapter.

Traditional learning methods involve face-to-face teaching which is usually offered to students in a classroom situation, where teachers give lectures through traditional instructor-led training (Oyelere, Suhonen, Wajiga & Sutinen, 2018). Campus-based traditional learning involves lectures, handouts and students listening and taking notes from the blackboard. This was the norm before the introduction of digital tools or blended learning (Singh, 2013). The 21st-century technological age has integrated digital tools with face-to-face learning, and has transformed traditional teaching-and-learning methods.

In addition, generating materials for course content, arranging and recording, and evaluating students' progress was difficult before the integration of new technological skills into traditional learning (Alharbi, 2014). The introduction of technology into education has injected new life into traditional teaching-and-learning methods (Singh, 2013).

Studies have shown that the use of technology in traditional education has influenced and transformed teaching and learning (Teo, Zhou, Fan & Huang, 2019; Crompton & Traxler, 2019; Elsaadani, 2013). This provides opportunities for students and teachers to integrate new skills and technological advances through blended learning, which has been examined in this study with a focus on the CBT skills and academic performance of undergraduate students in Nigerian universities.

The researcher submits that a thoughtful use of blended learning to support traditional education is critical to the attainment of rich learning and hands-on technologies, which support students' academic performance. The current study advocates that teachers develop a positive attitude towards teaching integrated with CBT in traditional education. Furthermore, this chapter relates to the ongoing body of literature with respect to CBT usage in an academic environment, especially in traditional education, to critically examine its effects on undergraduate students' academic performance.

2.2 Learning in the Digital Age

Studies suggest that digital technologies should be fully integrated into traditional education in order to assist students' learning and reading in a digital world (Kennedy, Latham & Jacinto, 2016; Johnson, Danhausen & Perry, 2017; Nkanu & Okon, 2010). Healy (2018) adds that well-informed teachers are making extensive use of text processing tools (word processors), analytic and information tools (especially databases and spreadsheets), graphics tools (graphics programs and desktop publishing) along with instructional software (including problem-solving programs); all of which improve student learning in the classroom and their academic performance.

Barak (2017) stresses that advanced use of technological tools in the digital age has changed the way teaching and learning is carried out in contrast to the methods of traditional learning. Edwards (2018) and Yilmaz and Orhan (2010) identified the use of blended learning as the method to solve the challenges facing the use of technology-based learning in campus-based education. The authors stressed that e-learning with traditional learning through the combining of the technological tools used in teaching and learning in the classroom such as email, online animation, audio and video messaging, multimedia and others should be encouraged during traditional or face-to-face methods of learning.

The development of inexpensive multimedia computers and the explosion of the internet in the mid-1990s quickly changed the nature of educational communication tools (email and computer conferencing, blogging) and multimedia use, according to Crittenden, Biel and Lovely (2019), and have dominated the role of technologies in the classroom ever since. What the students produce is often done by using the computer to reinforce what the teacher or textbook has told them or what they have learnt from the internet.

The IT world is now moving to the era of cloud computing which has proved to be of remarkable benefit to studies in universities and related tertiary institutions in instructional delivery, management, storage and retrieval. Schools use the cloud to store presentations, videos, documents, pictures, grades, test data, students' records, mail, contacts, calendars, notes, lists passwords, books and much more.

The numerous services can be overwhelming but with a little understanding we can leverage the cloud in our daily routine to make things easier. In the world of cloud computing we need a reliable internet connection for uploading, downloading and collaborative editing of any documents. Cloud computing has the potential to transform classrooms into paperless learning environments; allowing for personalised, differentiated, anytime and collaborative learning for students. Kolesnichenko, Radyukova and Pakhomov (2019) state that the main purpose of ICT consists just in the development of human mental resources, which allow people to both successfully apply the existing knowledge and produce new knowledge. This implies that use of digital tools in learning with campus-based education in the classroom prepares students for the 21st century as computer-based learners and this will enhance the academic performance of students learning in the umbrella of traditional education in this digital age. An electronic examination, also called computer-based assessment, or e-exam for short assessment, is a test conducted using a personal computer or an equivalent electronic device, in which the delivery, responses and assessment are done electronically. E-exams were developed more than four decades ago for professional certification in the IT industry and progressively evolving as a preferred alternative to paper-and-pencil tests in schools, universities, recruiting firms as well as private and public organisations.

Nigerian universities are increasingly adopting CBT to replace the traditional paper-based test for academic assessment of students, like other universities globally. The successes of transition from paper-based tests depend on the extent and ability of testing professionals to communicate the benefits and limitations of CBT to stakeholders (Olawuyi, Tomori & Bamigboye, 2018). The use of CBT for assessment can provide several benefits for educators and test-takers. It is on this note that scholars Castellacci and Tveito (2018) and Oni and Uko (2016) conclude that CBT is a system which spurs development in education to increase the use of digital technology in the classroom as well as other sectors of the economy.

Many efforts have been made to upgrade the use of technology for networks for use by the internet and to effectively use new technology in teaching and learning which will prepare students for their studies and workplace in the digital age (Kennedy et al., 2017). Various scholars (O'Flaherty & Phillips, 2015; Tsai et al., 2011; Ituma, 2011; Bawenah, 2011) advocate the use of hybrid learning in campus-based education, as it increased students' academic achievement and improved their learning when blended learning was used together with teachers' course content delivered in classroom learning. This study reveals that most undergraduate students in universities in Nigeria use the PowerPoint application tool with a multimedia projector to create their seminar presentations and class assignments done using e-tools to get more information to their studies, unlike the old method of using paper-based typed handouts and books.

According to Lai and Hong (2015) and Shehu, Urhefe and Promise (2015), the use of the internet has been a major and vital tool making technology available for teaching and learning for both teachers and students in the classroom. Studies from Shelton, Warren and Archambault (2016) and Rose (2011) showed that the use of e-learning and blended learning using electronic devices such as e-tool technologies – internet-enabled or web-based and others – enhanced the performance of students over traditional methods. This present study agrees with these scholars that the use of technology in blended or e-learning enables students to have full access to technologies with their campus-based education. This differs from traditional teaching and learning which relies on paper-based handouts and text books.

Al-Said (2015) points out that the use of nomadic ubiquity computing is commonplace with development in the use of tools such as Wi-Fi, 3G and 4G mobile phones that combine with a range of devices such as smart phones, tablets and desktop and laptop computers. Findings in this study illustrate the impact of these technologies as blended tools that undergraduate students in Nigerian universities use – mostly word processing, PowerPoint, spreadsheets, synchronous and asynchronous chat and the internet – which seem to enhance their achievement in campus-based education. This agrees with the findings of scholars like Anshari, Almunawar, Shahrill, Wicaksono and Huda (2017) and Fu (2013) who stress the importance of the use of various technologies or ICT facilities.

They argue that the use of these technologies and facilities enhances learning environments to enable students to be more active in their learning during classroom lectures. Azeiteiro, Bacelar-

Nicolau, Caetano and Caeiro (2015) also reported that learning in an environment with quality of information and e-materials, searching various sources and accessing scholarly literature online encourage good education. The present study observed that the integration of blended learning in support of traditional learning makes teaching and learning easier, more effective and enhances students' performance compared to traditional ways of teaching and learning.

2.2.1 Blended Learning and E-Learning in Education

The technology that has taken place alongside traditional learning is blended learning (e-learning) which simply means to fuse online learning with traditional methods of learning. This development has influenced the mode of teaching and learning in the classroom. This enables students to learn independently without depending on note taking from their teachers in the classroom; they improve their competence to positively relate the information and new skills acquired via the technology to their academic performance. Fu (2013) affirmed that the use of innovative use of e-tools in traditional learning empowers teachers to easily develop their course content materials in teaching and learning and furthermore assists students to improve creativeness through the use of multimedia, internet and other e-tools for their learning.

Blended learning courses (also known as hybrid or mixed-mode courses) are classes where a portion of the traditional face-to-face instruction is replaced by web-based online learning approaches. It is a training approach that combines different learning techniques. In the standard educational model, blended learning often refers to the use of laboratory equipment or computers to complement the class sessions and strengthen the teaching process through practice and the application of theories learnt. The term e-learning derives from electronically-supported learning or learning with and through the employment of technologies. Other commonly used terms are online learning, computer-assisted learning or ICT in education. E-learning incorporates both the content (curriculum) and instruction (pedagogy). E-learning has become a term representing a replacement model of education that will incorporate a “bionetwork” of networked communities and a range of learning resources.

This development brings hope to the likelihood of colleges having the ability to use new technologies to leapfrog over several of their problematic issues like shortage of academics and textbooks, and low attainment levels, and to coach their students in technologies and to own “21st

century skills” like creativity and problem solving (Adesanya & Idogwu, 2015; Pandey & Pande, 2014). E-learning settings and technologies obtainable for use in colleges are abundant, but each comes with its own benefits and applications. Usually the best practice could be a combination of technologies reckoning on the actual needs and learning surroundings. Examples are multimedia classroom, computer lab, single station, personal computers, microcomputer, laptop or notebook, small and personal devices (tablets, mobile phone/smartphone, e-readers).

2.2.2 Collaboration in Learning

The fast improvement in the use of technologies influences collaboration in student–student, student–instructor and student–content interactions in traditional education. Goldie (2016), Arkorful and Abaidoo (2015) and Lammers et al. (2013) agree that interaction and collaboration with e-learning gives teaching and learning a capacity to change the world positively. Students collaborate in learning, making them learn together and collaborate to learn new e-tools which will aid their confidence in acquiring new knowledge and CBT skills in a technological age, as shown in the present study. In another study, Collins and Halverson (2018) asserted that the newly acquired information gives a person more opportunities to succeed, with new potentials in career and individual development, because learning is a lifelong endeavour. Yen et al. (2019) showed that group computer-mediated discussion with students’ studies had a positive effect on students’ interactions, critical thinking and academic performance. Both teachers and students can work collaboratively as a team using Bluetooth or the internet to send files, short messages, WhatsApp or email messages to interact within or outside the classroom (Chan, Wan & Ko, 2019). The use of computer-mediated material in teaching and learning with traditional methods such as electronic mail, computer conferencing and the internet to deliver learning materials has enabled teachers and students to interact during lecture periods in traditional education. Students’ interactions with the use of blended learning in their traditional education in forms of synchronous and asynchronous communication, such as exchanging text messages, Skype, YouTube, WhatsApp, Yahoo, Gmail, Google search and so on are examined in this present study to determine their influence on academic performance.

According to Glăveanu, Ness, Wasson and Lubart (2019) learning is a way of changing performance or potential of a human being, and it involves characteristics that are often associated with behaviourism, cognitivism and constructivism. On the other hand, collaboration in learning

enables communities to practise as informal networks that support professional practitioners to develop a shared meaning and engage in knowledge building among the members of the communities (Premo, Cavagnetto, Davis & Brickman, 2018). Schmerbach (2016) argues that knowledge is fast and easy to acquire due to the digital age and learning is a long process that will last for a lifetime. The author explains these theories of learning as:

Behaviourist learning: This is learning that only focuses on objectively observable behaviours and discounts any independent activities of the mind. It defines learning as nothing more than the acquisition of new behaviour based on environmental conditions.

Cognitivist learning: This tries to understand concepts like memory and decision-making using technology to process information. It concerns itself with behaviour that can be observed. Revealed actuality in interpretation and knowledge is negotiated through experience and thinking.

Constructivist learning: This suggests that humans construct knowledge and meaning from their experiences. It is not a specific pedagogy. Constructivism has a wide-ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements. Hallisey (2017) and Saenz (2015) argue that technological tool use is constructivist in nature. In this study, the researcher observed that those digital tools were connected with students' academic performance such as synchronous communication like WhatsApp, Skype, Twitter and so on, used by undergraduate students as blended learning in their face-to-face classroom lectures. These are constructivist ways that connect those students in various groups, enabling them to get more information relating to their studies.

Connectivism: This occurs when acquiring knowledge by way of networking and getting information relevant to a learning environment by means of the internet. The knowledge can be reserved for future use.

Milad (2019) explains that connectivism enables a person to seek out current information and opinions, and to use this new information to formulate new concepts, fields and ideas. This applies to the core skills as defined in this present study. These connections are a way that learners network themselves – such as Facebook, class video blog etc. – and find new information to use in learning (Sharma, Joshi & Sharma, 2016; Liu, 2016). The present study identifies the core skills most used

and correlated with undergraduate students' academic performance, which are six variables – keyboarding or general computer use, email, spreadsheet, PowerPoint, internet and synchronous and asynchronous chat. The researcher observed that connection and collaboration in learning with these students in the digital age enhances student collaborations in the use of internet and online connectedness of learners in the educational sector. Studies emphasise that integration of CBT in the classroom is changing the educational environment as students and teachers are enjoying and mixing technology with traditional learning in classroom lectures mostly in the basic ICT tools – the use of mobile phone and internet facilities (Saenz, 2015; Ololube, Kpolovie, Amale, Amanchukwu & Briggs, 2013; Yusuf, et al., 2011).

2.2.3 Connectivism and Networking in Learning

The digital age refers to period in which available technology gives access to information and ideas for teaching and learning, enabling connectivism between the teacher and the students in the usage of digital technologies which enable networks. Previous scholars (Al-Rahmi, Othman, Yusuf & Musa, 2015; Farley et al., 2015; Reese, 2015), found that collaboration and connectivism with technology learning is a way in which learners communicate with one another, experience, and become active with new skills and knowledge, where the teachers become the initiators, and the learners are encouraged by their teachers to interrelate, exchange views, understand and co-construct meaning and knowledge that is based on their needs and results in improved students' academic performance.

Delgado, Wardlow, McKnight and O'Malley (2015) explain that teachers are connected today with the use of digital technologies, unlike teachers in the past. Using mobile phones, Google pages and other means to get more research and new information on materials, constant contact and instant messaging with their students makes teaching and learning more effective in classroom learning.

This current study is of the opinion that the use of digital tools in the face-to-face educational learning environment develops knowledge and relevant computer-based skills needed for learning, creating connections which allow students to share information anywhere at any time through the use of the internet. The use of the internet by these students was revealed in the current study as one of the e-tools that enhance the academic performance of students (Altun, 2015).

In terms of interactions among teachers and students, the intelligent Web 2.0 gave an opportunity to the learners to access information, comment, make personal contributions and interact via online group pages, through self-selected networks. Anshari et al. (2017) and Goldie (2016) stress that connectivism in the digital age, between teachers and students, enriches teaching and learning in an educational environment. The integration of digital tools in the traditional classroom creates new skills for students in the area of CBT, which influence teaching and learning with availability of digital tools to be used both within and outside the campus premises.

Many scholars have examined how teachers integrate and students embrace e-learning in the use of digital tools in synchronous and asynchronous forms in their teaching in the classroom while lecturing their students (Arkorful & Abaidoo, 2015; Schrum, 2010; Buzzard et al., 2011). AbdAlla (2017) maintains that students with positive attitudes towards using these technologies can enhance their performances over traditional forms of education. This scholar concluded that the full use of relevant ICT equipment and infrastructure in the campus still needs more attention.

Studies explained how effective connectivism in educational learning by learners and educators defined ways in which digital tools in the use of internet technologies shaped new skills for teachers and students to learn and share information together in their learning using the world wide web such as email, wikis, online discussion forums, YouTube, Skype, WhatsApp and other e-tools in education (Zhu, Yu & Riezebos, 2016; Ching Lam, 2015; Downes, 2012). Connectivism in digital learning gives an avenue and environment where students interact and create own knowledge.

Several theories (such as behaviourism, cognitivism, and constructivism) were developed during a time when learning was not impacted by technology.

Over the last 20 years, technology has reorganised how we live, how we communicate and how we learn. Constructivism suggests that learners create knowledge as they attempt to understand their experiences (Bell, 2011). Behaviourism and cognitivism view knowledge as external to the learner and the learning process as the act of internalising knowledge. Constructivism assumes that learners are not empty vessels to be filled with knowledge. Instead, learners are actively attempting to create meaning. Learners often select and pursue their own learning.

With the changes that have occurred as a result of increased accessibility of information and a rapidly evolving technological landscape, educators in higher learning institutions have been forced to adapt their teaching approaches without a clear roadmap for attending to students' various needs. The wide range of approaches and learning paths that are available to redesign curricula cause friction for educators and instructional designers who are required to deliver course materials in accordance with learning outcomes prescribed and mandated by educational institutions.

Connections between disparate ideas and fields can create innovations known as connectivism. Connectivism is the integration of principles explored by chaos, network and complexity and self-organisation theories. It presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity. How people work and function is altered when new tools are used. Connectivism is driven by the understanding that decisions are based on rapidly altering foundations. New information is continually being acquired. The ability to draw distinctions between important and unimportant information is vital. The ability to recognise when new information alters the landscape based on decisions made yesterday is also critical. According to connectivism, knowledge is distributed across an information network and can be stored in a variety of digital formats. Learning and knowledge are said to "rest in diversity of opinions" (Zhu, Yu & Riezebos, 2016; Ching, 2015). Learning takes place through the use of both the cognitive and the affective domains; cognition and the emotions both contribute to the learning process in important ways.

Mijumbi et al. (2016) suggest that instead of modelling our knowledge structures as hierarchical or flat, confined belief spaces, the view of networks enables the existence of contrasting elements selected on the basis of particular research or learning activities.

Some years ago, Kop and Hill (2008) referred to four constituent elements that must exist to qualify a theory as well-constructed: clear assumptions and beliefs about the object of the theory should be highlighted; key terms should be clearly defined; there should be a developmental process, where principles are derived from assumptions; and it should entail an explanation of "underlying psychological dynamics of events related to learning".

Researchers view interactivity as enabling our ability to learn what we need for tomorrow, which is more important than what we know today. A real challenge for any learning theory is to actuate

known knowledge at the point of application. When knowledge, however, is needed, but not known, the ability to plug into sources to meet the requirements becomes a vital skill. This is where the use of connectivity and networking in the digital age is valuable to teaching and learning in traditional education.

Based on the explanation of connectivism, learning is a process where teacher and students connect by networking in acquiring more new skills and knowledge, such as technological tools used in educating people, websites, books and so on which students can use to become connected in their learning, enhancing their understanding of the relevance of their studies. This current study revealed that most students in Nigerian universities use their mobile and online forum webpage to connect to one another for urgent information relating to their learning. This reflects the view of Barak (2017) who found that most students are active when connected with the use of digital tools for their personal network such as webpages and synchronous chats through Skype and WhatsApp.

Elazhary (2018) discusses online office applications as web applications used via internet remote server software packages such as word processors, spreadsheets, online presentation and multimedia; these web applications enable learners to be connected with editing tools in different locations. This web office in desktop applications revealed in this study of the use of spreadsheets, PowerPoint, Google docs/sheets and so on, allowed students to present their seminar and data processing on projects and assignments. These online tools used in connection applications are mostly used for educational resolutions.

Moodle is one of the free software products used among teachers for e-learning platforms which educators use to create an avenue for learners to be connected in online courses to give rich interaction (Trust, Krutka & Carpenter, 2016).

Baltzersen (2010) noted that learning with networks, in connection with teaching and learning, would create positive collaboration and give students relevant learning experiences that would serve their needs. Connectivism through the use of online and desktop applications facilitates teaching and learning in traditional education to enhance or to facilitate the CBT skills acquired by students in their learning, such as online documents and discussion via online tools.

2.3 Tools That Support CBT Education in Digital Age Education

2.3.1 Internet

The internet has made it possible for scholars and researchers at different locations in the world to exchange thoughts in various fields of study and allows students and lecturers to communicate both within and across international borders (Anshari et al., 2017; Li, 2015). Before the internet, ARPANET (precursor to the modern internet) had been created by the Advanced Research Projects Agency Network, founded in December 1969 by the US Department of Defence. Its purpose was to be managed by the military to share military intelligence and research with university sources. ARPANET was decentralised in a “network to networks” controlled by different organisations by using shared standards, forming a shared “internet” which was developed by Robert Kahn and Vincent Cerf on 1 January 1983, and switched to TCP/IP, giving birth to the modern internet applications such as email and Telnet.

This was followed by the development of the Hypertext Transfer Protocol (HTTP) by Tim Berners-Lee and others at the European Organization for Nuclear Research, known as CERN, in 1989. The HTTP protocol is the backbone of the World Wide Web. Today the “internet” and the “web” are often used interchangeably, because relatively few users are familiar with the technical background. Li (2015) noted that the web has become a widely used civilian tool for communication, research, entertainment, education, advertisement and so on. The internet/web has become an integral part of university education as it plays an indisputable role in meeting information and communication needs of teachers and students.

Aldhafeeri and Male (2016) studied web-technology used in the College of Education in Kuwait University, investigating its adoption and influence among faculty members as well as in teaching and academic studies.

Internet tools used, and the challenges confronted while using the internet also revealed that the internet had assisted them in time saving, accessing recent data and coordinating with their colleagues. Chopik (2016) and Lazar (2015) stress that teachers and students, who are the majority of users, need to enhance their internet use skills through formal coaching. The internet has helped many to use the technology in their daily activities and getting information and cooperation with

their fellow scholars. Hamari, Sjöklint and Ukkonen (2016) reported that websites are viewed as a widely growing crucial reading platform.

A study by Nilati (2016) indicated that researchers are convinced of the quality of web-based information for academic research functions and for broadening their scholarly community. Dash (2015) found that the availability of knowledge does not essentially translate into actual use. This indicated that users do not seem to be conscious of the provision of such resources or are lacking in the skills of evaluating them or not understanding what the available knowledge could offer them. The study recommended that there should be continuous information literacy programmes in internet use and computer technology for institutional systems (teachers and students) to acquire new skills in CBT.

2.3.2 Synchronous and Asynchronous media

Cohen and Greenlaw (2017) suggest the design of a Modern Software Engineering Training Program with Cloud Computing to improve the teaching and learning of students. Previous studies stress that cloud computing also accelerates record keeping (Zhou et al., 2013; Almorsy, Grundy & Ibrahim, 2011; Foster & Lu, 2008). It allows users to work and access tools virtually. Using cloud tools helps keep records for reference purposes for future occurrences. The researcher observed that globally, the use of synchronous and asynchronous tools in teaching and learning is creating new skills for students and enables blended learning and teaching in most campuses in Nigeria. Bower, Dalgarno, Kennedy, Lee and Kenney (2015) argue that blended learning combines the use of asynchronous and synchronous methods of education with flexibility of use by both teacher and students.

Also, Kahoot, an e-learning tool, can assist the teacher to develop new methods in assessing students' performance by giving quiz tests during lecturing in the classroom with learners gathered around a common screen.

In a typical classroom environment, this will be an interactive whiteboard, projector or a computer monitor. The following tools listed can be seen in synchronous or asynchronous interaction during teaching and learning in campus:

2.3.2.1 Skype tool

Skype is helpful for students to interact together after the class work and also at home. It is also useful for teachers throughout academic communications, to link with others globally. Bleistein and Lewis (2015) add that Skype enables users to communicate freely with other Skype users through the use of video and audio calls with an internet link for both local and international collaboration. Other researchers note that Skype has been used traditional education for some time (Ainooson-Noonoo, 2016; Yen, Hou & Chang, 2015; Muñoz et. al., 2015). This allows students to bring their opinions together during group discussions and other related activities using their phone or computer to link each other with a Skype account. Easy accessibility in the use of Skype makes it comfortable for teacher and students to engage with teaching and learning outside the classroom. Muñoz et al. (2015) and Eaton (2012) explain that Skype works computer-to-computer rather than person-to-person, which enables Skype to teach or communicate with groups of people at the same time. E-conferencing, online examination for students, and interviews for jobs are the tools that Skype works with. Some of the advanced features of Skype used for learning purposes include conference calls, instant messaging or chat, file sharing and screen sharing.

2.3.3 WhatsApp tool

Dorwal et al. (2016) and Sahu (2014) stress the use of the WhatsApp tool, which was established by Acton and Jan Koum in 2009, for collaborating and using audio-visual aid messages, also enabling users to create groups, update their status and display pictures. According to Kiran, Vasantha & Srivastava (2017), WhatsApp is one of the applications used for instant messaging in environment. It is found in Smartphone applications for most devices and operating systems such as Apple's iOS and Android.

Bouhnik and Desheed (2014) add that WhatsApp comprises a range of tasks, such as audio and video files, text messages, attached images and links to web addresses which makes its usage unique for the users. WhatsApp is regarded as a solid social innovator or network that users use to interact to get information quickly and deliver better solutions. According to Kiran et al. (2017), WhatsApp has been part of innovative technology to make social media impact and become more popular and regularly used than Facebook among youngsters and students for their studies. The present study reveals that most undergraduate students in Nigerian universities create group pages via WhatsApp to share, interact and exchange information on their studies as part of a social

network that connects all students in a class together and also with their teachers in getting and updating new information relating to their course of study in their WhatsApp platform group page.

2.3.3.1 Email

Plant and Fish (2015) state that email is the most crucial internet tool used by the workforce, teachers and students. Mojaye (2015) observed that, as a result of the ever-present access to digital tools that students have, courses have evolved to where they are now taught in a ‘hybrid’ mode – in which teaching and learning take place both face-to-face and online. This is a way of communication that gives students the opportunity to join other learners across the globe in getting information regarding their studies easily by way of discussion of mutual educational interests to create peer groups online and enrich students’ campus-based learning (Greenhow & Lewin, 2016; Yilmaz & Orhan, 2010). This email tool has been used by students as the fastest tool to communicate to other students and is also used by teachers to send course-related information on to students via school email. Electronic mail is an asynchronous interactive tool where the teacher can send information to students via group email, or when learners send requests for urgent information to the teacher or fellow learners.

2.3.3.2 General computer use, Spreadsheet and Word Processing

These are also among the technological tools that make teaching and learning become an essential means for organising the courses/subjects such as syllabi, schedules, PowerPoint slide shows, handouts, bulletins and different course materials – like grades, which can be posted from teachers to their students – and can be used at any time to give access to everything involved with a course (Oduma & Ile, 2014; Ogbomo, 2011).

2.3.4 Intelligent Tutoring Systems

An Intelligent Tutoring System (ITS) typically aims to replicate the demonstrated benefits of one-to-one, personalised tutoring, in contexts where students would otherwise have access to one-to-many instruction from a single teacher (classroom lectures), or no teacher at all (online homework). These systems are based on cognitive learning theory, a theory interested in how information is organised in human memory. The use of ITSs in an educational system has a positive impact on teaching and learning, since they are intelligent programs that perform to know what, how and whom they will teach, so computers play an important part in education and how instructional

aims are performed, and all are suggested in this work. Alkhatlan and Kalita (2018) and Gharehchopogh and Khalifelu (2011) identify four ways in which IT is used in educational applications (student, expert, tutor and user interface), and observed that ITSs are implemented at a high level with feedback provided at each stage, which helps the student to be evaluated more properly.

2.3.5 Groupware and Video Conferencing

Collaborative software or groupware is application software designed to help people involved in a common task to achieve their goals. One of the earliest definitions of collaborative software is “intentional group processes plus software to support them”. Video conferencing is the ability for people in different locations to see and talk to each other through technology. It may also support the electronic exchange of files, sharing of computer applications and co-working. Distinctions are becoming blurred by technological developments, but three types of video conferencing system exist – desktop units, roll-about and room systems. Desktop video conferencing involves each individual using a computer, with one on-screen window for each site. A roll-about system stores all the equipment required in a wheeled cabinet. A room system includes the same equipment but is housed in a permanent installation. However, the term is truly applied to a variety of things ranging from live video instruction to large audiences, to a point-to-point, individual-to-individual, desktop computer chat. One potential division is into massive scale and small scale. The bulk of huge scale set-ups are presently satellite-based within the sort of “interactive television” i.e., unidirectional video and multidirectional audio (Pandey & Pande, 2014).

2.3.6 Visual Aids

A visual classroom environment tries to emulate classroom environments, with different tools and approaches, such as:

- Interactive white board and smart board;
- PowerPoint;
- Word processing;
- Teleconference and video conferencing; and
- Projector.

2.3.6.1 Interactive White Board and Smart Board Tools

An interactive white board (IWB) is a technological instrument that contains many features that engage students and enable computer images or pictures to be presented on a board with a digital projector. Acosta-Gonzaga and Gordillo-Mejia (2015) noted that the use of technology as blended learning with traditional education is shown to be highly effective for the ease of access by the teacher, student frequency usage and overall skills in e-tool use in the classroom. Lectures notes can be created with virtual pens and saved for future uses. It is one of the interactive educational technologies used in an organisation and in educational institutions which has improved how interactive whiteboards tools are used to aid and improve teaching and learning in the classroom (Sabi, Uzoka & Mlay, 2018). In a study conducted in Hofstra University in Long Island, NY, these authors explained how whiteboards help learners to network and work together as a team in solving problems together. One of the main arguments for the massive uptake of IWBs in schools is that they can help improve whole-class teaching by adding to the lesson's visual impact and interactivity (Hennessy & London, 2013). In fact, many researchers have suggested that the IWB can even reinforce traditional teaching styles because it is well suited for whole-class, teacher-led pedagogy. Gregorcic, Etkina and Planinsic (2018) found that multimedia technology in teaching is more effective as compared to the traditional print-based teaching methods.

While the smart board operates as part of a method that includes the IWB, the components are connected wirelessly or via a USB port. A projector connected to the computer through an HDMI port displays the desktop image on the interactive whiteboard.

The whiteboard accepts touch input from a finger, pen or other solid object. According to the British Educational Communications and Technology Agency report (2007), smart boards are helpful presentation tools that may be adopted to replace old and familiar schoolroom resources (for example the chalkboard, flipchart, overhead projector, maps, images, graphs, books, calculators and players), which offer one-click access for academics to a bank of resources that may otherwise take years to gather and require considerable storage space.

Stanley (2016) points out that smart boards promote a colourful classroom environment and with their touch-screen characteristic, stimulate scholars and academics to intervene, modify and record things with their alternative options like sound, video and animations, colours, images and

zooming in or out. The Smart Technologies Report (2006) states that smart boards increase students' participation within the learning method and their interaction with the course, encouraging them to find and support totally different learning designs.

2.3.6.2 Teleconference and Video conferencing, and Projector

White boards used in conjunction with a projector and a computer to display desktop images, together with the smart board, have become very active within the field of education recently (Farouki, 2017; Mathews-Aydinli & Elazis, 2010; and Digregorio & Sobel-Lojeski, 2010), significantly in countries like the United Kingdom, the United States of America, Australia and Turkey, attracting large allocations in their education budgets. Whereas 90% of lecture rooms in Japan and the United States of America have smart boards, 70% of European Union lecture rooms have them. The Italian Ministry of Education started a project known as "Digital Schools" in 2010, with which they are making an effort to extend the number of smart boards across the country and guarantee their effective use with teacher coaching (Lai, 2010). These countries principally use tools that fit conventional boards, but include touch screens to relate with the user, and are connected to a PC. In Turkey, smart boards have recently become a well-liked tool of learning and teaching, particularly in elementary schools, and their use is on the increase in both public and private institutions. The researcher feels that the use of IWBs improves the teaching and learning in the classroom. It also seems to support a positive attitude and more interest in the use of CBT among students.

2.4 An overview of CBT in learning

2.4.1 An Insight into CBT

The impacts of technology in education have become globally accepted in all aspects of our life and incorporated into our educational structures. Technology plays a key role in almost all facets of life and the majority of people use it in their day-to-day activities. Technology is one approach to developing knowledge more effectively as well as to solving education-related problems (Suhadi et al., 2015). According to Sung, Chang and Liu (2016), students are often already familiar with these computer interfaces and the techniques of interacting with and using them. This fact is one of the most obvious benefits of using these technologies for learning. The authors assert that

students have become more than comfortable with digital technology and it has been fully integrated into all aspects of their lives.

Al-Hariri and Al-Hattami (2017) claim that the use of technology in the classroom produces greater increases in academic performance than if it were not used. Researchers perceived that educational technologies are influential devices for teaching and learning. Teachers can use technology to find resources and attend virtual professional development seminars and conferences, which also gives educators and learners extended resources, new opportunities for learning and ways to cooperate with each other in the classroom.

As awareness of the use of educational technologies inside our classrooms increases for both learners and teachers, we are seeing more modernisation being implemented in the scholarly world at all levels (Alsghaier, 2018). Technology that makes learning easier achieves greater learning, and reflects innovation used by industry. These technologies have been added to educational modules. Examples are automated drafting for mechanical designing or a geographic information systems program for topography (Crochet, 2015).

A new degree of pressure has been placed upon teachers and students to become up-to-date with present social trends and adhere to new modern teaching techniques, which include the use of recent technologies for teaching and learning (Goldie, 2016). The use of technology in learning can be seen as a “mind tool”. A mind tool is any computer program that a learner uses to engage with and facilitate critical thinking and higher orders of learning (Lai & Hwang, 2015).

Vogrinc and Zuljan (2010) stress that computer-based technology for education must be affordable and available in the school environment. Their study regarded five technologies as appropriate and suitable, correlating with the teaching and learning in the classroom. The first is computer hardware and software. The computer hardware is a component that includes monitor, keyboard, mouse, power supply unit, drives, flash disks, speakers, printers, plotters, digital cameras, scanners, electronic whiteboards, microphones, LCD overhead projectors and data projectors, while system software includes the internet browser, office applications, operating system, photo and graphics programs. Another aspect of the computer software is the utility software which includes anti-virus packages and backup systems, applications such as word processing, spreadsheets, databases, presentation, multimedia authoring and so on.

The second aspect of the technology identified by Vogrinic and Zuljan (2010) is network hardware and software. The hardware consists of servers, network interface cards, wired and wireless communications media and network devices; the software allows functions such as sharing files and devices, and communication within the network. The authors further recognised that internet hardware and software are the third CBT required for learning. Internet hardware includes modems, routers and communication channels which enable a physical link to the internet network infrastructure, while internet software enables functions such as file transfer, email, discussion forums, chat rooms, internet chat, information publication, learning management systems and information retrieval. The author also identified a fourth CBT as video technology. This includes computerised video and still cameras, video (or information) projectors, screen displays and editing services. The fifth component is classroom technologies. These are ICT tools used in face-to-face teaching and learning such as e-books, black-white boards, overhead projectors, laboratory equipment and so on. Brown and Mbati (2015) believe that learning with technology needs more than making learning activities digital; it is also about creating contexts for authentic learning that use new technologies for integrating and meaningful ways to enhance the production of knowledge and the communication and dissemination of ideas. Kayode (2016) adds that the use of computer-based information systems has become a reality in our daily activities across the globe. The author further explained that the use of CBT has increased the work rate of Nigerian universities' secretarial staff effectively and efficiently.

The results of the study, which was based on a computer-based management information system and job performance of secretarial staff in universities in Oyo State, Nigeria, revealed that the use of CBT by secretarial staff has a positive correlation with staff job performance. This was a comparative study carried out in the federal university of Ibadan and Ladoke Akintola University of technology in Nigeria.

Literature has revealed that computer-based technologies are taking over the way we carry out our routines, particularly in the academic sphere. Computer technologies have also been found to influence teaching and learning to increase students' academic performance in our universities, especially in African education (Chaka & Govender, 2017; Hassan, Khan & Lalitha, 2016; Kareem, 2015). According to Vogrinic and Zuljan (2010) countries in the developed world are narrating success stories resulting from the adoption of computer-based technologies and academic

performance of students, in Africa and in Nigeria in particular, are still struggling to cope with the influx of such technologies. Some barriers to proper adoption of computer technologies in Nigerian education are unstable electricity supply, inadequate ICT tools, limited computer competence (computer literacy) and limited access to communication infrastructure, among others (Ikegwuiro, 2017; Omeluzor, Oyovwe-Tinuoye & Abayomi, 2016; Adeyemi & Olaleye, 2010).

2.4.2 Use of CBT in Education

Previous studies have indicated that CBT in educational settings acts as a catalyst for change in the way education is disseminated (Cheok, Wong, Ayub & Mahmud, 2017; Noor-ul-Amin, 2013). These scholars view ICT as an acronym which covers every communication device from radio, cellular phones, television, computers and network hardware to software, satellite systems and video conferencing.

Tella and Mutula (2008) add that the Department of Education in the United States of America (1996) showed that information-literate individuals know how to use the computer for word processing, spreadsheets and internet access and make use of the increased learning opportunities provided by such technology. The Economic Commission for Africa has indicated that the ability to access and use information is no longer a luxury but a necessity for development (Oluwatobi, Efobi, Olurinola & Alege, 2015).

Unfortunately, many developing countries, especially in Africa, are lagging in ICT application and usage of ICT in teaching and learning (Ngwa et al., 2016; Kpaduwa, 2015; Matthew, Joro & Manasseh, 2015).

Using CBT as a blended approach to face-to-face learning enables teaching techniques to be more effective than traditional teaching methods, as it is used for presenting information, testing and evaluation and providing feedback. The technology provides graphics, animation, drawings, music and useful materials for the students to continue at their own pace and in line with their individual differences. Noesgaard and Ørnsgreen (2015) found that CBT serves to control many variables having an impact on students' learning that cannot be controlled by means of traditional educational techniques. The effective use of technology interventions is highly dependent on several factors, such as teachers' attitudes, beliefs and perceptions; school adoption rate;

pedagogical aspects; students' perceptions and acceptance; and sustainability (Alotaibi, 2019 and Berry, 2011). The use of CBT enables learners to be active in the learning process, to construct knowledge, to develop problem-solving skills and to discover alternative solutions (Seyhan, 2015).

McKnight et al. (2016) states that schools as well as educational technology research often turn to how much time students spent using technology and what technology was available as indicators of successful technological integration. However, they do not measure whether technology is being used in meaningful ways in teaching and learning. Papageorgiou and Lameras (2017) studied the technology in schools, education, ICT and the knowledge of the society with the aim of offering guidelines for programme implementation in terms of management needs and programme enhancement. The study concluded that many countries around the world that have invested in ICT to improve and update the education of their younger generations have recorded substantial improvement. According to Ahlan, Atanda and Isah (2014), planning and reporting surveys, quizzes, tests and examinations by trainers and teachers have been made much easier through the deployment of CBT, while Onyibe, Nwachi-Ikpor and Abdulhakim (2015) posit that proper adoption and use of these technologies promote learning and that its deployment by both the teachers and students contributed to excellent performance in academic activities.

In the previous studies, Oye, Salleh and Iahad (2011) observed that, despite the recognised role of ICT in improving education, it remains a low financial priority in most educational systems in Africa, especially in Nigeria, where this study was carried out, and focused on the area of insufficient infrastructural CBT resources on campuses in the country. Serdyukov (2015) stressed that the willingness and attitudes of users in the usage of new computer applications or tools are the key element in accepting the diffusion of new technology. In the researcher's view, new skills in the area of computer-based education will be of added value to students in their learning activities in and outside classroom lectures. This could be used in students' learning if there should be availability of the necessary CBT facilities on the school premises. The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning and research (Matthew, Joro & Manasseh, 2015; Adu & Olatundun, 2013; Adeoye, Oluwole & Blessing, 2013). The study was corroborated by Onyibe et al. (2015) who reported that studies have proven the positive influence of ICTs on the quality of education. The study concluded that for students to relate the school experience to work practices, and to strengthen teaching and help universities to diversify,

the full potential of ICTs must be deployed. The study is premised on the fact that ICTs have the ability to innovate, accelerate, enrich and deepen skills to motivate and engage students.

It could be deduced from literature that most countries in the region lack resources for sustainable integration of ICT in education, and that African countries face numerous competing development priorities. This standpoint is that the use of CBT has become an essential and accepted part of everyday life for many people.

2.4.3 Computer-Based Literacy

Some years ago, computer literacy was classified by Hall (2005), based on the users' characteristics. The author categorised users into the emergent user, the progressive user, the high user and the dependent user. Based on the author's argument, the emergent users are qualified by their access to computers at home and/or at the workplace, knowledge of using word processing, sending email, browsing the web and ability to download information and save onto compact discs or any other storage devices. The studies show that the progressive users are characterised by their readiness for whatever it takes them to have knowledge of computers.

These categories of users expended their time and resources to learn more about the technology. High users are categorised as those who are well acquainted with computer technology. These are those that know how the technology works and how it can be manipulated. The category at the other extreme is the dependent users; they are those who know nothing about computers and are not making any move to learn. They rely on those who are well versed in computing to assist them in case they need to use a computer.

The scholars stress that it was necessary to ascertain the existing level of students' prior experience of using IT to help schools to plan, design and execute basic IT courses, and to help students interact seamlessly with an e-learning environment. Vigdor, Ladd and Martinez (2014) and Mitra (2008) observed that the amount of time spent by students with home computers and internet access had a positive relationship with maths achievement. Patrick and Benwari (2014) also posited that computer literacy is based on the amount of the time spent on the computer, ownership of a computer and number of computer-related courses taken. Oladunjoye et al. (2014) stress that computer literacy is the measure of computer knowledge and the extent of the usage of computer

technology and further explained that computer literacy is influenced by computer experience and use, acquaintance with programming skills and ability to use software. Aypay (2010) reported that there was no significant relationship between students' ICT usage and academic performance taking into account the concerns of the Programme for International Student Assessment (PISA) 2006.

Schlebusch (2018) observed that information-literate individuals, in addition to knowing how to use the computer for word processing, spreadsheets and internet access, make use of increased learning opportunities provided by such technology. Chun, Kern and Smith (2016) found that many faculties expect students to know how to use a word processor to create and format papers, use system software for classroom presentations and speeches, use spreadsheet software to create charts and graphs, browse the internet for research information and have the ability to learn and participate in online classroom discussions using various software tools.

The International Technology Education Association (1996) and Li (2008) postulate that technology is human innovation in action and computer literacy is the basic condition for a technology learning environment.

In the study of Torres-Díaz (2016), the author employed a comparative study considering math and language scores and analysing the differential effect at home and at school. He found a positive result of ICT use on academic performance in the two cases. Aydeniz (2018) also explained that computer literacy is important, because it transforms the computer user's ability to carry out proficient and productive activities. The scholar carried out a comparative analysis in Turkey on university students' computer skills. The results showed that possessing a personal computer or the possibility of having access to a computer from the lab at their various faculties affected students' computer skills in a positive way. The study further revealed that computer skills of the students' family had positive impacts on students' computer experiences. The study concluded that the students' ability to access a computer easily at home and at school and the family members' possession of computer skills might affect students' computer skills in a favourable way. This study revealed that computer literacy plays a major role in determining how a teacher and students could adopt and use computer-based technologies to become computer literate.

2.4.4 Necessity of Computer-Based Technology Skills in a Modern-Day Academic Environment

In modern society, students are being brought up with the consciousness of a society that is changing rapidly because of the flood of new computer-based applications and tools which have made possible hitherto restricted global interactions in social activities, business, correspondence, culture and education. Selwyn (2016) and Serfontein (2010) assert that technology has changed the educational sector by incorporating computer skills into the traditional learning setting. It has also included other aspects of life and improved our communication, our professions, entertainment, access to information, financial activities, e-business and even doctors' treatment of patients, among many other uses.

The world is rapidly generating innovation skills and this improvement has encouraged changes in our social belief system, education and how we work or do things every day. Wu, Guo, Huang, Liu and Xiang (2018) state that the integration of information tools (hardware and software) and communication technology (information and media networks) into new ICTs have a positive impact on humankind.

Many past researchers have described how technology in schools has increased within the past decade, but there have been few large-scale research studies done on the impact of these programmes on teaching and learning (Skryabin, Zhang, Liu & Zhang, 2015)

It could then be inferred from the literature that incorporating computer literacy skill acquisition in the teaching and learning processes in tertiary institutions both in the university system globally and in Africa and Nigeria in particular, is relevant. Students' proficiency in CBT skill acquisition was highlighted as important in the reviewed literature, and this points to the fact that it will aid positive usage of CBT skill level in education.

2.4.5 Students' Level of Computer-Based Technology Skills

Technology has changed immensely in recent years. Computer devices are more capable and come in various modes, from those in our work areas to those in the palms of our hands. The web interfaces of those devices connect students to each other in the classroom, through the school and around the globe (Watkins & Cho, 2018; Tanenbaum, 2016; Sagarmay, 2014). The authors stress

that CBT is the ability to perform tasks which help in teaching and learning to provide technical support in the classroom, and the following are the skills to be used for proper deployment of CBT in our classrooms as proposed by Sagarmay (2014): having the knowledge and skills to use technology devices; selecting appropriate technology for particular tasks; applying technology to a task; and maintaining and solving problems regarding technology systems. It also refers to using technology to effectively access and process information. It enables students to attain high levels of skills in computer-based technologies in order not only to use computers as tools to access and process information, but also to communicate worldwide and generate creative solutions to real-world problems. The researcher observed that the blended approach to teaching and learning does appear to enhance the academic performance of students.

Seyal and Rahman (2015) and Margareth (2009) reported that computer skills are important factors in ensuring proficiency in basic reading and writing skills. The paper further reported that ICT is designed to enhance the flow of information and communication and that it is a means to access information and knowledge.

It argued that technology launches education into the world at large and creates a valuable opportunity for all those engaged in education to review their practices and in so doing to formulate a more reflective approach to their educational practices. This article advocated for capacity building in the use of CBT, which it asserted will improve literacy and training for teaching and learning.

The previous scholars stress that positive attitudes towards the computer were associated with a higher level of computer knowledge (Van Deursen & Van Dijk, 2015; Al-Emran, Elsherif & Shaalan, 2016). The quantity of technology does not impact students academically, but effective teaching practices in conjunction with quality technology usage can improve student achievement. According to Lepp, Barkley and Karpinski (2015), students using a computer for one hour per day had better scores in mathematics. Kubiatko and Vickova (2010), stated that the amount of time expended on computer application usage had a positive and strong relation to science knowledge. Jain, Mishra and Shukla (2016) stated that the literature contains many unsubstantiated claims about the revolutionary potential of ICT to improve the quality of education, and also noted that in future, hardware will presumably be more affordable and software will become an effective learning tool. An evaluation of the programme concluded that students believed that laptops had

facilitated their learning and improved the quality of their work. Teachers reported that students became more engaged in their learning and produced more and better-quality work as a result of using ICT tools (Todd & Kuhlthau, 2016; Wollscheid, Sjaastad & Tømte, 2016).

In view of the above, Sung, Chang & Liu (2016) suggested that the use of technology in the classroom changes other variables, such as teachers' roles, levels of student collaboration and students' study habits. Thus, it was impossible to definitely state that the technology alone caused changes in students' performance or behaviour. Linking with contributions of reviewed authors, this present study's contribution to knowledge will be to assess whether the students' level of CBT skills will enable them to develop new skills in the use of CBT in their relevant studies, thereby offering them many new opportunities for working in innovative sectors.

The researcher observed that most increases in CBT skills have been during students' collaboration using CBT tools which were mostly on homework assignments, feedback from their teachers and group discussion using platforms through their Moodle page. These helped students to be more active in their learning in the face-to-face traditional education.

Genlott and Grönlund (2016) elaborate that there is a change in education when ICT is used with the traditional method and the effects of CBT skills have often been regarded as a positive change, as if change always means an improvement. This current study reveals that digital tools such as laptops, electronic whiteboards, video conferencing, e-mobile learning, projectors and others, have been some of the e-tools put to effective use by students that enhanced their learning outside the classroom context. Seeing the different impact that students' level of CBT skills has on learning in the campus-based environment, it is imperative that we focus more on specific core skills in the use of computer-based tools that are necessary to influence learning.

2.4.6 Previous CBT Skills Experience and Its Influence on Students' Academic Performance

Previous knowledge of computers has been confirmed as playing an important role in the use of CBT. The amount of previous computing expertise has additionally been hypothesised to have an influence on computerised academic performance evaluation of students. Ignorance and unfamiliarity with computers might increase anxiety and interfere with test taking. If this were the case, then computerised testing might discriminate against examinees that have not worked with

computers before testing. Those that have additional past experience with computers would then be at an advantage in taking a computerised test examination or learning in classroom and also when using any technology tools. Some years ago, Govender (2006) stressed that individual variations in terms of past access to computers are also a vital issue in computer-based testing. The International Test Commission (ITC) (2016) found that increased coaching on computer usage before taking a computer-based test considerably increased the test scores of the examinees. The authors attributed the advance in scores to the mitigating of tension by the coaching before test.

The direct link between ICT use and students' academic performance has been the focus of extensive literature during the last two decades. ICT helps students in their learning by improving the communication between them and their instructors (Greenhow & Askari, 2017; Uluyol & Şahin, 2016).

According to Dell, Newton and Petroff (2016) and Albugami Ahmed (2015), ICT has the potential for increasing access to technology tools and improving the relevance and quality of education. ICT can help deepen students' content knowledge, engage them in constructing their own knowledge, and support development of complex thinking skills (El Rouadi & Al Hassan, 2016; Noor-Ul-Amin, 2013). Previous studies by Nyoni (2015) and Raychaudhuri, Debnath, Sen and Majundra (2010) corroborate this. They report that students' academic performance depends on several socio-economic factors, like students' attendance in the class, family income, parents' educational level, teacher-student ratio, presence of trained and qualified teachers in school, sex of the students and distance from the school. Diep, Zhu, Struyven and Blieck (2017) found that students' performance is significantly correlated to satisfaction with the academic environment and the facilities of the library, computer lab, ICT devices, and so on, in the institutions. This was in line with the findings of Coleman (2014) who notes that the use of the internet has become part of everyone's daily life.

Salemink, Strijker and Bosworth (2017) predict that forms of ICT will change with time, and that access demand and use will remain the reason for full engagement and participation in an information society. Küçük, Kapakin and Göktaş (2016) agree that ICT can improve the quality of teaching, learning and management in schools. This research further revealed that the field of education has been influenced by the use of technology in education in the frequency of use of digital tools, which has affected teaching, learning and research positively.

Other scholars (e.g., Aydin & Öztürk, 2016; Delen, 2015; Ahlan, Atanda & Shehu, 2013) also state that computer-based tests enhance the academic performance of students. The researcher discovered that courses learnt in the use of CBT skills in addition to blended learning in the classroom benefited the students by improving their academic grades and limiting their failures. The internet as one of the digital tools of computer-based learning has strengthened teaching and learning as it provides powerful resources and services for students, thereby enabling them to meet their educational needs.

Yamazumi (2016) agrees that technology allows for networking among students and teachers, which facilitates exchange of ideas and improves opportunities for connecting schools to the world, as learning is expanding beyond the classroom, so a real-life context can be established.

Burns (2017) and Liaw (2017) urge the use of synchronous Computer-Mediated Communication tools to facilitate students' self-efficacy and in turn their academic achievement. In their research, Kim and Jang (2015) also established that the use of tablets had a positive influence on mathematics instruction. The frequency of use of CBT applications will prove influential in improving Nigeria's educational system and giving students a better education if difficulties such as infrastructure and stability in electricity supply are resolved in the educational premises,. A technologically advanced workforce will lead to ICT growth in Nigeria, with the potential to improve military technology and telecommunications, media communications, and skilled ICT professionals who will be well equipped to solve IT problems in Nigeria and other parts of the world (Matthew & Manasseh, 2015). Underfunding of Nigerian universities in the area of CBT has limited teachers' and students' abilities to effectively and efficiently perform their traditional duties of teaching and learning and has also affected their capacity to improve the state of their physical facilities, which are crucial to teaching and research (Aworanti, 2016; Bamiro & Adedeji, 2010). Conducting CBT tests is seen as enhancing performance as against paper-based tests. It further highlights the importance of consistent access to CBT facilities. The literature reviewed above has revealed that such synchronous applications as Skype, WhatsApp and Moodle have enhanced the students' capacities in group discussion after class, which makes their lecture more like blended learning. It also revealed that CBT skills acquired by students can influence their academic performance, and that computer-based technologies do have an influence on the academic performance of students. It further revealed in this review that those learners with the

required skills in computer-based technologies have a better chance of surpassing their counterparts who do not have the skills.

2.4.7 Availability and Importance of CBT for Academic Purposes

As CBT becomes more user-friendly, interesting and efficient in teaching and learning, these tools have come to serve a dual function: for the realisation of learning as construction, as well as for the social process of meaning appropriation.

It was also thought to offer novel opportunities for learning activities and ways of teaching, which in turn would require novel psychological insights (Hod, Bielaczyc & Ben-Zvi, 2018; Kabassi, Dragonas & Ntouzevic-Pilika, 2015). In the past, The National Education Association (2008) recommended that the technology available to students and teachers be compatible with the technology generally in use outside the schools (Sánchez-Prieto, Olmos-Migueláñez & García-Peñalvo, 2016).

Huber (2016) adds that technology software should be age appropriate and engaging, flexible enough to be applied to many settings, relevant to the content areas being studied, and able to be easily integrated into existing curricula. Séraphin, Ambaye, Capatina & Dosquet (2018) emphasised that ICT is a subject that has attracted a great deal of interest in the literature because of its characteristics and utility in service delivery. Majumdar (2015) and Oduma (2013) liken ICT to a utility (like water and electricity) which plays a major role in education and has impacted on the quality and quantity of teaching and learning as well as research in educational methodology to initiate a new age in education. It is essential that the National Department of Education perceives that, regardless of the amount of technology and its advancement, technology will not be adopted unless it is immediately available for students to use in the classroom and teachers have the skills, knowledge and attitude required for incorporating it into the classroom syllabus. Previous studies revealed that an educated citizen in the year 2020 will be more valuable as an employee who is able to produce more builders of theory, synthesisers, and inventors of strategy than valuable as an employee who manages facts (Li, Darema & Chang, 2018; Haddud, DeSouza, Khare & Lee, 2017; Riggins & Wamba, 2015). The prediction of these scholars is becoming a reality in our educational sector.

Martha (2016) outlined how ICT facilities have reshaped the handling, management and storage of information in both the government and private sectors, including academic institutions. ICT facilities have ensured speed and efficiency, and timely and accurate record keeping. Li et al. (2018) and Zuboff (2015) corroborate the above viewpoint by noting that via the internet it is possible to record, assess, search and retrieve information from any obscure corner of the world at any moment in time.

Various kinds of ICT products of great relevance to education, such as teleconferencing, email, audio conferencing, television lessons, radio broadcasts, interactive radio counselling, interactive voice response systems, audiocassettes and CD ROMs, have been used for different purposes in education (Buttar, 2016; Chelladurai & Pitchamal, 2016).

The availability of relevant computer-based technologies that enhance the attainment of the desired 21st-century educational aims and objectives is still lacking in Nigeria. Onasanya, Shehu, Ogunlade and Adefuye (2011) observed that usage of computer-based technologies in teaching Sciences and Health Education in Nigerian schools is still lagging behind due to many challenges such like unstable electricity, lack of Wi-Fi and lack of CBT facilities.

The study was based on teacher awareness and extent of use of information communication technologies for effective science and health education in Nigeria, and a questionnaire was used as the research instrument. The authors identified the reasons for deficiencies, including unavailability of facilities and equipment to promote computer education. The study reported that the majority of public schools in Nigeria lacked the necessary facilities and equipment in secondary school stages, with adverse effects on students when they gained admission into the university.

Ibenne (2016) and Moja (2000) conducted a study on the Nigerian education sector by analytically synthesising the performance and main issues in the Nigerian education system relating to human resources capacity, access and equity, quality and information for decision making. The study reported that basic CBT facilities which aid teaching-and-learning resources were generally not available. It then inferred that the unavailability of these CBT resources needed to be revisited once again in order to determine if this scenario still persists or has changed. The current study aims to address this scenario.

2.4.8 Computer-Based Tests on Students' Academic Performance

Computer-based tests have been found to increase self-confidence and help students become independent and proficient in their studies and researches. Abubakar and Adebayo (2014) found students taught with computer-mediated learning performed better in class than conventionally taught students.

The study further reported that computer-based testing, which has been in circulation in various forms for more than four decades, has grown from its initial focus on certification testing for the IT industry into a nearly universally acceptable delivery model serving elements of virtually every space once dominated by paper-and-pencil testing. The use of computer-based testing for entrance examinations in education, military training, and certification examination by professional groups and promotional examinations in various stages and categories of life cannot be overemphasised. Van der Kleij, Feskens and Eggen (2015) reported that the use of computer-based testing has gained popularity as a means of testing on assessment of undergraduate students in their performance.

These previous scholars, (Jerrim, 2018; Cosgrove & Cartwright, 2014; Khoshima & Hashemi, 2017) conducted a study of comparability of computer-based and paper-and-pencil testing reading assessments by examining a meta-analysis of testing mode effects. The study reported that one big innovation in the education field was educational evaluation and testing, as it transitioned from paper-based to CBA. The study further found that CBA's gain in momentum over the traditional paper-and-pencil test was attributable to the numerous benefits that CBA provides and it concluded that there was an improvement in the use of CBA.

The question remains, why test on a computer? Studies by Kretschmann (2015), Mango (2015), Yilmaz (2015) and Davey (2011) identified three basic reasons for testing on a computer. The first is to enable measurement of constructs or skills that cannot be fully or appropriately captured by paper-based tests. The second is to improve measurement by increasing the precision or efficiency of the measurement process. The third is to make test administration more convenient for examinees, test sponsors or both.

The need for valid measurement is at the heart of virtually every testing programme, and measurement is highly dependent on the availability of reliable data. Paper-and-pencil testing provides only the basic information required for simple analysis (item number, response and the answer key). Beyond these basics, technology-based test delivery provides a rich array of data, including starting and ending time, break periods, time spent on each item/group/section and integrated survey responses. Constructed responses, such as free form text and essays, can be collected electronically and easily scored without the challenges associated with hand-written responses (Surjono, 2015).

Some years ago, The Prometric Industry Report (2012) equally established the superiority of computer-based testing over paper-based testing. The report established that paper-based testing is susceptible to being erased or changed while its CBT counterpart has the ability to record all interim answers through keystroke capturing. The report also made a strong case for forensic data collection for security investigation as it is a valuable tool both for assessing candidate and test behaviour (Nepivodová, (2018)). Direct access to data generated by third-party applications, including word processors, spreadsheets and other software packages such as simulation tools which can also be provided through CBT while provision for a seamless integration of traditional theory- or knowledge-based content with performance-based material can also be achieved. Based on the reviewed literature above, it is then clear that computer-based testing technologies have relative advantages over pencil-paper testing. It is important to factor in the teachers' perspectives on this assertion.

2.4.9 Effects of Computer-Based Testing on Student Performance

Comparison of computer-based testing and paper-based tests is not absent from the literature, though scanty. In the opinion of Simin and Heidari (2013) there may not necessarily be any comparative metric for paper- and computer-based testing without empirical verification before a claim of equivalent validity could be made and justified. Even though the content of the items is the same, the mode of presentation could make a difference in the test-related activities, such as test creation, assessment task, answer collection and scoring, statistical analysis, storage, transmission and retrieval of information. However, behaviours such as the propensity to guess, the facility with which earlier items can be reconsidered, and the ease and speed of responding may be used as deciding factors for comparison. The study concluded that students were more

ready to learn if they were fully involved in the learning process, received feedback on their progress and had the chance to run through or repeat the assignment. Sun and Johnson (2016) stated that the advancement in the use of this technology improves students' learning achievement and leads to positive willingness of students to learn. The study added that the use of CBT for assessment in the classroom helped students to monitor their progress, revise and rehearse and receive feedback for evaluation on the assignments on modules or courses given to them.

Abubakar and Adebayo (2014) suggested that the way a person approaches computer-administered and paper-and-pencil testing tasks may be mediated by cognitive differences. The study further suggested that the manner of cognitive functioning exhibited by the test-taker may be the manipulation necessary for working with a computer, while the stimulus value of the computer itself may alter. Test performance, according to Abubakar and Adebayo (2014), may well be influenced by minor differences such as the formatting of a microcomputer screen display. Mohamad, Hussin and Shaharuddin (2015) however posited that parallel tests, the subtest and total test scores for a paper-and-pencil test and its computer-administered counterpart should yield equal means, equal variances and equal correlations with the scores on any other criterion variable.

The authors added that in case the scores from the computer-administered test variant are intended to be symmetrical with scores obtained by the paper-and-pencil test, then the two test variants can be evaluated against the criteria for parallel tests.

Hakim (2018) compared the validity of paper-based and computer-based tests in the context of educational and psychological assessment among Saudi female foundation year students from the English Language Institute in Saudi Arabia. The study was aimed at getting some valid data to provide a solid base for the effective use of computer-based testing in academic and placement modes. The study used a computerised assessment method which required comparable test score data based on the comparative study scores of both paper-based test and computer-based test methods. Results showed that pre-tests improved the results by providing experience for the tests themselves, and that participants in the computer-based testing group performed better. It was concluded that computer-based testing is an efficient tool for assessment.

A similar study was carried out in Iran by Mojarrad, Hemmati, Jafari Gohar and Sadeghi (2013), which examined the impact of transitioning traditional reading comprehension assessments to

CBAs. It assigned 66 male English as a Foreign Language (EFL) learners aged eight to 12 years to take two different 20-minute reading comprehension tests with the same level of difficulty on paper and computer screen using scrolling text to navigate through pages. The study also combined an attitude questionnaire to reveal their attitudes towards computerised testing.

Findings revealed that there were no significant differences in reading comprehension scores across testing modes, but also revealed that most students preferred to take the test on a computer. The study suggested that the degree of reading comprehension among children does not differ considerably while switching from paper-and-pencil-based assessment to CBA.

Hosseini, Morteza and Toroujeni (2017) studied the equivalence of test scores on paper-based testing and computer-based testing in the English achievement test in Payame Noor University (PNU) among undergraduate students and investigated if there was any relationship between computer attitudes and testing performance on computer-based testing. The studies gathered and analysed both quantitative and qualitative data. Major findings revealed that there was a statistically significant difference between two sets of mean scores. In comparing the results of computerised and paper-based tests, there was indication that students showed better performance on paper-based testing than computer-based testing.

The results supported the necessity of doing comparability studies in higher educational contexts before substituting computer-based testing for paper-based testing or including it in the system. Results further revealed that attitudes to computers had no relation to testing performance on computer-based testing among Iranian undergraduate students in PNU. The results of interviews also supported the quantitative findings where participants mostly showed a high preference for computerised testing and liked CBT more than paper-based testing. However, for reasons such as ease of answering, test taking speed, prompt scores reporting, ability to prepare for the prospective examinations, and progress output and usage of CBT, they performed better on paper-based testing.

In the study of Hardcastle, Herrmann-Abell and DeBoer (2017) students' performance on paper-and-pencil and computer-based-tests was compared with the aim of finding whether students' performance on computer-based tests and paper-and-pencil tests could be considered equivalent measures of student knowledge. The study reported the performance of students who took either a

paper-and-pencil test or one of two different computer-based tests containing multiple-choice items assessing science ideas. Propensity score matching was used to create equivalent demographic groups for each testing modality, and Rasch modelling was used to describe student performance. It was found to vary across testing modalities by grade band, students' primary language and the specific CBT system used.

2.4.10 Teachers' Students' and Administrative Perspectives of Computer-Based Testing on Students and Academic Performance

Olatokun (2017), Abukhattala (2016) and Agbo (2015), reported that studies recently conducted have revealed that to implement educational technologies successfully, the attitudes of the educators who eventually determine how they are used in the classroom are critical; also, there should be availability and accessibility of these computer technologies. Keengwe and Bhargava (2014), Olojo, Adewumi and Ajisola (2012) found that educators' attitudes were major enabling or disabling factors in the adoption of technology in teaching and learning in the classroom. Similarly, Nguyen, Barton and Nguyen (2015) found that educators who have positive attitudes towards technology feel more comfortable with using it, and usually incorporate it into their teaching.

Successful technology-based learning relies heavily on the context for use; classroom teachers play a significant role in facilitating student learning and aligning educational technology with content from complementary sources.

According to Ogunlade and Oladimeji (2014), usefulness, ease of use and credibility are important in the use of computer-based testing in Nigerian universities, as perceived usefulness, ease of use and credibility play an important role in the use of computer-based testing. The perceptions of teachers of the importance of technology usage indicated that they have a positive attitude to its use. However, for it to be fully and successfully deployed there must be a symbiotic relationship between their perception and that of the students.

McCall (2016) researched the instructional power of digital games, social networking and simulations and how teachers can leverage them. The authors pointed out that the evolution of social networking technologies and digital games has assisted in shaping the new strategies by which people communicate, collaborate, operate and form social constructs. The study reported

that recent research findings indicate that these technologies are shaping the manner in which we think, work and live and that younger ones are the most affected.

Students' performance has been identified as a key aspect in the learning process as regards the use of computer-based testing, as it helps students, parents, teachers and management to take various decisions on the students' learning.

Computer-based testing has become a necessary and perhaps imperative component of life and living in modern society, and training and retraining has to be fashioned towards skills improvement (Sanni & Mohammad, 2015). While computer-based testing is gradually and increasingly being accepted for solution testing when assessing students' performance as well as conducting examinations in universities, overall academic performance of students in most universities in Nigeria is still low, despite increased awareness of CBT. This may be attributed to students' CBT skills levels not being adequate.

The following explains some of the benefits accrued by using computer-based testing. Literature revealed that both teachers and students have a positive disposition to the adoption and use of computer-based testing simply because it enhances study and teaching and academic performance of students. It then becomes necessary to focus equally on the administrative component of the universities' management.

The Prometric Industry Report (2012) concluded that activities such as post-test retrieval of test results, scanning and scoring of test materials in paper-based tests can be time consuming and labour intensive. The report further stressed that often the challenge of paper-and-pencil testing comes not from the actual administration of the event itself but from all the tasks that take place before and after test day when months of work go into such tasks as securing testing facilities, hiring proctors, developing and printing test materials and arranging for secure delivery and storage of the test content, as against computer-based testing. Robby and Gitsaki (2015) and James, Yuguda, Moses, Jeremiah and Bitrus (2016) found in their study that computer-based testing eliminates many of these problematic activities highlighted by the Prometric Industry Report (2012), while Kirmiz (2015) observed that by leveraging technology and the economies of scale made possible through computer-based testing, test sponsors were enabled to focus on important activities such as ensuring test validity and providing high-quality service to their constituents.

2.4.11 Computer Anxiety and Computer-Based Testing

Onyibe, Nwachi-Ikpor and Abdulhakim (2015) defined computer anxiety as the complex emotional reactions that are evoked in individuals who experience computers as personally threatening.

Darrell (2003) described it as the fear or apprehension felt by individuals when they used computers, or when they considered the possibility of computer use. Computer familiarity was examined as another necessary cause which may have effects on students' computer-based test performance, but the results were not consistent. Some studies suggested that computer familiarity was not associated with performance differences between computer-based test and paper-and-pencil test groups (James, Yuguda, Moses, Jeremiah & Bitrus, 2016). Little or no performance distinction was reported relating to students' computer familiarity, indicating that computer expertise does not have any effect on students' computer-based test scores (Rohatgi, Scherer & Hatlevik, 2016; Alabi, Issa & Oyekunle, 2012).

Several studies have reported that computer-related attitudes are generally determined by computer self-efficacy and computer anxiety (Cazan, Cocoradă & Maican, 2016; Celik and Yesilyurt, 2013; Huffman et al., 2013). According to Sultan and Kanwal (2017), the authors investigated personal attributes of distance learners that may contribute to their levels of computer anxiety and computer self-efficacy.

Five hundred distance learners were surveyed using a questionnaire. Results indicated that computer anxiety is negatively associated with computer self-efficacy, with female and older distance learners reporting high computer anxiety and low self-efficacy; and computer anxiety decreased and self-efficacy improved with work experience, computer handling experience and total number of hours spent on computer work. The study suggested that identifying these factors may help in designing and implementing learning environments that may better fit the students' needs at distance learning institutes.

Schlag and Imhof (2017) conducted a study on computer anxiety among 310 pre-service mathematics teachers from Lagos and Ogun States of Nigeria. The study aimed to contribute to a better understanding of challenges and factors that influence learning efficiency with electronic

portfolios. The study analysed external variables and computer-related attitudes and correlated them with external variables as well as measures of self-regulated learning. Results showed that computer anxiety and the challenge of working with an electronic portfolio decreased over time. It further found that the more the computer is appreciated as a useful tool for learning and teaching, the less computer anxiety is experienced by the user. The study used a quantitative research method and descriptive survey design.

The findings revealed that attitudes towards computers were a multi-dimensional construct (affective, perceived usefulness, behavioural intention and perceived control component) while gender differences in attitudes towards computer and computer anxiety among pre-service mathematics teachers were equally significant. Affective component, computer self-efficacy, perceived control component, and perceived usefulness component made statistically significant contributions to the variance in respondents' computer anxiety. The study recommended that academic institutions should pay more attention to this computer anxiety and adopt proper ways of reducing it, so that positive e-learning experiences can be created for pre-service teachers. It has been established that computer anxiety may be triggered by the consideration of the implications of using computer technology (Cazan, Cocoradă & Maican 2016). Olson et al. (2011), therefore, proposed that it is imperative to plan interaction with computers. Differences in computer attitudes such as interest, liking and confidence were also obtained in investigations, with males holding more positive attitudes.

Tuma and Maser (2018) and Davey (2011) defined test anxiety as an unpleasant feeling or emotional state that has physiological and behavioural concomitants, and that it is experienced in formal testing or other evaluative situations. Studies have examined the relationship between CBTs and student test anxiety. Effects of online testing on student examination performance and test anxiety were examined. Stowell and Bennet (2010) hypothesised that administering regular course exams in an online format would reduce test anxiety experienced at the time of the exam and improve exam scores. The authors selected 69 participants from a psychology course to take classroom- and online-delivered exams, using a counterbalanced crossover design. The study found that students who normally experience high levels of test anxiety in the classroom had reduced test anxiety when taking online exams, while the reverse was true for those low in classroom anxiety. The study further found that the relationship between test anxiety and

examination performance was weaker in an online setting than in the classroom and thus recommended that instructors should evaluate the potential impact of these findings when considering offering examinations online.

Dashtestani (2015) examined the attitude of the students towards computer-based tests at the University of Ilorin, Nigeria, relying on a survey. Data were collected through a computer-based test attitudinal survey questionnaire and a focus group discussion.

The results demonstrated that respondents had positive attitudes towards computer-based testing. More than half of the respondents preferred a computer-based test to a paper-and-pencil test. Respondents also demonstrated a strong perception of increase in their learning performance as a result of taking computer-based tests or examinations. On the other hand, problems such as shortage of computers, lack of skills, loss of data in the process of writing a computer-based test, slow network speed and difficulty of reading on the screen were identified.

Similarly, Gaylle (2015) examined the state of anxiety in the computer-based English test and the impact of the test anxiety on the candidates' performance. Eighty respondents were measured with a questionnaire adapted from Sarason's Test Anxiety Scale. Correlation between the test anxiety score and that of their oral test was analysed. Findings indicated that there is high test anxiety in the computer context and apprehension of different levels affects the candidates' spoken English performance to some extent among respondents.

The study suggested that improving the testing environment and strengthening pre-test training could be used to reduce the level of anxiety.

A related study of the interaction between computer-related factors and anxiety in a computerised testing situation at Nigeria's National Open University was conducted by Owolabi and Dahunsi (2014). The focus of the study was to investigate the interaction between some student-related factors (age, gender, year of study, ownership of computer, computer anxiety and computer experience) and test anxiety in a computerised testing situation. It adopted a correlation design with test anxiety in a computerised testing situation as a dependent variable while the student-related factors constituted independent variables. The data collection instrument was a questionnaire while data collected was analysed using frequency, percentages, Pearson product

moment correlation (PPMC) coefficient and multiple regression analysis. Results showed that those with higher computer experience had significant contributions to the variation in test anxiety in a computerised testing situation and based on the findings the study suggested that students should be encouraged to have their own computers and use them often in order to reduce test anxiety in a computerised testing situation.

A recent study by Baig, Al-Zahrani, Al-Jubran, Chaudhry and Qadri (2018) evaluated the test anxiety levels among students during computer-based and traditional paper-and-pen examination. A descriptive survey-based study was conducted on 199 male and female students of the preparatory year of allied health sciences through random selection. Data was analysed using descriptive statistics and mean anxiety scores were compared by unpaired *t*-test. Results indicated that there was a statistically significant decrease in mean anxiety score on worry, anxiety and tension scales in students taking part in a computer-based examination when compared with pen-and-paper-based examination.

2.4.12 View of CBT Learning in the Educational Setting

Computer-based testing in learning has come to stay as technology advances, but the main pedagogic issue is to know where the new technology can have a real impact on learning effectiveness (Johnson & Lester, 2016; Sharples et al., 2016; Govender, 2006). Some of the technology supports a second-generation approach, conveying new impact and potency to the second-generation model.

Different aspects of the technology, however, permit the constraints of time and distance to be greatly lessened in conveying the ability of small-group face-to-face teaching to the individual desktop, at home or in the workplace. The opportunities give ways to manage time and will positively influence students' time management in their studies.

A similar review that focused on students was carried out by Schindler, Burkholder, Morad and Marsh (2017). The study presented a critical review of the literature from the past five years relating to how web-conferencing software, blogs, wikis, social networking sites (Facebook and Twitter), and digital games influence student engagement. Findings suggest that digital tools

provide the most far-reaching influence across different types of student engagement, followed by web-conferencing and Facebook.

Learning could be viewed as a human process involving the active construction of the latest content and understanding through individual learning, cluster and peer interaction. Technology is shortening the boundaries between distance, open and traditional learning.

Technology also provides a way to assess students' performance through the skills of computer-based technology (Ferguson, Coughlan & Herodotou, 2016). Blasco, et al. (2015) stressed that multimedia used to deliver hardware, presentation mode and sensory modalities in the classroom lecture in different ways, such as sound and pictures or images of video, or text and computer-based instruction. Adbo et al. (2009) explained that students remember 10% of what they read; 20% of what they hear; 30% of what they see and 50% of what they hear and see. The study showed that use of technology in the classroom enhances effective teaching and learning, which means these technology tools engage students to initiate their interest in the particular lectures with collaboration with other classmates to make learning effective.

Many students have been completely acclimatised to digital technologies – it may be a totally integrated side of their lives (Yang & Wu, 2012; Young, 2012). Many students are using new media and technologies to create new things in new ways, learn new things in new ways, and communicate in new ways with new people, behaviours that have become ingrained in their ways of thinking and operation in the world. The impact of technology on students' accomplishment is advanced and affects accomplishment.

Educational or learning institutions at all levels are faced with the responsibility of providing a good learning experience for the learners, with or without the instrumentality of technology. Area, Gonzalez and Mora (2015) and Killingworth and Marlow (2014) explained good learning as immersing students in a learning experience that permits them to grapple with a problem, gaining higher-order thinking skills from seeking the answer. To foster learning through the employment of technology, it is helpful to evaluate the pedagogic principles behind teaching and learning with information and communication technologies.

Technology could be a powerful and effective tool, but if teachers use it solely as a delivery vehicle, the outcomes may not be equal to its potential. The challenge is how to devise a means for full use of technology in order that it does not become merely a substitute teacher (Young, 2012). Indeed, instructional content can be embedded in the technology and then delivered to the student with the assumption that if you deliver content, the students will learn. But by blending the use of technology with teaching by the teacher, students have been shown to have much higher learning outcomes.

Ptak and Schragenheim (2016) and Young (2012) emphasised the following useful roles for technology to support effective pedagogy in the classroom:

- Technology as a tool to support knowledge construction;
- Technology as a support in developing contents or lessons;
- Technology as a means of supporting practices and hands-on exercises;
- Technology as a social platform to encourage learning through peer group communication;
- Technology as knowledge associated to aid learning through manifestation; and
- Technology as an information vehicle for exploring knowledge.

2.4.13 Effects of CBT in Learning/Teaching Patterns

Scholars have also studied the relationship that exists between student knowledge acquisition behaviours and online learning and testing. It is worthy of note that researchers define learning behaviours of students differently, and there is presently no globally accepted definition of what a learning style is. A study by Siti and Zamzami (2015) addressed learning styles, focusing on two internet-based learning conditions and four learning behaviours. The behaviours active-reflective, visual-verbal, sequential-global and sensing-intuitive were studied. It was reported that students who were more active-reflective showed a preference for face-to-face study classes rather than online study classes and online tests.

Early in the century, Ames (2003) used Gregory's definition of four clear learning styles – abstract sequential, abstract random, concrete sequential and concrete random.

The results showed that computer-based or computer-assisted instruction may not guarantee optimal performance for all students. In their study to inquire into the impacts of formative assessment and learning style on students' achievement in internet-based learning conditions, Lin, Yu, Wang and Ho (2015) identified four different learning models – concrete experience, reflective observation, abstract conceptualisation and active experimentation. Findings indicated that each of the learning styles and formative assessment methods are factors influencing student accomplishment in internet-based learning conditions.

2.4.14 Test Results and Data Collection and Use of Computer-Based Testing

Unlike static paper-and-pencil answer sheets, computer-based testing collects far more information than the candidate's responses. Computer-based testing results capture data regarding the test event (candidate name and ID, start time, end time, date, workstation ID, test centre location, etc.) as well as item data (like item sequence, item ID, correct response, candidate response, time spent on item).

This information is valuable from a psychometric perspective, in terms of item difficulty, and enables a degree of analysis impossible with paper-and-pencil testing. Such data analysis allows test sponsors to identify performance differences and isolate potential security risks. Testing on a computer can allow scores to be entered automatically into classroom-, school-, district- or state-level databases. Once there, various individual and aggregate reports can easily be produced to summarise and track the performance of individual students and defined groups (Fisher, 2018; Davey, 2011).

2.5 Nigerian Universities and Use of CBT

Universities in Nigeria have recently introduced CBT as learning support for education. According to Olatokun (2017) and Joshua and Ikiroma (2012), Nigerian universities are making a shift to adapt to the use of the internet, telecommunications and networking in teaching and learning in the educational system. The Nigerian Educational system may have started late in adopting IT as a tool in delivering learning but is fast catching up with the trend (Pandeya & Tiwari, 2014).

The National University Council and Nigeria Information Technology Development Agency have played a vital role in the integration of technology in learning in Nigerian universities. NUC prescribed that each university in Nigeria should provide a personal computer as follows: one PC to two lecturers below the rank of lecturer I, 1 PC per lecturer I/senior lecturer, and one notebook per professor-reader. Using the internet in teaching and research makes the communication between the students and the teacher more convenient and interesting. Especially, using the web in teaching and research makes it available for the students who prefer or require learning outside the classroom to study at their convenient time and space (Anshari, Almunawar, Shahrill, Wicaksono & Huda, 2017; Kaplan & Haenlein, 2016; Christopher& Maria-Gorretti, 2012). Most universities in Nigeria are making this shift via the internet, telecommunications and networks (Otugo, Uzuegbunam & Obikeze, 2015; Joshua & Ikiroma, 2012).

Universities in Nigeria are becoming aware of the need to adapt these innovations of technology on their campuses and increasing their use in academic activities. CBT skills have been embraced for students' academic performance in tertiary institutions in Nigeria (Joshua, Obille, John & Shuaibu, (2016).

This is in order to keep up with the vastly different forms of technology being devised every day around the world, with great impact on the academic performance of students (Rahman, Zaid, Abdullah; Hwang, Lai & Wang, 2015; Simin & Heidari, 2013). It has been observed that the application of new software, hardware and other digital tools is on the increase in teaching and learning in most universities in Nigeria. Students need CBT skills in their academic activities while at campus and off campus.

Technology has further enabled and encouraged interdisciplinary research in several institutions in the country and entire globe (Dwivedi et al., 2015; Ubale & Igomu, 2014). To establish and maintain high-quality standards, the Nigerian universities and the NUC have a shared responsibility in addressing the following key areas, according to scholars Abass, Olajide and Samuel (2017), Aremu, Jacob and Ogedebe (2015): minimum academic standards; accreditation; carrying capacity and admission quota and visitation; impact assessment; research and development; publications and research assessment; and structures, infrastructures and utilities.

Since the inception of universities in Nigeria, the conduct of examinations as well as the process of producing results has been fraught with various problems leading to inability to release results on time, inability of some students to get their results and several incomplete results. These problems have become embarrassing to the universities, with criticisms like delay in the release of examination results, failure to graduate undergraduate students since inception and many others (Ogunlade, Raphael, Elasela & Ogunlade, 2015). The problems associated with conventional methods in the university made the NUC recommend the introduction of management information systems to Nigerian universities in 1987 to alleviate the problem of data collection, information processing and storage in the universities (Chudi & Chudi, 2017; Tella & Bashorun, 2011). The urgent need for improvement led to the total adoption of technology into the university system. Increasingly, students are expected to be CBT literate and to learn and adopt this new skill, which will enhance their academic performance (Boevé, Meijer, Albers, Beetsma & Bosker, 2015). Computer and related technologies provide powerful tools to meet the new challenges of designing and implementing assessment methods that go beyond the conventional practices and facilitate a broader repertoire of cognitive skills and knowledge (Abubakar & Adebayo, 2014), from cell phones and texting to instant messaging on laptops, browsing the school web platform and so on.

The use of technology has become a tool to which students have adapted in enhancing smooth communication and learning between them and their teachers. Today's students require an education that incorporates their obvious technological prowess; teachers need to teach in a way that helps students find relevant information and materials (Hwang, Lai & Wang, 2015; Olson et al., 2011). The researcher observed that the use of digital technology in teaching and learning encouraged students to study outside the classroom at their own convenient time and pace. A study carried out by Adeoye, Oluwole and Loto (2013) in six randomly selected tertiary educational institutions in South West Nigeria showed that ICTs have significantly impacted on educational practice in Nigeria.

Earlier researchers, Akuegwu, Ntukidem, Ntukidem and Jaja (2011) and Ntukidem and Ashi (2009) stress that availability of ICT facilities and internet usage is significantly low for instructional service delivery in a study was carried out in universities in Akwa Ibom and Cross River States, Nigeria.

Also, the study by Ntukidem and Ashi (2009) maintains that persons with visual impairment have variously benefited from the use of electronic devices such as a screen reader, which an increasing number of blind or low vision computer users use to listen to textual materials that appear on their computer screen. The more popular screen readers are Windows and Job Access with Speech for Windows, both of which pass information to a Braille display or speech synthesiser.

As a way of curbing examination irregularities, in Aworanti's (2016) study, the scholar highlighted some examination bodies that have adopted e-examination for registering and assessing their candidates through an intranet medium. Among these are the Joint Admissions Matriculation Board, West African Examinations Council, National Examinations Council, National Business and Technical Examination Board, National Teachers' Institute and Teachers' Registration Council of Nigeria.

Although technology has pervaded the Nigerian higher institutions, it is still believed that there is still a long way to go in optimising the rapidly changing technological trends, especially as concerns the pace of lecturers coping with the trend (Pandeya & Tiwari, 2014; Ubale & Igomu, 2014; Bukar, Bello & Ibi, 2016). Pandeya and Tiwari (2014) pointed out the challenge of quality policy, maximum implementation of the policies and involvement of both public and private sector.

Bada, Adewole and Olalekan (2009) highlighted that the challenges of computer education are both educational and administrative. Prominent among the administrative problems, they say, is cost. The costs of installation, maintenance and replacement are unavoidable. This has been a deterrent to the adoption of computers for instruction in most Nigerian institutions. Coupled with this is the high price of software; it follows the same pattern as that for the hardware.

Temitayo, Adebisi and Alice (2013) viewed the challenges from the angle of administering examinations to students, asserting that the examination system used to have limitations which included inadequate measurability, near-reliability, lack of robustness, and inflexible timing mechanism that auto-logs off candidates on time expiration.

Technology encroachment in the Nigerian educational system may have been slow compared to developed countries, reasons for which abound. Some argue that "Nigerian factors" are largely

responsible for the slow ICT pickup pace in the country, while others maintain that our educators are fundamentally committed to the usage of crude teaching/instructional delivery methods. These problems have eaten deep and are still creating a very wide cognitive gap between the theoretical classes and what is obtainable in the teaching/learning industry.

2.5.1 CBT Skills and Their Influence on the Nigerian Academic System

Despite the introduction of technologies in Nigeria, frequency of use of these devices in the education sector in various universities has been a challenge in the campus due to challenges facing the usage of CBT due to regular power failures and insufficient available resources in the universities. There is limited research on the computer-based technology skills and academic performance of students in Nigerian universities. This review is premised on synthesising and critiquing past studies that relate to the core variables in this study.

Learning systems have seen some progress in the field of knowledge transfer. The 1980s witnessed the development in technology and in the introduction of affordable microcomputers into schools to teach programming. These computers have subsequently become useful tools for a wide range of functions. The need for computer skills became a concern due to the prevalence of computers and applications of technology in everyday activities.

Over a decade ago, Govender (2006) found that ICT is being used in education, but not to their full educational potential. Ozden (2011) added that computers were not fully integrated into conventional courses, though there was a boost in interest in computer-based technology because of the belief that education would need it.

Advances in computers and computer applications have had positive impacts on the educational sector as well as changing the nature of teaching and learning, including training delivery and performance assessment all over the world (Ogunlade & Oladimeji, 2014). Computer-based technologies have turned into a usual part of life, being used to send emails, write reports, manage finances or just to surf the web. It is said that computers and technology have made the world a global village, restructuring every aspect of human life and activities.

There has been a paradigm shift from the conventional classroom to blended learning, to Web 2.0 internet learning, to e-learning and to online learning (Ozden, 2011).

Nearly all fields have exploited the potential of these technologies for decades. Games and simulations, for instance, have been a central constituent of educating doctors, pilots and military personnel, which shows how effective these technologies are. Newer technologies used include multimedia distance learning expert systems, electronic support systems and training software applications (Klopfer, Osterweil, Groff & Haas, 2009).

Undoubtedly, without the introduction of these contemporary technologies in the transfer of knowledge, robust learning is attained, but there is a distinct disconnect in the experience of educating and evaluating students in schools with and without these technologies. It is paramount that education not only seeks to bridge this disconnection to make these two “divides” more coherent, but of course, also to take advantage of the adoption of these technologies for educational benefits.

2.6 Summary of Literature Reviewed

The literature reviewed assisted the researcher to put into perspective the subject under investigation: the availability of resources, frequency of use of applications, student and teacher perspectives on CBT skill level and CBT facilities and their effect on the academic performance of undergraduate students in federal universities in the South West Region of Nigeria. Most literature cited was in the form of journal articles, online resources and conference proceedings. It was evident that most of the reviews were conducted in developed nations of the world because of their technological advances, while some other studies with relevance to the Nigerian situation were also reviewed and incorporated into the study.

The cited researchers judged that undergraduate students are now more technology savvy, and teachers need to make rapid advances in technology in traditional education delivery to take in online modules such as Skype, CourseWeb, YouTube, email, Kahoot, Wikispaces and Bloglines. Education delivered with a blended approach in face-to-face traditional education has been seen as a means of improving computer technology relevance to the academic community. Adoption of computer-based applications in teaching and learning has been intensively researched, cutting across various stages of education and different methodologies adopted. This includes e-testing, e-examination, e-evaluation, e-teaching, e-learning, e-administration and e-library. As far as computer-based technology in education is concerned, many case studies exist about different

institutions' experience with adoption of computer-based technology in education. However, most of these studies have not really addressed the Nigerian education system, particularly the university system.

Computer-based technologies are now being adopted in universities in Nigeria in the area of blended approaches, and related literature reflects reasons such as time saving, getting more value from online services, teaching and learning, monitoring, recording how students use computer technologies, automatic and seamless access for teachers and cost recovery, improving efficiency of existing processes and enabling cost recovery on other services.

Computer-based technologies, as integrating blended learning into the traditional methods, are now being adopted in tertiary institutions in Nigeria. Literature in the area of ICT and CBT has recorded reasons such as time saving, accessing online materials, usage monitoring, automatic log on and access control, central control of passwords and smooth searching for students' assignments and studies and having group discussions via online forums like Moodle. It was also learnt from the literature that problems regarding use of computer-based technology in traditional methods persist in Nigerian universities due to the lack of stable electricity, inadequate CBT infrastructure, underfunding of universities and so on.

Adoption of computer-based technologies generally is influenced by various factors such as awareness, ability to develop knowledge more effectively, as well as to solve educational challenges associated with the usage of CBT, such as irregular electricity, lack of resources or infrastructural facilities in the campus, perceived cost, value-added services and personal innovativeness.

A need was found in the literature for evaluating the existing computer-based technologies in teaching and learning, particularly by students in the Nigerian university system. This is to ensure the functionality and performance evaluation of these systems. This study was assisted by literature as regards the style to adopt in conducting the survey of computer-based technologies used in Nigerian universities.

In light of the above, the present study concentrates on the influence of CBT factors on academic performance of undergraduate students in Nigerian universities. Its examine the knowledge gap

in the use of CBT to supplement and augment classroom-based learning and other necessary skill require on the use of CBT for effective academic performance of students. The next chapter will explain the theory and conceptual framework (WST model) for the current study.

CHAPTER THREE: **RESEARCH DESIGN AND METHODOLOGY**

3.1 Overview

The researcher has observed that when traditional face-to-face teaching and learning is supplemented with CBT there appears to be an enhancement in teaching and learning in our educational sector. This assertion was the inspiration for this research work, the purpose of which was to look at the usefulness of CBT in universities in Nigeria. With the importance of computer technologies in blended learning, the purpose of this study was to determine if correlations exist between CBT use and academic performance among undergraduate students in the selected Nigerian universities.

Research technique is an approach to enquiry which moves from the unknown to research design, and data collection Creswell and Creswell (2017). Hence, this chapter describes and explains the techniques or procedures used in this research according to the following sections: research design, research study area, population, sample size and sampling techniques, research instrument, reliability of the instruments, validity of the instruments, data analysis method and ethical considerations. Although the research is largely quantitative, focus group interviews were used to support the results of the quantitative analysis.

The quantitative component of this research used a correlational design. Previous studies emphasise that this kind of research involves the significance of the relationship that exists between two or more variables, and to what degree, with an attempt to determine an association (Brewer, Torrisi-Steele & Wang, 2015; Morgan & Hodge, 2015). This methodology was deemed suitable for this study because both dependent and independent variables were measurable and it was thus possible to investigate the relationship between them.

3.2 Research Design

This study adopted a descriptive survey research design according to Popoola (2012). Structured and well-planned research adheres to rules regarding the research design. Popoola explains that descriptive survey research design is plan of action using the systematic and scientific collection of data or information from the population or sample of the population for testing hypotheses and

giving responses to research questions. Scholars further explain that research design guides the researcher on how to combine data collection and analysis, and on how to interpret the results (Okite-Amughoro, 2017; Awodoyin, Osisanwo, Adetoro & Adeyemo, 2016; Granell & Ostermann, 2016).

This study used a mixed method design in order to combine and compare both quantitative and qualitative data. This approach was deemed appropriate for answering the research questions. When conducting mixed method research, quantitative and qualitative data are collected at different phases of the research procedure and then examined collectively (Bryman, 2017; Schoonenboom & Johnson, 2017, 2017; Molina-Azorín et al., 2015; Christensen & Johnson, 2010). Figure 3.1 below adapted from Creswell (2014) gives an overview of how the quantitative and qualitative results were combined and interpreted.

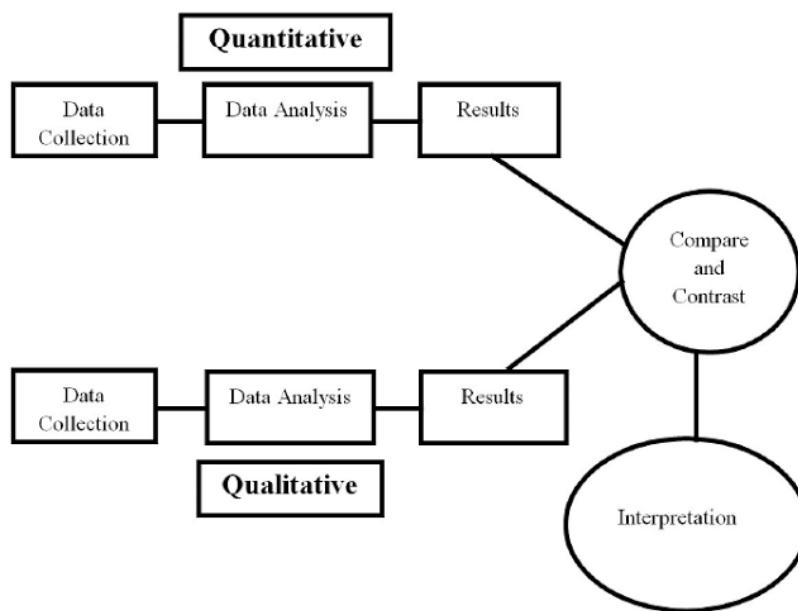


Figure 3.1: The mixed-methods research design used in this study (Creswell, 2014)

The quantitative component involved a structured Likert-scale questionnaire and statistical analysis, which provided data on how CBT affects students' academic performance in the classroom. The quantitative data obtained from the questionnaires were analysed using the Statistical Package for Social Sciences (SPSS) version 22 software to report results in terms of descriptive, correlation and inferential statistics.

The qualitative component used an open-ended focus group interview schedule. King, Horrocks and Brooks (2018) and Cohen et al. (2011) explain that a focus group interview is an interview bringing together participants to discuss a particular given theme or topic where the researcher acts as moderator in asking questions and the interaction with the groups leads to data gathering. The responses were coded and themed according to the theming method advised by Saldaña (2015) for large data sets. The themes, with supporting quotes, were used to support the results of the quantitative analysis by enabling the researcher to explore participant views and clarify responses to the questionnaire items.

3.3 Research Study Area

This current study was carried out in South West Nigeria. Nigeria is a large country with a land mass of 923,768 square kilometres and a population of 195 million. There are six states in the South West, namely Lagos, Oyo, Osun, Ondo, Ogun and Ekiti (Figure 3.2). It is largely a Yoruba speaking area with different dialects spoken within the same states. The South West region has the largest number of universities in Nigeria, with federal, state and private universities. The National University Commission under the umbrella of the federal government in Nigerian regulates transformation and innovation of quality university education in Nigeria together with National Policy on Education. According to the National Universities Commission (2018), there are 162 Nigerian Universities: Federal – 40; State – 47 and Private – 75 and each state in the country has a federal and state university.



Figure 3.2: Map of Nigeria showing Six States in South West Region

3.4 Population

McMillan and Schumacher (2010) identify a population as a group of people or objects, organisations or circumstances with the same features to which the researcher wishes to generalise the study findings. Nigeria has six geopolitical zones namely – South West, South South, South East, North West, North East and North Central. This study focused on the South West geopolitical zone, which was large enough to provide the data required for this study. There are six states in South West geopolitical zone, Oyo, Osun, Lagos, Ogun, Ondo and Ekiti. Therefore, the population comprises selected students in the federal universities in South West region in Nigeria. The following table shows the name of the six federal universities and dates of establishment with their website address in South West Nigeria (Table 3.1).

Table 3.1: Six Federal Universities in South West Nigeria

S/n	Name	Date Established	Website Source
1	University of Ibadan, Ibadan (UI)	1948	http://www.ui.edu.ng
2	Obafemi Awolowo University, Ile Ife (OAU)	1962	http://www.oauife.edu.ng
3	University of Lagos, Lagos (UNILAG)	1962	http://www.unilag.edu.ng
4	Federal University of Agriculture, Abeokuta (FUNAB)	1988	http://www.unaab.edu.ng
5	Federal University of Technology, Akure (FUTA)	1981	http://www.futa.edu.ng
6	Federal University Oye-Ekiti, Ekiti (FUOYE)	2011	http://www.fuoye.edu.ng

Source: NUC, 2017 – List of Nigerian Universities.

The targeted population consisted of 60,024 students from the six federal universities. The respondents in this study were undergraduate students from level 100 to level 400. Sampling was carried out on this population.

3.5 Sample Size and Sampling Techniques

The sample size was determined using a simple random technique of 5% of the total population and the researcher used purposive sampling. The purposive sampling method is a type of non-probability sampling where the researcher chooses the sample depending on certain conditions (Etikan, Musa & Alkassim, 2016; Palinkas et al., 2015; Babbie, 2010). Therefore, purposive random sampling was used to select 500 students from each university, making a total of 3,000 students. Three focus group interviews were also conducted at each university (eight to 10 respondents from each faculty) making 18 focus groups interviews conducted in total. Content management software was used for data handling and management. The questionnaire was administered to all undergraduate students from year 1 to 4 (level 100–400). The respondents were selected from three faculties in each of the federal universities for uniformity: The Faculties of Social Sciences and Natural Sciences; Science and Management Science; and Technology and Environmental Management.

The researcher also purposively selected eight to 10 voluntary participants from each respondent group in the three faculties in each university for the focus group interview. Therefore, the sample size screened and corrected for this study was 2,327.

Some years ago, Govender (2006) described the procedures in selecting a sample size as follows:

- For small populations (with fewer than 100 people), there is little point in sampling; therefore, one should survey the entire population.
- If the population size is around 500, one should sample at least 50% of the population.
- If the population size is around 1,500, then one should sample at least 20% of the population.
- Beyond a certain point (at about 5,000 or more), one should sample at least 400 or at least 5% to 10% of the population.

The researcher feels that the sample size for this study was truly representative because the sample was drawn from every faculty in each of the federal universities in the South West region (refer to Table 3.2).

Table 3.2: Questionnaires distributed to Faculties in selected campuses in Nigerian Universities, South West

University of Ibadan				
Name of Faculty	Questionnaires			
	Distributed	Not Returned	Spoiled	Coded
Social sciences	166	2	5	159
Science	167	9	6	152
Technology	167	6	2	159
Total	500	17	13	470
Obafemi Awolowo University Ile Ife, Osun State				
Social Sc./Administration	166	19	3	144
Science	167	12	4	151
Environ./Management	167	20	4	143
Total	500	51	11	438

University of Lagos				
Social sciences	167	57	4	106
Science	166	57	2	107
Environmental Science	167	54	2	111
Total	500	168	8	324
Federal University of Agriculture, Abeokuta, Ogun State				
Natural Science	166	36	3	127
Science	167	41	5	121
Environ. Management	167	30	2	135
Total	500	107	10	383
Federal University of Technology, Akure, Ondo State				
Social sciences	166	47	4	115
Management Tech	167	43	3	121
Environ. Technology	167	48	2	117
Total	500	138	9	353
Federal University, Oye, Ekiti State				
Social sciences	167	40	3	124
Science	167	45	3	119
Technology Engineering	166	49	1	116
Total	500	134	7	359
Sampled Coded for this study				2,327

3.6 Demographic Analysis

Descriptive statistics were used to calculate the socio-demographic and students' status variables, namely study school, gender, age, religion, marital status, home background, level of education, faculty of study and year of study. All these variables are known to influence CBT use, as discussed in the literature review. This analysis is explained and discussed in Chapter 5.

3.7 Data Sources and Research Ethics

This study used both primary and secondary data. According to Flynn and Korcuska (2018) and Kinyua (2014), primary data refers to the data that the researcher as an individual obtains from the field, whereas secondary data consists of existing information from external sources.

Such external sources could be magazines, libraries, the internet or e-books and archives. For the secondary data, this study surveyed articles, journals, theses, e-books and the internet, all of which have been fully referenced wherever cited. The primary data used was elicited from participants using a survey method (a self-administered questionnaire) and focus group interviews. The research ethics that guided the collection of primary data is discussed below.

An introductory letter giving permission for the researcher to conduct study in those universities was granted by the University of KwaZulu-Natal with the support of the researcher's supervisor. The researcher was approved from all the authorities in the six universities in the South West Nigeria (see Appendix C and E). An ethical clearance certificate was issued to the researcher after meeting the ethical requirements of the Research Ethics Committee of the University of KwaZulu-Natal, South Africa (reproduced on prelim page iv). Research assistants were involved from each university to help in the distribution and collection of the questionnaires, and during focus group interviews.

According to Silverman (2013) ethical decisions are the right of the participants to withdraw from the research at any times; protection of the participants; and obtaining consent from and causing no harm to the participants. A letter of participation was given to the participants to ascertain if they were interested and willing to participate. All participants showed their enthusiasm to participate in the research study and signed a consent letter. Anonymity was assured. The focus group interviewees also voluntarily agreed to participate in the interviews (Kim, Sefcik & Bradway, 2017). Participants were free to withdraw at any time without penalty.

3.8 Methods of Data Collection and Analysis

As explained above, the researcher used structured Likert-scale questionnaires for the survey. According to Christensen and Johnson, (2000) a questionnaire is a self-reporting data collection instrument that each research participant fills out. Thus, different variables can be measured using a questionnaire. The survey research method is dependable, cost-effective, extensive and flexible (Flynn & Korcuska, 2018). Questionnaires enable the participants to understand all the variables under investigation, which helps to ensure uniformity in the collection of data (Saunders et al., 2012).

Quantitative data was collected using a Likert-scale questionnaire; and qualitative data was collected using a semi-structured interview schedule. Therefore, this study depended on the use of a questionnaire appropriate for the research questions to be answered, and focus group interviews to support the quantitative results.

3.8.1 Quantitative Data Collection

Nardi (2018) and Creswell and Creswell (2017) explain that a questionnaire helps to generate quantifiable and standardised data that are ready for statistical analysis, which makes the processing of responses easier. The questionnaire was generated with items adapted from previous research (Govender, 2006; Kayode, 2016). The instruments that were used by these authors in their studies on “Information and Communications Technology (ICT) Integration in Teaching and Learning: A Critical Analysis” and “Computer-based Information System and Job performance of secretarial staff in Nigeria Universities” were guided by an extensive literature review. Content validation was based on literature and the statements used for the different constructs in their studies were subject to Cronbach’s Alpha to ensure reliability.

The elements comprise demographic and perceptual data. The elements were assessed and approved by the University of KwaZulu-Natal’s ethical clearance committee (see page iv). Out of 3,000 questionnaires distributed to all the participants, 2,385 (79.5%) were retrieved, 615 (20.5%) questionnaires were not returned and 58 (1.93%) were spoiled and could not be used for the study. Thus, 2,327 (77.5%) instruments from all the six universities in South West in Nigeria were used for analysis in this current study.

The questionnaire (Appendix A1) consists of 21 Likert-scale items that addressed all the variables in the current research. The questionnaire was constructed from extensive research on the applicable literature. Specific constructs that would aid in answering the research questions were used as explained. The questionnaire was divided into seven sections. Section A: Socio-demographic characteristics, Section B: Students’ status and grades (CGPA), Section C: Availability/campus CBT resources, Section D: Frequency of use of CBT, Section E: CBT skill level, Section F: CBT students’ willingness, Section G: Students’ CBT proficiency. An explanation for the inclusion of each Likert-scale item is provided below.

Section A: Socio-demographic characteristics: Six items were used in this section. Although these variables were not used directly to answer the research questions, it was deemed important to describe and confirm the representability of the sample.

Section B: Students' status and grades (CGPA): Six items were used in this section to collect data on student's status and grades. Participant academic performance was done by adding their first semester grade with the second semester to provide their cumulative grade point assessment (CGPA).

Section C: Availability/campus CBT resources: Five items were used in this section. The items were included to determine whether there were sufficient computer and internet facilities or infrastructure on the campus, and also to find out if the students had regular access for their learning. These were coded as (Availabva and CBResources).

Section D: Frequency of use of CBT: One item with 19 sub-times was used in this section. These items asked students to indicate how often they used computers for their studies. The researcher also wanted to ascertain the availability of and access to computers in the universities. This data was coded as (CBTFreqUsage).

Section E: CBT skill level: One item with 17 sub-times was used in this section. Six core skills that were coded as (Core-Skill level). These were:

- General computer use;
- Email;
- Word processing;
- Spreadsheets;
- Internet use to retrieve information; and
- Synchronous and asynchronous chat.

Section F: CBT students' willingness: One item with 9 sub-items was used in this section. As noted in the literature review, there is a strong correlation between technology availability and willingness of students to use the technology (Kintu, Zhu & Kagambe, 2017; Kokolakis, 2017; McKnight et. al., 2016).

According to Olatokun (2017), an investigation of the situation in Nigeria regarding availability and accessibility of technology in the education systems is necessary. Hence Section F was used to determine how regularly the participants accessed computers and their readiness to do so. It was coded as (CBTwillingness).

Section G: Students' CBT proficiency: One item with 11 sub-items was used in this section. Students' CBT Proficiency was coded as (Proficiency).

3.8.2 Quantitative Data Analysis

The data collected were analysed using descriptive and inferential statistics. This study used SPSS version 20 for the primary quantitative data analysis as the researcher wished to identify variables that correlate, and the strength of that correlation. According to Diamantopoulos and Schlegelmilch (2000) the SPSS package is accessible and can perform many types of statistical analyses, making the results easy to interpret and represent in tables and graphs for a research report. Alharbi (2014) stresses that thorough cleaning of data collected from the respondents will assist the researcher during data capture, by identifying any missing values.

The data was first entered into Microsoft Excel and imported to SPSS. Variable data in socio-demographic information uses descriptive statistics tools such as frequency, percentages, pie-chart and bar chart to present the general descriptions of the data. Research questions 1–3 were analysed using descriptive statistics such as frequency counts and percentages to explain some research questions.

Inferential statistics like PPMC were also used to test the research question 4 at a 0.01 or a 0.05 level of significance. The Cronbach's reliability coefficients for elements 13, 17, 18, 19 and 20 were: Availability of CBT resources = .836; campus CBT resources = .709; CBT frequency use = .925; Students' skill level = .850; and CBT Willingness on academic performance = .898

3.8.3 Qualitative Data Collection

Based on the large-scale quantitative method used, it was necessary also to use a qualitative data collection method to support the quantitative results.

Okeke and Van Wyk (2015) agree that a focus group interview is appropriate for collecting data from a group of people with the same characteristics. The researcher formulated 10 items from the research questions to be used for the focus groups interviews. According to Krueger (2002) six to 10 participants for the focus group can be used for the interview. Hence, in this study, eight to 10 students were randomly selected from three faculties in each of the universities. The following open-ended questions were posed during the interviews (see Appendix B1).

Question 1: *Do you consider the CBT resources (tools) adequate on your campus and why?* The question was intended to find out availability of CBT infrastructure inside the classroom and campus generally. The responses helped to determine if the participants had completed the questions in the questionnaire properly, especially those related to the usage of CBT.

The question also intended to find out from the participants the quality and sufficiency of CBT infrastructure on their campus and, if inadequate, what contributed to it.

Question 2: *Do you foresee any problems with the accessibility of these CBT resources on your campuses?* The reason for this question was to give an opportunity to the participants to reveal if they had access to the use of CBT resources in their campus, or during classroom lectures, and also intended to confirm whether they had understood the questions in the questionnaire.

The question verified whether the participants were allowed to use CBT resources on their campus, and how much access they had to these resources. If not allowed why was this? This prepared the students for the next questions that asked them to enumerate/highlight the problems associated with the accessibility of these resources on their campus.

Question 3: *What are the problems with the frequency or accessibility of these CBT resources on your campus and why do you think this is so?* This question intended to find out the possible problems in accessing and using CBT resources on campus, and to determine whether the problems were internal or external.

Question 4: *What can be done to improve accessibility to these CBT resources in the campus?*

This question was to obtain suggestions and solutions to the frequency of use or accessibility of CBT resources on the campus. The highlighted problems can then be critically examined and channelled to the appropriate quarters so that solutions can be found.

Question 5: *What do you think is your CBT skill level and does it contribute to your academic achievement and how?* The question was intended find out the participants' CBT skills level and whether these skills have contributed to their academic performance. The question was also intended to discover the proficiency of the participants in the use of CBT, and to determine the extent of `their knowledge of CBT. This would help to determine what they most need. It would also help to motivate the students in the use of CBT. It was also meant to find out if CBT contributed to their learning in a positive way or negative way.

Question 6: *Did you have prior knowledge/engagement of CBT before your admission for your studies at university?* The question was intended to find out from the participants whether they had learnt, and had been using, CBT before they gained admission to their universities. The question would also help to determine the CBT skill level of the students before they gained admission to their university.

Question 7: *Did this prior engagement/knowledge of CBT affect your studies in any way? How?* This question intended to find out if the participant's knowledge of and/or engagement with CBT had helped them in any way in their studies, and how it had contributed to their academic performance. For those who had prior knowledge, it would be revealed from the answer if the knowledge actually positively or negatively affected their learning. It would also make known the degree of their understanding of CBT. For those who have no prior knowledge, it would reveal if they have any regrets about not having prior knowledge, or not, and had it affected their academic performance.

Question 8: *Do you observe the usage of CBT among the lecturers during their teaching and do you feel it is adequate?* The question was intended to ascertain the usage of CBT by lecturers in their teaching, and also whether the use of CBT by these lecturers was adequate. This question was also intended to explore the lecturers' knowledge of CBT, and how well they use it, as this would influence the attitudes of the students to CBT.

Question 9: *What is your own perception about the students' integration of CBT in their studies?*

The question was intended to verify the participants' ability to incorporate CBT in their studies. This question also attempted to ascertain students' acceptance of CBT in their studies. This helped to determine if the students have embraced the use of CBT, or whether they need this skill, and whether it is beneficial to them in any way.

Question 10: *What are the motivating factors that encourage you to develop CBT skills while on campus and do you see any impact on your academic performance?* The purpose of this question was to find out what made or encouraged the participants to acquire CBT skills while on campus. It was also to discover if there was any impact of CBT skill on their academic performance. This will also reveal if the students see any need to use CBT. Is it of any interest to them in any way? Is it of any use to them? What interests them about the use of CBT? Do they see it as a challenge, especially based on the problems confronting the use of these resources on their campuses? Then, do they feel the knowledge has benefited them in their studies.

3.8.4 Qualitative Data Analysis

Focus groups are a type of qualitative data collection tool using questions to prompt discussion among the participants; while the researcher guides the discussion and keeps an audio or video record (Barbour, 2009). With the consent of participants, the researcher used audio to record the discussions. The recordings were subsequently transcribed and analysed according to Saldaña, (2015). The present study used the themes to support the quantitative data.

3.9 Reliability of the Instruments

Reliability has to do with the consistency and dependability of the instrument and the extent to which the instrument measures what it is supposed to measure (Alharbi, 2014). Gliem and Gliem (2003) provide the following values for Cronbach's Alpha coefficient reliability scales (Table 3.3).

Table 3.3: Cronbach's Alpha coefficient reliability scales

S/N	Alpha Coefficient Range	Strength of Scale
1	>0.9	Excellent
2	>0.8	Good
3	>0.7	Acceptable
4	> 0.6	Questionable
5	>0.5	Poor
6	<0.5	Unacceptable

Source: Gliem and Gliem (2003)

The reliability of the Likert-scale questionnaire was tested by calculating the Cronbach Alpha coefficient for the survey data collected. This was done by calculating internal consistency and reliability coefficient values for each section (Table 3.4). These results affirm the reliability of the items used in the questionnaire.

Table 3.4: Reliability coefficient values for each section of the questionnaire used in this study

Section	Variables	Number of Items	Reliability (Cronbach's Alpha Value)
C ₁	Availability of CBT resources	10	0.836
C ₂	Campus CBT resources	4	0.709
D	Frequency Use of CBT	19	0.925
E.	CBT skill level	17	0.850
F	CBT students' willingness	9	0.898
G.	Students' CBT competency	11	0.782

Source: Researcher's computerised records

3.10 Validity/Methodological Norms

According to Bryman (2012), validity in qualitative research is related to the authenticity of the findings of the study and the conclusions made from the work.

The validity of the questionnaire was checked through face and content validation. Face validity tests whether the statements in the questionnaire do relate to what they are supposed to measure. Adequacy tests, whether a scale or measure, conform with the intended content. It is also the extent to which the elements within a measuring instrument are relevant and representative of the construct that they will be used to measure.

The researcher used the period between October 2016 and February 2017 (five months) for the collection of data in both quantitative and qualitative procedures. All the research procedures were documented and an in-depth methodological description was written that reviewed the integrity of this study. As recommended by Merriam (1998), these ‘audit trails’ were kept through detailed accounts of methods, procedures and reasons for decisions.

3.11 Conclusion

This chapter detailed the research design and methodology adopted for this study, as well as reasons for the choices made. This included sampling, data sources, data collection and analysis procedures and instruments, as well as issues around ethics, validity and reliability. The next chapter (Chapter 4) deals with the guiding theory of the study and the conceptual framework.

CHAPTER FOUR: THEORY AND CONCEPTUAL FRAMEWORK

4.1 Introduction

The word theory has various meanings depending on its context. In everyday usage it has come to mean a speculation or opinion, sometimes not fact based. In the natural sciences it means an explanation that is strongly supported by empirical evidence. In the social sciences, it is associated with the paradigms and perspectives that organise research (Creswell, 2014). It seems that “being theoretical” is akin to “being certain”; is there room for uncertainty? These paradigms are human constructs; they help to define the stance taken towards the main principles of ontology, ethics, epistemology and methodology. In contrast, a perspective is less solidified or unified but can share elements of a paradigm (Alexander, 2017; Saldaña, 2015). In this context, both signify an approach that the researcher uses to plan, carry out and discuss a piece of research. Therefore, as Mai (2016) argues, the grand theory that underpins the work is already and unavoidably in place; it affects early choices and decisions and grows organically with the project.

Ugulube et al. (2015) add that a conceptual framework, which is simply a less developed form of a theory, consists of statements that link abstract concepts to empirical data. Theories and conceptual frameworks are developed to account for or describe abstract phenomena that occur under similar conditions.

By connecting theory with practice, they make the link that many researchers often overlook, but which Lewin expressed succinctly: ‘There is nothing as practical as a good theory’ (Barth, 2017; Avison & Malaurent, 2016). They argue that conceptual frameworks serve a particular purpose: ‘Generalisations are made on the basis of the particular data that have been observed and are tied to a conceptual framework which then leads to the elucidation of further research questions and implications for additional study’ (Brannen, 2017; Yanow & Schwartz-Shea, 2015).

The researcher has selected to apply the WST model in the current study due to its relevance to the research questions.

The WST conceptual framework can be used to describe Will (positive attitudes), Skill (competency in technology) and Tool (technological tools access), which are all crucial prerequisites for the use of technology in the classroom by both teachers and students.

Furthermore, this study uses descriptive theory derived from the WST model of Knezek and Christensen (2016). Much recent research in educational technology has used the WST model to study technology integration and its impact on students' performance (Niederhauser & Lindstrom, 2018; Knezek & Christensen, 2016; Knezek et al., 2000).

The WST model is often used to inform tutors on how to employ ICT in the classroom (Knezek & Christensen, 2016; Petko, 2012). However, this study sought to reveal the relevance of the WST tools according to student participants. While various studies have assessed the link between the WST model of technology integration and academic performance of students (Knezek, Christensen, Hancock & Shoho, 2000) they suggest that enhancing an educator in using WST in technological tools leads to greater phases of classroom technology integration, which in turn leads to positive academic performance. Tarhini, Hone and Liu (2015) and Knezek et al. (2016) agree that enhancing an educator's will, skill and access to technology tools improves classroom technology adoption, which eventually leads to greater student achievement. However, the WST model was specifically chosen for this study because it can be applied to both teachers and students, the latter being the unit of analysis in this study.

In this study, this model was used to explain findings with regard to willingness (Will); the competence of students in using technology (Skill); the infrastructure available for the use of CBT (Tool); and the relationship of these factors to academic performance. The questionnaire items were based on, and adapted from, the WST model as shown in Table 4.1 below:

Table 4.1: Conceptual Models

WST model item(s)	Modified Model Item(s)	Support Theories (Modified Model)
Will	Teachers, Students and Supported staff	Bandera 1977; Davis 1989; Ajzen 1991
Skill	Educators Preparation and Development	Ajzen 1991; Fishbein and Ajzen 1975
Tool	Infrastructure for Technology	Venkatesh et al. 2003; Thompson et al. 1991
Technology Integration	Teaching and Learning	Davis 1989; Venkatesh et. al 2003

WST model item(s)	Modified Model Item(s)	Support Theories (Modified Model)
Academic Performance	Campus-based Academic Performance	Eisenhardt 1989

4.2 Conceptual Framework

The conceptual framework provided a lens through which the variables of this research study could be examined. Therefore, this section supports the use of the WST model as a conceptual framework to examine the academic performance of students using computer-based technology. These independent variables examined in this study were: availability of computer-based technology; frequency of use of computer-based technology; and level of computer-based technology skill.

The dependent variable examined in this study was the academic performance of students in the sampled Nigerian universities. These variables and their relationship to the WST model are shown in Figure 4.2A and 4.2B.

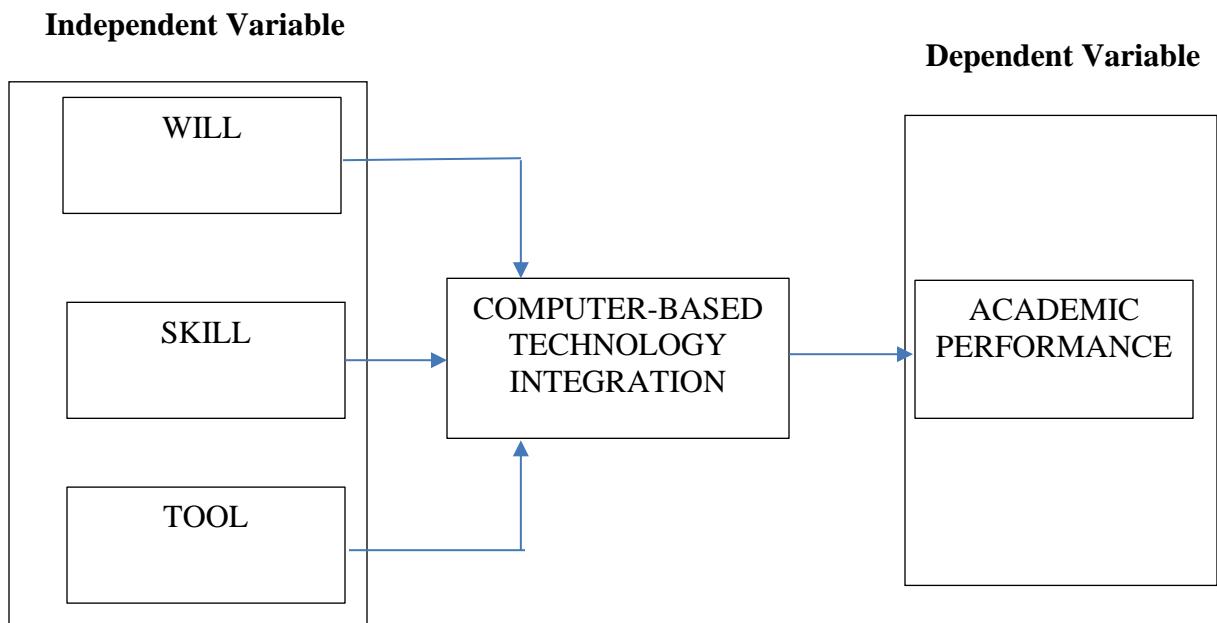


Figure 4.2A: The WST Model of CBT Integration

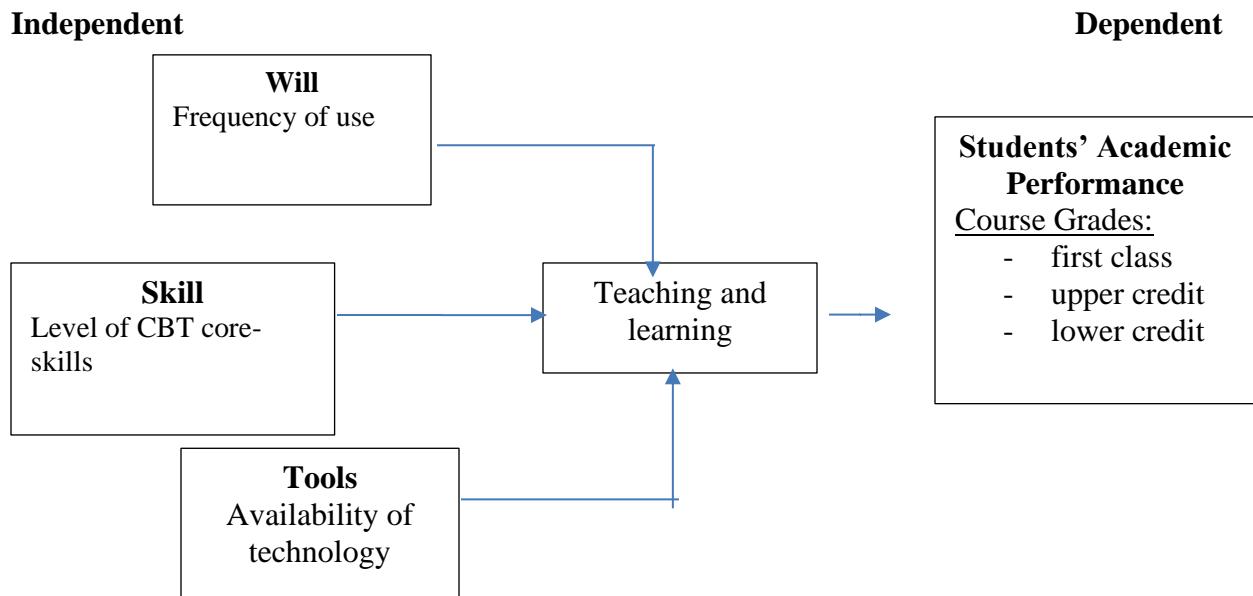


Figure 4.2B: The WST model as applied in this study

The WST conceptual model as applied in this study shows the three independent variables and how they interrelate to influence the dependent variable.

Will is the willingness of students to integrate technology into the academic exercise that can lead to, or affect, academic performance. Blended learning enables the learners to build their own understanding of new ideas with personal effort by using CBT in their learning. Therefore, rather than teachers conveying knowledge to students, they are expected to be a guide, a facilitator, and a co-explorer who encourages learners in the use of CBT in order to allow them to question, challenge and express their own ideas and opinions, participate in online group discussion, and follow up their classwork assignment using CBT. Supportive technical staff should also be available to assist the students.

Skill is the computer literacy skills that form the fundamental knowledge and basic ability to use CBT resources in the everyday life. Tarhini, Arachchilage and Abbasi (2015) regard CBT skill as preparation and development, including students' prior knowledge and abilities, which that can be applied to technological integration and affect academic performance.

Also, a high skill level and positive attitude towards the use of CBT is likely to influence the learner's computer skills; with a highly skilled teacher as facilitator, the learners should, in turn, perceive learning as attractive and interesting through the use of CBT.

Tools are the availability of hardware, software and competent educators. The recognition of how the use of CBT in face-to-face classroom lectures improves education, has proved to be one of the most essential developments in modern education, and has helped to enable students to learn anywhere, at any time.

Availability of tools, frequency of use of CBT applications and the integration of CBT into teaching and learning (i.e., blended learning) are factors that increase and enhance to use of CBT and students' academic performance (Zuljan & Vogrinc, 2010). Gerald and Rhonda (2015) explain that Will is defined as a positive attitude to the adoption and usage of technology in instruction and training; Skill as the self-perceived confidence and willingness to use technology; Tool is connected to the availability and use of technology; and integration is a self-perceived level of technology acceptance for educational purposes.

The WST model indicates that the critical predictors for a high level of CBT adoption are a positive attitude on the part of the teacher towards the use of technology in the classroom, good skills in operating the technological tools and its fields of application, and sufficient access to the devices or gadgets. Bolarinwa (2015) and Petko (2012) argue that the validity of the model can be tested through the use of a questionnaire with relevant questions to ascertain the quality and quantity of ICT used.

Several studies have based their rationale on the WST model (Christensen & Knezek, 2017; Knezek & Christensen 2016). These authors saw the explanatory variable "readiness in the use of digital technology" as one of the "will variables". In these studies, willingness was defined as students' personal beliefs concerning the use of ICT. Other variables used in these studies included "tool variables" such as ICT resources and applications; and "skill variables" such as students' abilities to integrate ICT into their learning.

There are six stages of adoption that a teacher or student passes through in the process of developing towards an understanding of the integration of ICT in the classroom.

The stages include being aware of the technology, learning to use the technology, understanding the application of the technology, developing confidence in using the technology, adapting the technology to other contexts, and, lastly, being able to make decisions to use the technology if and when required to do so.

The WST model involves all the factors to be investigated to answer the research questions for the current study. Most of the studies cited above emphasise that, in order for ICT integration to be realised in schools, teachers and students need adequate tools, appropriate technological skills and a willingness to use the tools in their teaching and learning.

The model covers all the factors investigated in this study. In the researcher's view, therefore, the model can be used to determine the level of students' competence and skill needed for their use of CBT for educational purposes and to enhance their academic performance.

The model was also seen as appropriate for Nigerian institutions where blended learning is still facing challenges in terms of unstable electricity, lack of infrastructural facilities, inadequate computer hardware and software, underfunding and inadequate supply of modern technologies in the classroom. These and many other challenges are the major drawbacks in the development of new skills in CBT in students' education in Nigerian universities.

4.3 Conclusion

This research study is informed by the WST model (Ledbetter & Finn, 2016; Christensen, et al., 2011; Knezek, et al., 2010). The WST model was developed specifically to study how teachers impart skills to students, and clearly explains conditions under which tutors are most likely to integrate ICT in the classroom (Instefjord & Munthe, 2017; Knezek & Christensen, 2016; Petko, 2017).

The current study examined the performance of students who use CBT in their learning in the selected Nigerian universities. The WST model was used as conceptual framework for the interpretation of the findings of this study.

The next chapter discusses socio-demographic characteristics of the sample.

CHAPTER FIVE: DISCUSSION OF SOCIO-DEMOGRAPHIC DATA

5.1 Introduction

This chapter describes the participants in this study in terms of the following selected socio-demographic variables: gender, age, religion, marital status, home background, entry level of education, faculty of study, and year of study (see Appendix A1). These particular variables were collected and analysed based on reports in the literature that such variables do affect the adoption and use of CBT. The analysis of this demographic data as discussed below, support the researcher's assertion that the sample was representative of the broader student population from which the sample was drawn. Although these variables were not used directly to answer the research questions, it was deemed important to describe and confirm the representability of the sample.

5.2 Respondents by Gender

Data was collected on gender, which is the first variable. This was to help the researcher determine the disparity on the frequency of ratio males to females that participated in the survey, as gender does affect the use of CBT, as claimed by some scholars (Appianing & Van Eck, 2015; Adamus et. al., 2009; Laosethakul, et al., 2010).

Table 5.1: Distribution of respondents by gender for each university in the study

Variables Sex	Universities										Total Response	Total %		
	UI		UNILAG		OAU		FUNAB		FUTA		FUOYE			
	Freq (n=470)	% (100)	Freq (n = 324)	% (100)	Freq (n = 438)	% (100)	Freq (n = 383)	% (100)	Freq (n = 353)	% (100)	Freq (n = 359)	% (100)		
Female	194	41.3	155	47.8	196	44.7	209	54.6	221	62.6	210	58.5	1185	50.9
Male	276	58.7	169	52.2	242	55.3	174	45.4	132	37.4	149	41.5	1142	49.1
Total	470	100.0	324	100.0	438	100.0	383	100.0	353	100.0	359	100.0	2327	100

Table 5.2: Distribution of respondents by gender for all universities in the study

Gender	Frequency	Percentage (%)
Female	1185	50.9
Male	1142	49.1
Total	2327	100.0

The tables above show the distribution of respondents by gender. The findings reveal that male students are slightly more numerous (2%) than females. This shows that there is not much difference in the use of CBT for learning between the sexes. There is an increased participation of

the use of CBT with face-to-face learning by females. This result, although minor, is in contradiction to other research on the disparity between sexes in the usage of CBT. According to Adamus et al. (2009) the use of computers and the internet have been traditionally associated with men, and that men are more prone to use the computer than women. In addition, other scholars (Appianing & Van Eck 2015; Laosethakul & Leingpibul, 2010; Wentling, 2009; and Laosethakul et al., 2010) found that females found the use of CBT boring and male dominated, which may affect their tendency to use computers. Moreover, Venkatesh, Croteau and Rabah (2014) supported the view of CBT as male dominated, and also found that females are less likely to use CBT because they perceive it as a male-dominated activity even when given equal access with their male counterparts. Meanwhile, Chambers and Schreiber, (2004) in another view of the achievement gap between males and females, found that females showed improved performance over males in their learning when they used CBT. The present study reveals that females were interested and willing to use CBT with their traditional education.

5.3 Respondents by Age

As the age of the individual increases it usually affects the various developmental changes and subsequently affects every area of human performance. Studies have revealed that age has an influence on the adoption of technology (Wang, 2004). It was, therefore, necessary to determine the distribution of the respondents' ages, which is a factor that could also contribute towards computer integration.

Table 5.3: Distribution of respondents by age for each university in the study

Variables	Universities												Total response	Total %	
	UI		UNILAG		OAU		FUNAB		FUTA		FUOYE				
Age	Freq (n=470)	% (100)	Freq (n = 324)	% (100)	Freq (n = 438)	% (100)	Freq (n =383)	% (100)	Freq (n = 353)	% (100)	Freq (n = 359)	% (100)			
16 – 20yrs	190	40.4	91	28.1	210	47.9	148	38.6	188	53.3	190	52.9	1017	43.7	
21 – 25yrs	198	42.1	182	56.2	206	4.7	194	50.7	146	41.3	142	39.6	1068	45.9	
26 – 30	71	15.1	46	14.2	21	4.8	40	10.4	19	5.4	25	7.0	222	9.5	
31 – 35	9	1.9	3	.9	1	.2	1	3	-	-	2	.6	16	0.7	
Above 35	2	.4	2	.6	-	-	-	-	-	-	-	-	4	0.2	
Total	470	100.0	324	100.0	438	100.0	383	100	353	100.0	359	100.0	2327	100	

Table 5.4: Distribution of respondents by age for all universities in the study

Age	Frequency	Percentage (%)
16-20 years	1017	43.7
21-25 years	1068	45.9
26-30 years	222	9.5
31-35 years	16	0.7
Above 35 years	4	0.2
Total	2327	100

The tables above show the distribution of respondents by age. Forty-four percent of the respondents were in the age bracket of 16 to 20 years; 46% were in the age bracket of 21 to 25; 10% were within the age bracket of 26 to 30; one percent were within the bracket of 31 to 35 and less than 1% (0.2%) were above 35 years. The data revealed that the majority of the participants fell between the age brackets of 16 to 25. Less than 11% of the respondents were above 25 years. The reason for the large participation of respondents between 16 to 25 years is that the study was carried out among students in the university. This indicates that a majority of the students in the university are within the same age bracket. Perhaps the participation of more young students in the study is an indication that young students are more likely to be knowledgeable in the use of CBT. On the other hand, the difference may also indicate that in most schools, the majority of the students are young, which is a positive factor towards adoption and use of CBT.

5.4 Respondents by marital status

Data collected on marital status was necessary to know the usage of CBT across different marital statuses, particularly the single and the married.

Table 5.5: Distribution of respondents by marital status for each university in in the study

Variables	Universities										Total Resp.	Total %		
	UI		UNILAG		OAU		FUNAB		FUTA		FUOYE			
	Freq(n= 470)	% (100)	Freq (n = 324)	% (100)	Freq (n = 438)	% (100)	Freq (n = 383)	% (100)	Freq (n = 353)	% (100)	Freq (n = 359)	% (100)		
Married	30	6.4	17	5.2	9	2.1	10	2.6	6	1.7	2	6	74	3.2
Single	432	91.9	304	93.8	422	96.3	370	96.6	345	97.7	349	97.2	2222	95.5
Never Married	5	1.1	3	9	6	1.4	3	.8	2	.6	7	3	26	1.1
Divorced	3	.6	-	-	1	.2	-	-	-	-	1	.3	5	0.2
Total	470	100.0	324	100.0		100.0	383	100.0	359	100	359	100	2327	

Table 5.6: Distribution of respondents by marital status for all universities in the study

Marital Status	Frequency	Percentage (%)
Married	74	3.2
Single	2222	95.5
Divorced	5	0.2
Never married	26	1.1
Total	2327	100

The tables above show the distribution of respondents by marital status. The table reveals that 3% of the respondents were married; 96% were single; less than 1% divorced and 1% never married. The reason for the majority of the respondents being single is that data were collected from undergraduates. It is expected that many of them are single. Being single as an undergraduate is important to help them avoid distractions and concentrate on their studies.

5.5 Respondents by Background

As discussed in the literature review, home background does influence the level of skill of students and their academic performance. The distribution of the demographic factor, was therefore, important for sample description.

Table 5.7: Distribution of respondents by background status for each university in the study

Variables	Universities											Total respon dents	Total %		
Background	UI		UNILAG		OAU		FUNAB		FUTA		FUOYE				
	Freq (n= 470)	% (100)	Freq (n = 324)	% (100)	Freq (n = 438)	% (100)	Freq (n = 383)	% (100)	Freq (n = 353)	% (100)	Freq (n = 359)	% (100)			
Rural	57	12.1	35	10.8	31	7.1	38	9.9	62	17.6	83	23.1	306	13.1	
Urban	347	73.8	234	72.2	294	67.1	272	71.0	247	70.0	223	62.1	1617	69.5	
Semi-urban	66	14.0	55	17.0	113	25.8	73	19.1	44	12.5	53	14.8	404	17.4	
Total	470	100.0	324	100.0	438	100.0	383	100.0	353	100.0	359	100.0	2327	100	

Table 5.8: Distribution of respondents by background status for all universities in the study

Home Background	Frequency	Percentage (%)
Rural	306	13.1
Urban	1617	69.5
Semi-Urban	404	17.4
Total	2327	100

The tables above show the distribution of respondents by home background. The majority of the respondents, about 70%, lived in urban areas; 13% were from rural areas, while 17% were from semi-urban areas. The majority of the respondents lived in the city. Only three out of 10 of the respondents lived in semi urban and rural areas. The areas in which they lived and were raised can affect their exposure to and use of CBT. Many studies agree that there is relationship between the educational, economic and social background of parents and students' academic performance. Most students that came from poor and low socio-economic backgrounds encountered family stress during their studies (Abdu-Raheem, 2015; Mekonen, Fekadu & Workie, 2017; Nwokeyen, 2015). The researcher observed that most students from urban areas enjoyed greater access to CBT facilities, and were exposed to new technologies. This was in contrast to students from rural and semi-urban backgrounds.

5.6 Respondents by Prior Level of Education

It has been shown in many studies that previous qualification or students' prior level of education before admission into the university has a positive correlation with their academic performance (Abdullah & Mirza, 2018; Goga, Kuyoro & Goga 2015; Wambugu & Emeke, 2013). The data on this variable is shown below.

Table 5.9: Distribution of respondents by prior qualification for each university in the study

Variables	Universities										Total response	Total %		
	UI		UNILAG		OAU		FUNAB		FUTA		FUOYE			
Prior qualification	Freq (n = 470)	% (100)	Freq (n = 324)	% (100)	Freq (n = 438)	% (100)	Freq (n = 383)	% (100)	Freq (n = 353)	% (100)	Freq (n = 359)	% (100)		
O level	266	56.6	146	45.1	264	60.3	251	65.5	294	83.3	303	84.4	1524	65.5
A level	102	21.7	70	21.6	67	15.3	75	19.6	40	11.3	39	10.9	393	16.9
OND	58	12.3	64	19.8	60	13.7	57	14.9	19	5.4	13	3.6	271	11.6
NCE	44	9.4	44	13.6	47	10.7	-	-	-	-	4	1.1	139	6.0
Total	470	100.0	324	100.0	438	100.0	383	100.0	353	100.0	359	100.0	2327	100

Table 5.10: Distribution of respondents by prior qualification for all Universities in the study

Prior Qualification	Frequency	Percentage (%)
O Level	1524	65.5
A Level	393	16.9
OND	271	11.6
NCE	139	6.0
Total	2327	100

The tables above show the distribution of respondents by entry level of education. About 66% of the participants were admitted into the institutions through their O Level or Unified Tertiary Matriculation Examination (UTME); 17 % gained admission through A Level, i.e., Direct Entry, which means that they began their university education from Level 200, unlike those who came in through O Level and started from Level 100. About 12% of the respondents entered the university

with the Ordinary National Diploma Certificate, which is also in the Direct Entry category. However, they had been in a polytechnic before proceeding to the university, while 6% came in with an NCE. The majority of the students entered through UTME or A Level. Other forms of entry aside from the UTME are less than 40%.

5.7 Respondents by Faculty of Study

The tables below show the distribution of respondents by faculty of study. The table indicates that 34% of respondents were from the faculty of Social/Natural Science; 33% were from Management Science; and 33% were from Technology/Environmental Management. This shows that there was a fair distribution and collection of data from respondents across the various faculties of study. No faculty was over or under represented.

Table 5.11 Distribution of respondents by faculty of study for each university in the study

Variables	Universities										Total Respons	Total %		
Faculty of Study	UI		UNILAG		OAU		FUNAB		FUTA		FUOYE			
	Freq (n = 470)	% (100)	Freq (n = 324)	% (100)	Freq (n = 438)	% (100)	Freq (n = 383)	% (100)	Freq (n = 353)	% (100)	Freq (n = 359)	% (100)		
Social/ Natural Science	159	33.8	106	32.7	144	32.9	127	33.2	115	32.6	133	37.0	784	33.7
Mgt. Science	152	32.3	107	33.0	151	34.5	121	31.6	121	34.3	115	32.0	767	33.0
Tech/Envr .	159	33.8	111	34.3	143	32.6	135	35.2	117	33.1	111	30.9	776	33.3
Total	470	100.0	324	100.0	438	100.0	383	100.0	353	100.0	359	100.0	2327	100

Table 5.12: Distribution of respondents by faculty of study for all Universities in the study

Faculty of Study	Frequency	Percentage (%)
Social Science/Natural Science	784	33.7
Management Science	767	33.0
Technology/Envr. Management	776	33.3
Total	2327	100

5.8 Respondents by Year of Study

Table 5.14 shows the distribution of respondents by year of study. The table reveals that about 23% of the respondents were from 100 level; 25% were selected from 200 level; 26% were selected from 300 level while 27% were selected from 400 level. There was a fair representation of the various levels within the sample. No level was under- or over-represented. The data were evenly distributed and collected among the participants in the various levels. And this shows that the participants from various levels of study have equal chance to contribute to the data.

Table 5.13: Distribution of respondents by year of study for each university in the study

Variables	Universities											Total response	Total %	
	UI		UNILAG		OAU		FUNAB		FUTA		FUOYE			
Year of Study	Freq (n= 470)	%	Freq (n = 324)	%	Freq (n = 438)	%	Freq (n = 383)	%	Freq (n = 353)	%	Freq (n = 359)	% (100)		
100 Level	112	23.8	66	20.4	101	23.1	84	21.9	81	22.9	89	24.8	533	22.9
200 Level	118	25.1	73	22.5	106	24.2	107	27.9	95	26.9	86	24.0	585	25.1
300 Level	117	24.9	82	25.3	122	27.9	95	24.8	86	24.4	91	25.3	593	25.5
400 Level	123	26.2	103	31.8	109	24.9	97	25.3	91	25.8	93	25.9	616	26.5
Total	470	100.0	324	100.0	438	100.0	383	100.0	353	100.0	359	100.0	2327	100

Table 5.14: Distribution of respondents by year of study for all Universities in the study

Year of study	Frequency	Percentage (%)
100	533	22.9
200	585	25.1
300	593	25.5
400	616	26.5
Total	2327	100

5.9 Conclusion

The aim of Chapter 5 was to analyse the socio-demographic data collected from participants in Section A of the questionnaire. The analysis suggests that the sample was representative of the broader university student population in federal universities in Nigeria state. The next chapter presents the results and discussion of results that address research questions 1–3.

CHAPTER SIX: **RESULTS AND DISCUSSION: RESEARCH QUESTIONS ONE, TWO AND THREE**

6.1 Introduction

This chapter presents the results and discussion of analysed quantitative data that address research questions 1, 2 and 3. Responses from the focus group interviews that support these findings are included.

6.2 Research Question 1: What CBT tools are available in selected universities in Nigeria?

6.2.1 Results of the Statistical Analysis and Supporting Qualitative Data

In this study participants responded to 10 items in the questionnaire. All the questions provided options according to a three-level Likert scale, namely: not available, fairly available, and available.

Table 6.1 represents the frequency analysis of the calculated overall availability of CBT resources in the six sampled universities.

Table 6.1: Descriptive analysis of the availability of computer-based tools in the six sampled universities in Nigeria

S/n	Items	Not available	Fairly available	Available	Mean	SD
1	Computer/PC in classroom	955 (41.0%)	851 (36.6%)	521 (22.4%)	1.81	0.774
2	Internet	501 (21.5%)	1048 (45.0%)	778 (33.4%)	2.12	0.732
3	Email	455 (19.6%)	1049 (45.1%)	823 (35.4%)	2.16	0.724
4	Mobile phone	279	379	1669	2.60	0.693

S/n	Items	Not available	Fairly available	Available	Mean	SD
		(12.0%)	(16.3%)	(71.7%)		
5	Digital camera	876 (37.6%)	674 (29.0%)	777 (33.4%)	1.96	0.842
6	Data Projector	389 (16.7%)	1126 (48.4%)	812 (34.9%)	2.18	0.695
7	On and off shelf software	965 (41.4%)	704 (30.3%)	658 (28.3%)	1.87	0.825
8	Computer laboratory	472 (20.3%)	1058 (45.5%)	797 (34.3%)	2.14	0.725
9	Video conferencing	1127 (48.4%)	627 (26.9%)	573 (24.6%)	1.76	0.821
10	Scanner	812 (34.9%)	681 (29.3%)	834 (35.8%)	2.01	0.841

Source: Fieldwork, 2017

Table 6.1 shows that the majority of the students (1,372 or 59.0%) indicated that computers were made available on their campus, but were not always accessible due to irregular power supply. Consequently, they had to use their personal laptops, which they also charged in their residences for their learning activities. Whenever there is power failure, these students have to rely on a generator for power supply. This emerged from the focus group discussions, which revealed that most of the students agreed that the availability of CBT tools in Nigerian universities was not adequate. This is evident from the following quotes from the focus group discussions:

The CBT resources are not really fully available but we students have gadgets that we use our iPhone and our laptop, So, I think that solves it in the campus (FG1:P3).

Truly, on the matter of CBT, I would say it is not very satisfactory. Actually we have some in the computer laboratory but they are not enough and we've all resulted to having our own personal system, we don't really depend on that of the department (FG3:P2).

This present study corroborates the findings of Ibenne (2016) and Moja (2000) who conducted a study on human-resource capacity, access and equity, and quality and information for decision

making in the Nigerian education sector. The study reported that basic CBT facilities, which aid teaching and learning, were generally not available.

Those without access to computers on their campus (955 or 41%) revealed that most students in this category depend on cybercafés or on friends' laptops or desktops whenever they have an assignment to do. Participants from various universities expressed their opinion that:

It is not adequate in the hostel because there is no Wi-Fi to get internet to do our assignment and we all go to a cybercafé whenever we need internet on our laptop (FG2:P8).

Most students use their own laptop, so it is not available for us to use in the campus due to lack of electricity most times (FG2:P3).

The findings also revealed that the internet facilities, which a majority of the total respondents (1,826 or 78.4%) indicated were available, were not available at all times. In such cases, the students purchased their own data, which they used for internet resources for their studies. Students relied mostly on their data rather than internet facilities that should have been provided on campus. The restricted bandwidth of the internet connection on campus also hindered them.

Findings of the present study also revealed that some universities encourage students to open email accounts for registration, smooth communication and other official activities. In the process, students are made familiar with the use of email. The number of respondents who reported on this was 1872 (88%). They also made use of their personal laptops and mobile phones to send messages to their colleagues and teachers, but most of them complained of having to use their personal data to connect with the internet on their laptop or phone in order to send emails. In addition, 279 (12%) of the students responded that they had no access to email during their campus studies, which may be because they did not have their own device – computer/laptop, mobile phones and data – to give them access to the internet. Also, not all the universities required students to open student emails in order for lecturers, supervisors and staff to disseminate information to their students. Most universities in Nigeria interact with their students on paper or face-to-face, like posting information on a public board, using flyers or other documents in the department. In such instances, those students who could not afford personal laptops or mobile phones saw no reason to have one as they did not have to use email for their studies.

Studies show that the majority of the youth today operate Android phones and other devices in addition to their traditional learning (Al-Said, 2015; Kiran, Vasantha & Srivastava, 2017). These scholars found that Wi-Fi, mobile phones, smart phones, tablets, desktop and laptop computers were used in teaching and learning. WhatsApp was a commonly used app for blended learning. The participants in this study revealed:

I consider myself moderately skilled with computer application, especially on social media such like WhatsApp, Skype and YouTube to listen to lectures. After my class for the day, I do listen more on YouTube to get more knowledge on what lecturer has taught (FG3:P7)

Use of messages chatting CBT tools actually help students to collaborate and connect ... in educational ways. This has forced students to always visit their computer for their learning.. We have groups, let's use WhatsApp for example. We have a departmental group, where we share information, where people will do group discussion on their pages. Social media whatever it is, we have group and pages and so many things that people use to get information. So, it depends on what you want to do. It is personal with the students. Some people have systems and they don't watch movie on it. They don't play game. I personally don't play game on my system. So it depends on individual (FG2:P4).

Mobile phones were either provided by the students themselves or their parents. However, a majority of the students, that is 2048 (88%), did have access to mobile phones. The number of respondents (279 or 12%) who had no access to mobile phones was low. None of the universities in this study provided free mobile phones or laptops for students, so those who could not afford to buy one were permanently excluded.

The findings in Table 6.1 reveal that some of the universities have a computer laboratory which students can access (1,855 or 79.8%), but most students complained that these computers did not have access to electricity. Power failures and the inability to provide reliable electrical generation for these computers in the laboratory deterred students from using the computer laboratory. Those students with low use 472 (20.3%) indicated that a computer laboratory was not available in their campus. As one participant elaborated:

Truly, on the matter of CBT, I would say it is not very satisfactory. Actually we have some in the computer laboratory but they are not enough and we've all resulted to having our own personal system, we don't really depend on that of the department". (FG3:P2).

Another participant said that most students did not even have a personal computer:

And in addition to what my colleagues have said I believe we are in this school, this university to learn. A lot of students are here without their personal laptop and those on the financial capabilities of our parents were unable to get computer system, laptops and other electronic materials but if the CBT resources of the university are adequate enough I believe each students should have access to resources and even without our own gadget even if we are not able to get our own laptop and all gadget we must have”.

Table 6.1 also shows that 876 (37.6%) of the respondents indicated that digital cameras were not available. Out of these respondents 777 (33.4%) indicated that it was available for them while 674 (29%) said it was fairly available. In their interview responses, those who did have a digital camera used their private mobile phones as the school did not provide digital cameras for students to use in their classrooms.

The study revealed that a data projector and scanner were not available for all the students for use in their classroom. A total of 1,938 (83.3%) of the respondents indicated that they were available or fairly available, while 389 (16.7%) did not have access to this facility. In the case of a scanner, 812 (34.9%) had no access to one, while 1,515 (65.1%) indicated that a scanner was available or fairly available. The accessibility could have been because the university made it available, but there were not a sufficient number available. This was an indication that the university did not provide enough scanners in the classrooms for students' academic use.

Also, 812 (34.9%) indicated that a scanner was not available. Respondents might not have adequate access to scanner because of the price, except for those that had access for business use or at their parents' offices. If the prices of scanners were affordable, some of these students may have provided their own as they did with mobile phones.

Table 6.1 also revealed that 1,200 (51.5%) of the respondents indicated that video conferencing was available or fairly available. This fairly low number is an indication that video conferencing was either not provided or not often used by the students on campus.

But some respondents might have had access to this facility outside of the classroom, through some other means, such as through their parents or colleagues abroad. Unless relevant CBT tools

and facilities for video conferencing are made available, students will not have access. Hence 1,127 (48.5%) of the total respondents indicated that they did not have access.

6.2.2 Discussion

The extent to which CBT tools were used to augment traditional learning is indicated using means and standard deviation in below:

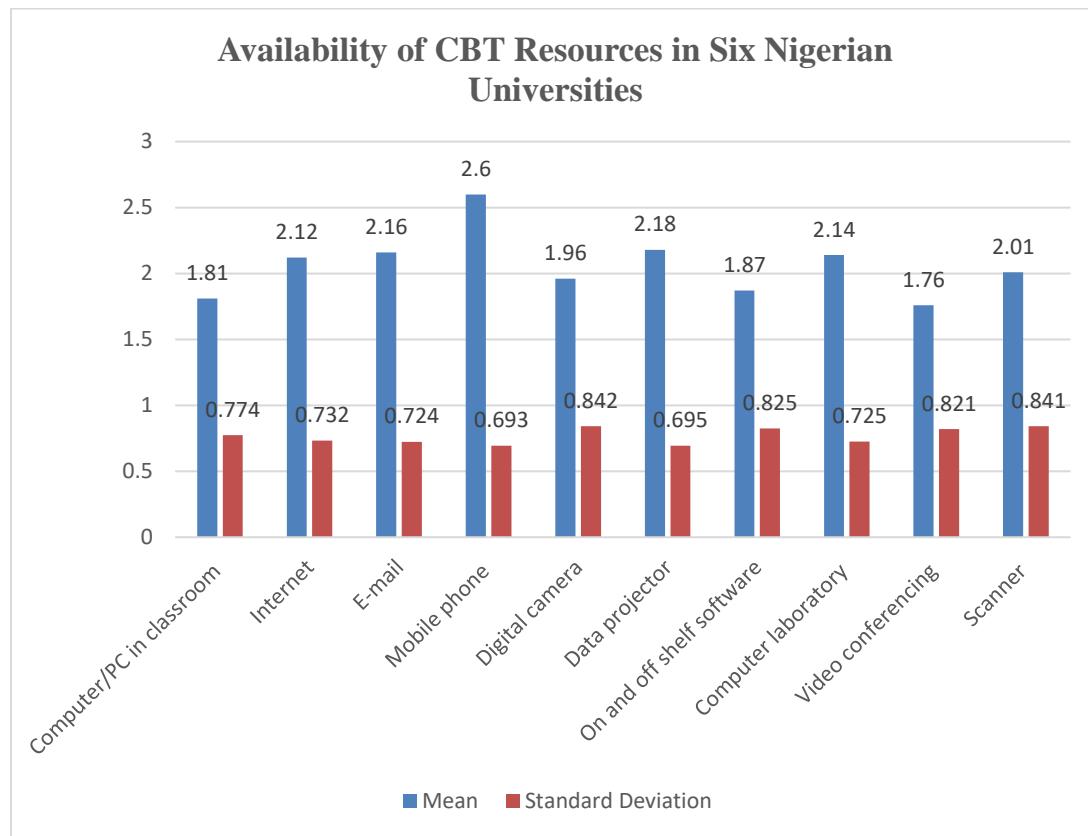


Figure 6.1: Availability of CBT resources in the six sampled Universities

Figure 6.1 shows the bar chart analysis consisting of means and standard deviations of CBT resources that were available in the six universities studied. The mean and standard deviation reveal some level of availability of computer resources for the use of students in the classroom, but most students complained that they did not have direct access to the available ones on the campus, due to irregular power supply and outdated CBT tools on campus; otherwise they relied on their personal computers and other devices.

These findings concur with those of Adeyemi and Olaleye (2010), and Onche (2016), who reported that unstable electricity in the country has been a challenge to the usage of CBT on the campuses.

The findings in Figure 6.1 are based on responses to the 10 indicators on availability of CBT resources in universities. The mean score for all the items in the scale range from 1.76 to 2.60. Since the Likert scale of ‘not available, fairly available and available’ was used as the data collection instrument, based on the calculated mean, any value above the mean score of 2 was regarded as available, while the 3-point Likert scales plus constant 1 gave the average of 2. Therefore, it implies specifically, that respondents ranked every item as: mobile phone ($x = 2.60$, $SD = 0.69$); Internet ($x = 2.12$, $SD = 0.73$); Email ($x = 2.16$, $SD = 0.72$); Data projector ($x = 2.18$, $SD = 0.69$); Computer laboratory ($x = 2.14$, $SD = 0.72$); Scanner ($x = 2.01$, $SD = 0.84$) were available for students’ use, though most students said they rely on their personal computer for their learning. While on- and off-the-shelf software use was ($x = 1.87$, $SD = 0.82$); Computer use ($x = 1.81$, $SD = 0.77$); Video conferencing ($x = 1.76$, $SD = 0.82$) were largely unavailable, they found ways off campus to use them for their learning. The study revealed that most CBT tools were partially available for the use of student learning in the classroom. It seems that if they were fully available for students’ use in the classroom, this might have affected students’ academic performance positively. From the responses during focus group discussion, it emerged that most of the participants agreed that availability of CBT tools in their campuses would have positively affected their academic performance. This was evident from the following quotes:

I believe the CBT resources in our campus to an extent are not adequate because there is no internet facilities to support our classroom learning in doing our assignment and other academic work (FG1:P.2).

I do not think the CBT resources in this campus [are] available for the use of students. In the department like where we need these facilities to enhance our learning, these gadgets are not adequate which would have positively affected our academic performance if fully available in the campus ”(FG3:P4).

I think the CBT resources on this campus are not adequate because the ratio of little computer we have is very low compared with the number of students in this university. (FG1:P4).

I don't consider CBT skill resources in this campus[are] adequate because in my own opinion I think every faculty or every department should give their student access to CBT resources but it is not so on this campus”(FG2:P1)

The present study is also in agreement with Zuljan and Vogrinc (2010) who found a reasonably positive effect of CBT between computer skills and students' academic performance. The results of this study are also consistent with previous studies which found a positive correlation in the use of CBT in the education system and students' performance (Kayode, 2016; Onasanya et. al., 2011). The participants responded as follows in the interviews when asked: 'Are the CBT tools adequate on your campus and are they easily accessible'?

I believe the CBT resources in our campus [are] not adequate to an extent because there [are] no internet facilities (FG1:P.2).

CBT infrastructure is not adequate because by now the way the world is moving and the way technology has gone very far I feel by now we should be doing our exams with computer and we should be sending assignments to our lecturers via online (FG1:P3).

I think the CBT resources on this campus are not adequate because the ratio of little computer we have is very low compare with the number of students in this university. (FG1:P4)

I just want to buttress what my fellow colleagues just said now. Talking about the adequacy of CBT on the campus, I can say to some extent ... It is adequate but at the same time it is not accessible. Because ... we have issue like when there is no light. Once there is no light you can't access internet on campus and if there is something urgent at that time you wouldn't be able to access it. So, I can't say it is really adequate like that but it is available not accessible always (FG1:P3).

I feel the resources are not adequate on my campus because we have just little and the little available self they are not, they do not give us the opportunity to use them. For example in my department, we have a room where they kept all these computers and they did not make it accessible to students (FG2:P1).99

I think the resources in this university is inadequate because we have, for instance, the Wi-Fi in our halls is not accessible, each time, it's always down. They only on it once and it was just for a short period of time. So, the Wi-Fi in my hall is not accessible and the one in the faculty, they place password and these passwords are only known to lecturers. Even the few students that know it cannot access, cannot use it, two student cannot use one

password at a time. So, you have to wait for a student to be free before you can actually use the password of [an]other student. So, that's why I think it is not adequate. (FG2:P4).

Actually on the issue of CBT, I would say it's not very adequate because in the department, actually we have some in the department but they are not enough and we've all resulted to having our own personal system. So, due to the fact that we already have our personal system we don't really make use and we don't really see the need for that of the department (FG1:P2).

The CBT is not adequate in my department and due to power failure at all time (FG2:P6).

The CBT in our school is not really adequate because apart from the exams we don't have access to it. Like some of us now even during the exams we cannot access it because of the way we are not given the privilege to access it apart from the exams day. I think maybe the school can provide some of the resources (FG1. P3)

The CBT in our school is not really adequate because apart from the exams we don't have access to it. Like some of us now even during the exams we cannot access it because of the way we are not given the privilege to access it apart from the exams day. I think maybe the school can provide some of the resources (FG2. P1).

CBT resources and infrastructure in our school [are] not adequate at all, due to the fact that we don't even have any CBT resource in our school in our main campus. The only thing we can say we have is a little bit far from the main campus and ... and the school do not have any shuttle to take us there ... to use the resources. (FG2. P2)

In the researcher's observation, teachers and students are willing to use CBT resources with their teaching and learning, the management of these institutions should make available adequate provision of CBT infrastructure and provide access to the computer resources needed for them. The responses from the focus group discussions confirm this observation:

On the part of the lecturers, I do not believe it's completely their fault not to use CBT because the university has not made any provision to use like visual aids, projectors and computers to teach us in the class. I think it will be going out of their way for them to make this facility available and then enhance learning in the classroom lecture but some lecturers still try their best to get visual aid available and they are not encouraged by the fact that most time during lecture there's no light in the campus to be able to use projector and other stuff. So, I do not believe it's their fault and then there should be management part to play in this issue".(FG3:P5).

Well, for me I would like to be a little bit realistic here. I would even want to say that most of the lecturers do not use these facilities due to lack of adequate availability of CBT resources and infrastructure in the campus (FG1:P4).

Well, I think, when it comes to CBT and stuff like that, there is a thing like personal development such that there's a need for them to get skilled and trained in this CBT for them to be able to use it and pass it across. I feel that the university management can actually make these CBT resources available for the use of lecturers for their teaching with the traditional method with the students". (FG2:P8).

The above findings further supported the WST model in the sub-components in which one of the independent variables explained that availability of technology should be made accessible in the campus. Zuljan and Vogrinc (2010) stressed that availability of these digital tools should be frequently used in the teaching and learning which will enhance students' academic performance positively. Tarhini, Hone and Liu (2015) and Knezek et al. (2016) also suggested that enhancing an educator's will, skill and access to technology tools improve classroom technology adoption, which eventually induces greater student achievement.

6.3 Research Question 2: What is the frequency of usage of CBT applications in these universities?

6.3.1 Results of the Statistical Analysis and Supporting Qualitative Data

The study participants responded to Likert-scale questions (Appendix A1). Section D contains 19 questions about how often students used CBT tools for their learning on campus. Table 6.2 below gives the analysed frequency usage of the responses.

Table 6.2: Descriptive analysis of the frequency usage of CBT applications in the six sampled universities

S/no	Items	Never	Once in a while	Almost everyday	Always	Mean	S. D.
1	General Computer Use	141 (6.1%)	371 (15.9%)	1098 (47.2%)	717 (30.8%)	3.03	0.842
2	Email (Gmail, Yahoo, Hotmail etc.)	56 (2.4%)	228 (9.8%)	1226 (52.7%)	817 (35.1%)	3.20	0.71

S/no	Items	Never	Once in a while	Almost everyday	Always	Mean	S. D.
3	Word Processing (i.e. MSWord, Notepad)	86 (3.7%)	353 (15.2%)	1193 (51.3%)	695 (29.9%)	3.07	0.77
4	Spreadsheets (i.e. Excel, SPSS, STATA)	69 (3%)	186 (8%)	1175 (50.5%)	897 (38.5%)	3.25	0.724
5	Presentation Software (i.e. PowerPoint)	454 19.5%)	1233 (53%)	408 (17.5%)	232 (10%)	2.18	0.859
6	Desktop Publishing (i.e. MS Publisher)	815 (35%)	1022 (43.9)	312 (13.4%)	178 (7.6%)	1.94	0.887
7	Graphics Software (i.e., CorelDraw, Adobe PhotoShop)	737 (31.7%)	1031 (44.3)	340 (14.6%)	219 (9.4%)	2.02	0.916
8	Google Scholar	701 (30.1%)	819 (35.2)	493 (21.2%)	314 (13.5%)	2.18	1.01
9	Internet to retrieve information	44 (1.9%)	192 (8.3%)	1170 (50.3%)	921 (39.6%)	3.28	0.692
10	Storage of data on a CD	195 (8.4%)	607 (26.1%)	442 (19%)	1083 (46.5%)	3.04	1.03
11	Smart board	1042(44.8%)	777(33.4)	332(14.3%)	176(7.6%)	1.85	0.933
12	WebCT course development (or similar program)	1050 (45.1%)	760 (32.7%)	311 (13.4%)	206 (8.9%)	1.86	0.959
13	Synchronous chat (i.e., MSN, Yahoo)	61 (2.6%)	165 (7.1%)	1285 (55.2%)	816 (35.1%)	3.23	0.689
14	Online course development	721 (31%)	942 (40.5%)	402 (17.3%)	262 (11.3%)	2.09	0.962
15	Multimedia presentations	748 (32.1%)	1009 (43.4%)	367 (15.8%)	203 (8.7%)	2.01	0.91
16	Skype	84	259	899	1085	3.28	0.801

S/no	Items	Never	Once in a while	Almost everyday	Always	Mean	S. D.
		(3.6%)	(11.1%)	(38.6%)	(46.6%)		
17	Twitter	96 (4.1%)	218 (9.4%)	1137 (48.9%)	876 (37.6%)	3.20	0.772
18	YouTube	46 (2%)	193 (8.3%)	1172 (50.4%)	916 (39.4%)	3.27	0.694
19	Google Docs (for document creation)	187 (8%)	423 (18.2%)	1072 (46.1%)	645 (27.7%)	2.93	0.881

Source: Fieldwork, 2017

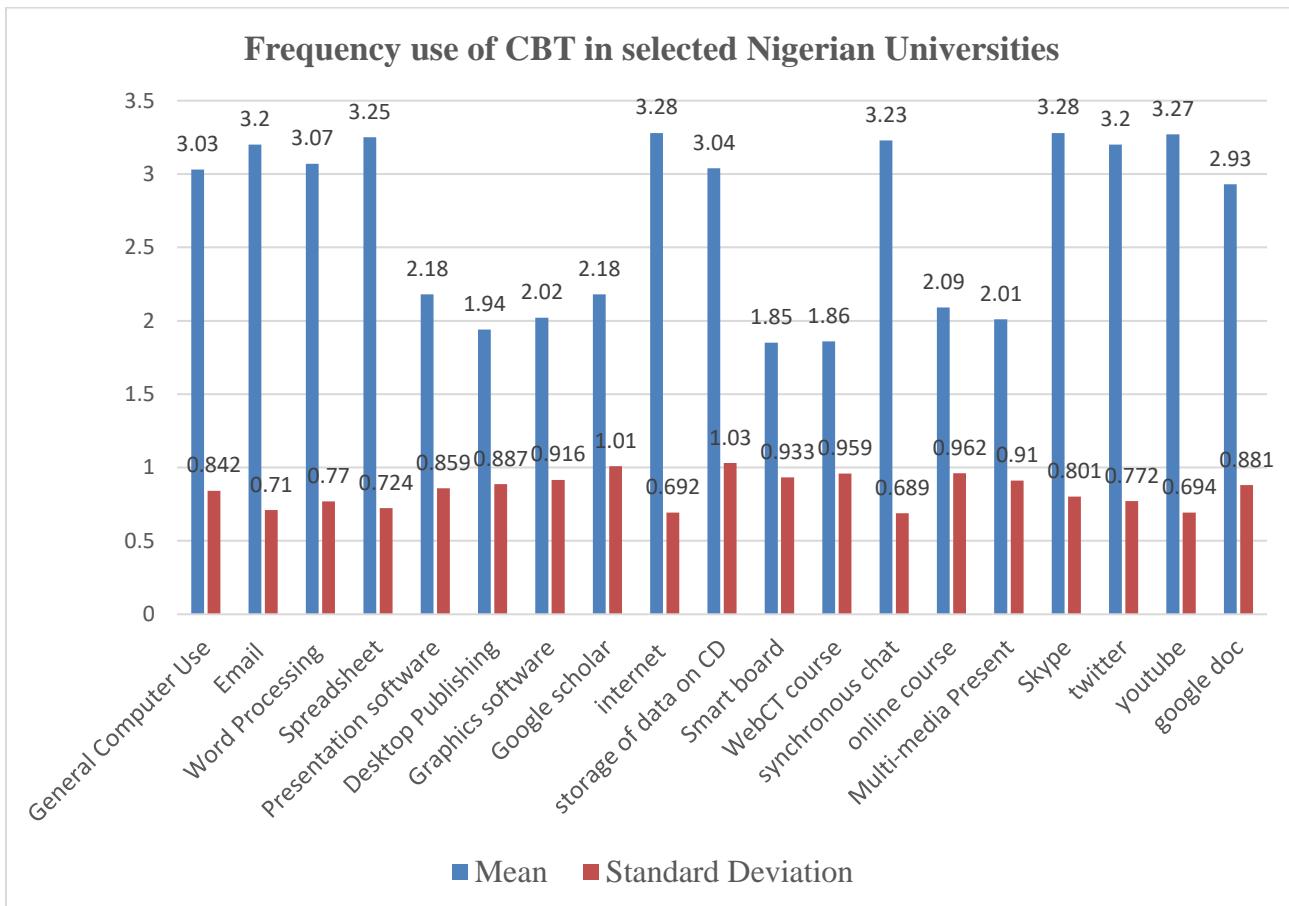
Table 6.2 reveals that the majority of the undergraduate students in the six universities indicated that they fell into the skill category of “General Computer use” either once in a while, always or almost every day. This indicated that 2186 (93.9%) have knowledge in the usage of a computer together with their face-to-face learning in the classroom. The researcher observed that students depended on their personal laptop which made it easy for them to have access whenever needed for typing their assignments, without depending on campus facilities. These students depended on their personal laptops or iPad. Most students without a personal laptop or access to the campus computer facilities would have nothing to resort to. Mobile phones are not a feasible device for typing assignments.

Table 6.2 shows that only 141 (6.1%) students had never used devices requiring typing skills. These students had no personal laptop or access to a school computer. Students should be advised to have a personal computers and management of the school should make them available for use on the campus.

Table 6.2 shows that 2271 (97.6%) respondents used email. The email tools used for academic purposes were from their personal email addresses – most using email within their circle of colleagues (student-student or student-teacher) in order to get information in relation to their studies. Personal computers and mobile phones are the main tools used to send or receive emails. This showed that almost all the students were conversant with the use of email among themselves, while only 56 (2.4%) reported that they did not use email.

6.3.2 Discussion

Figure 6.2 shows the CBT tools bar-chart analysis of students' frequency of use of technological tools used during their learning on campus.



These findings are based upon their responses to the 19 indicators on frequency of use of CBT resources in universities. The mean scores, for all the items in the scale, range from 1.85 to 3.28. The Likert scale of 'never, once in a while, almost every day, and always' was used in the data collection instrument. Based on a calculated mean of scale, any number greater than 3 was considered frequent use among the students. This shows that respondents ranked every item as: Internet ($x = 3.28$, SD = 0.692); Skype ($x = 3.28$; SD=0.801); YouTube ($x = 3.27$; SD = 0.694); Spreadsheet ($x = 3.25$, SD=0.724); Synchronous chat ($x= 3.23$; SD = 0.689);

Twitter ($x=3.20$, $SD = 0.772$); Email ($x = 3.20$, $SD = 0.71$); Word processing ($x=3.07$, $SD = 0.77$); Storage data ($x = 3.04$, $SD = 1.03$); General Computer use ($x = 3.03$, $SD = 0.842$) were frequently used while, Google docs ($x = 2.93$, $SD = 0.881$); Google Scholar ($x = 2.18$, $SD = 1.01$); Presentation software ($x = 2.18$, $SD = 0.859$); Online courses ($x = 2.09$, $SD = 0.962$); Graphics ($x = 2.02$, $SD = 0.916$); Multimedia ($x = 2.01$, $SD = 0.91$); Desktop ($x = 1.94$, $SD = 0.887$); WebCT course ($x = 1.86$, $SD = 0.959$); and Smart board ($x = 1.85$, $SD = 0.933$) were not frequently used by the students for their learning. The researcher observed that most students relied on their personal laptop or cybercafé for their assignments and their studies. Whenever they needed to use the CBT facilities, most students used their own computers or mobile phones, without depending on those barely available on campus. Song and Kong (2017) stress that unstable electricity and slow Wi-Fi connections to the internet discourage the students from depending on the on-campus system. Most students without personal laptops and without access to the campus computer would not be able to use it as they ought to. Mobile phones cannot be easily used to type assignments; these students should be allowed to have free access to the computers and internet facilities to make learning easy for them. This is in line with the findings of Lei and Zhao (2007) who reported that schools should be an educational technology hub where students can access computer tools for their studies and their research.

The mean and standard deviation above reveals the frequency of use of CBT tools by the university students studied. Most students complained that they have improved in their use of CBT through their own initiative by using their personal computers, and also by going to a cybercafé due to challenges they faced on campus. This might be due to lack of availability of mobile phones or a personal laptop; consequently, these students depend on other means of accessing computer technology when they need internet information, email communication, or to get their assignments and projects done. The students also said that they use their personal data to check their email on their phone.

The following responses from participants during the focus group interviews supported these quantitative results:

I believe ... most students don't willingly want to know or go ahead and make use of this resources but then when they need to make use of it is there maybe because of project or they have to get ... additional material to be able to prepare for their exams and pass well

that is when they now have to go ahead and sources for ways in which they frequently make use of these resources. (FG1:P2).

I think students are really appreciating the use of CBT in their studies because we are in the computer age and most students if not all have a computer and Android phone in which they often use with the learning and you see everybody feel alright using their system on their own and I feel if the school integrate CBT in our studies it will help a lot because we will have access to the internet, we can always check our assignment online and even to read more on what we are taught in class (FG2:P7).

I think, it is the joy of every students to learn to be taught CBT facility. This is because it is easier, it is flexible. So, it is with we have joy to always use CBT facilities with our learning in the campus but our authority should make easy access to these facilities CBT. (FG3:P6).

The thing is I would group the answer of this question into two. There are some students who are eager to use and familiar themselves frequently with these tools or there are some set of students who are afraid of anything that has to do with technology like this students in probably the social sciences and then Biological Sciences, they are mostly scare of the anything that has to do with ICT; they just hear ICT, they think is one very, very big thing, but students in that are in that are interested, most of students in my department now which is computer science and some other physical sciences. They even find it as an opportunity because what you see you tend to know better. If we have those facilities and we have access to using them. It would make things easier make the learning easier for us (FG3:P8).

I think frequent use of CBT has been of help to us students. Yes because It's actually very flexible. I mean you can be at home and for instance now I reside in Ilorin and at home I can just be in my dad's sitting room on the couch just go online pay my school fees, register my courses without even coming to school so I know that what I'll be doing is just packing my things, coming to school and just resume lectures. (FG3:P2).

Thank you for the question, I think students are interested in often use of these tools and combining the use of CBT with their studies because it is not uncommon to see student using the CBT, you see eagerness and frequency in the students' zeal - making research on what they are being taught in class. If they go website like Google, search or ask encyclopaedia to get more knowledge you understand to widen the all rising of the scope of the work they are being taught in class. So, I believe if the management or the school

authority can make this CBT available students will be eager and more interested in making use of this CBT for their academic activities. (FG1:P1)

Some participants commented that having access to these CBT tools would give them opportunities and influence their academic performance positively. Therefore, having their personal computers filled the gap as they did not depend on the university to provide these facilities for their use. Participants from the focus group interviews also commented:

We are being integrated with always use of these tools and often usage of CBT in addition to our classroom studies, because in our project they advise us to go online to search for journals, articles and all that which we don't have option than to go to the net. Also, in preparation of our seminal PowerPoint. We have to do the presentation with PowerPoint. So, those things are assignment that you have to use CBT resources. So, we are being integrated to use it.(FG2:P10).

Use of messages chatting CBT tools actually help students to collaborate and connect with themselves in educational ways. This has forced students to always visit their computer for their learning. We have groups, let's use WhatsApp for example. We have departmental group, where we share information, where people will do group discussion on their pages. Social media whatever it is, we have group and pages and pages and so many things that people use to get information. So, it depends on what you want to do. It is personal with the students. Some people have systems and they don't watch movie on it. They don't play game. I personally don't play game on my system. So it depends on individual. (FG2:P4).

I believe when students regularly or frequently use CBT tools, it will improve their performance and they have better understanding in whatever they taught them in the classroom learning.

Yeah! I can say they are very eager to use the technology. Though it can be a disadvantage to them but they use it a lot and they're always eager. Anytime the Wi-Fi is on, you see them running to use the Wi-Fi. (FG2:P1).

Actually, I would say I really see it in them because you can still see the eagerness. We have some that have already got their own personal system due to the fact that they could not access the one we have in school(FG3:P8).

So, most of students here in this university got their individual computer to frequently practise after the class work to enhance their studies, positively they are willing to use the tools for their studies so that they have more skills in CBT tools. (FG3:P4).

I believe the students are willing to make use of the computer, the internet because of different activities they have to do on the internet. But still so times some of these students make us of it the wrong way like one of my colleagues said the earlier on. They use the internet going on the social media instead of them mostly research in Google and I believe some students most let me say most students don't use the internet the way they are supposed to use it. But you see them always on their personal computer (FG3:P10).

And like I said before we the students are willing to often integrate or use the computers if they are available or the e-resources learning if they are available because we are in a computer age where everything is online. So, due to the fact that, if access is given to students, more computers in the resources centre with the computer labs. It will be easier for the students to get up-to-date to what's happening on ground. Because of knowledge is dynamic and we learn every day (FG1:P4).

The eagerness and frequently use of CBT tools but there's a challenge there. Some of them do not have the pre-knowledge of computer before coming. But actually after some ... usage of the computer during the self-practise with CBT and colleagues made it possible for them to grow their level... and their knowledge, level of their knowledge of computer but ... that means in summary my perception on their often use of CBT is that, this CBT has helped to groom students that have not even known anything about CBT before and has grown the knowledge of others that have known.(FG2:P9).

Students are eager to use ... the computer. So, most times when we are about doing computer base, using computer. Either computer base exam or we're about going for lectures that has to do with computer, students are always eager to practice with their computer and to go there, students who actually develop interest due to the programming language they taught us and some of them are actually using it to make money now.(FG3:P4).

I would say yes, my colleagues are frequently and eager to learn more about computer because even among ourselves when we are discussing some of them complain a lot about not accessing it. Even one of our friends we wanted to do our assignment she could not even change the font of the system so she was like even if the school is able to provide the system for them that they can use. So, she will be able to use the system more efficiently. But most of us depends on our personal computer and data connection to our laptop. That's just what I have to say. (FG2:P10).

I think Yes because It's actually very flexible to frequently practice our hands-on the system. I mean you can be at home and for instance now I reside in Ilorin and at home I

can just be in my dad's sitting room on the couch just go online pay my school fees, register my courses without even coming to school so I know that what I'll be doing is just packing my things, coming to school and just resume lectures, so the frequency use on the CBT has really help my skill in the usage of the tools. (FG3:P2).

From the above responses, the researcher realised that, for students to frequently use computer and internet tools on campus there must be stable electricity and the necessary facilities for students to access. According to students, the tools are inadequate, so most of them used their personal laptops, and provided internet facilities for themselves whenever they needed to use it.

6.4 Research Question 3: What is the level of CBT skill among students in these universities?

6.4.1 Results of the Statistical Analysis and Supporting Qualitative Data

Table 6.3 shows the different skill level in CBT items/applications, where HS represents highly skilled, MS represents moderately skilled, WS represents weakly skilled, and NS represents no skill.

Table 6.3: Descriptive analysis of CBT skill level of undergraduate students in the six sampled universities in Nigeria

S/no.	Items	HS	MS	WS	NS	Mean	S.D
1	General computer use	618 (26.6%)	1422 (61.1%)	225 (9.7%)	62 (2.7%)	3.12	0.675
2	Email	703 (30.2%)	1351 (58.1%)	236 (10.1%)	37 (1.6%)	3.17	0.662
3	Word Processing (i.e. MS Word, Word Perfect)	621 (26.7%)	1391 (59.8%)	253 (10.9%)	62 (2.7%)	3.10	0.687
4	Spreadsheets (i.e. Excel, SPSS, STATA)	591 (25.4%)	1274 (54.7%)	335 (14.4%)	127 (5.5%)	3.00	0.786
5	Presentation Software (i.e. PowerPoint)	389 (16.7%)	918 (39.4%)	666 (28.6%)	354 (15.2%)	2.58	0.94
6	Desktop Publishing (i.e. MS Publisher)	295	673	794	565	2.30	0.974

S/no.	Items	HS	MS	WS	NS	Mean	S.D
		(12.7%)	(28.9%)	(34.1%)	(24.3%)		
7	Graphics Software (i.e., CorelDraw, Adobe Photoshop)	298 (12.8%)	641 (27.5%)	810 (34.8%)	578 (24.8%)	2.28	0.978
8	Website development	321 (13.8%)	483 (20.8%)	650 (27.9%)	873 (37.5%)	2.11	1.06
9	Internet to retrieve information	695 (29.9%)	1356 (58.3%)	239 (10.3%)	37 (1.6%)	3.16	0.662
10	Storage of data on a CD	363 (15.6)	1262 (54.2%)	659 (28.3%)	43 (1.8%)	2.84	0.697
11	Smart board	244 (10.5%)	573 (24.6%)	734 (31.5%)	776 (33.3%)	2.12	0.992
12	Web CT course development (or similar program)	230 (9.9%)	565 (24.3%)	729 (31.3%)	803 (34.5%)	2.10	0.987
13	Synchronous chat (i.e. MSN, Yahoo)	607 (26.1%)	1421 (61.1%)	236 (10.1%)	63 (2.7%)	3.11	0.678
14	Online course development	359 (15.4%)	749 (32.2%)	697 (29.9%)	523 (22.5%)	2.41	1.00
15	Multimedia presentations	339 (15.4%)	749 (32.2%)	696 (29.9%)	523 (22.5%)	2.40	0.986
16	Using course-related software programs	335 (14.4%)	765 (32.9%)	694 (29.8%)	533 (22.9%)	2.39	0.992
17	Using databases	369 (15.9%)	721 (31.0%)	698 (30%)	539 (23.2%)	2.40	1.01

Source: Fieldwork, 2017

The table above shows that majority of the respondents, 2,040 (87.7%), are skilled in general computer use compared to 287 (12.4%) of the respondents having weak or no skills in the use of computer.

This indicates that the respondents with skills in general computer use, are those who use their personal computers without depending on facilities provided on campus, which may not be

available for students' use. Whereas few of the respondents, 287 (12.4%), are those without personal computers, and without availability of school computers. Thus, it would be difficult for them to develop skills in the use of a computer.

It can also be observed from the table that 2,265 (97.4%) students had skills in general computer use (highly, moderate and weak). Hence, the number of students with a certain level of skill in computer use was relatively high, while the number of students without any skills was only 62 (2.7%). The study shows that most students had alternative CBT to use. Hence, they did not depend on the few available on campus.

The findings also revealed that 273 (11.7%) of the students had either weak or no skill in the use of email. This might be because of lack of personal computer or inability to use personal handsets or mobile phones for email. Without a mobile phone or laptop, it may be difficult to send emails to relations and friends. This shows that the number of respondents with no skill in email is relatively small. On the other hand, 2054 (88.3%) of the respondents had email skill. The reason for this could be that the respondents had personal computers. Access to mobile phones gave them the opportunities to use email for sending messages to friends and relations. Availability of either of those tools help students in developing email skill. The larger part of the respondents, therefore, had knowledge of email.

Furthermore, 2290 (98%) of the students used email for their studies. This is revealed in Table 6.3 where students with high, moderate and weak skills had a certain level of knowledge of the use of email, either using it for their studies, passing information related to their class work, assignments or sending messages to their teachers.

The study also revealed that spreadsheets (Excel) and the SPSS package were used mostly when writing and analysing project work in the final year, and also used when given classwork or an assignment. These students used these tools to interpret data, for calculation and other related courses from classroom lectures. Spreadsheets were used by 1865 (80.1%) students. Hence, availability of personal computers or laptops increased the number of these students when compared to those with weak or no skills in the use of spreadsheets.

Furthermore, students with high, moderate and weak skill all had some knowledge of the use of spreadsheets. The total number of respondents with skill in spreadsheet use was 2100 (94.5%), whereas 62 (2.7%) of the respondents had no skill in the usage of this application. The respondents with no spreadsheet skills could be due to no access to the school computers, which were not available all the time, or no personal computer.

Most students could not depend on the campus computer for use; hence their personal computers were used to help them to develop CBT skills. Therefore, based on the findings, it can be said that not all students can afford personal computers, so the school management should provide computers for students use, with regular power supply to the campus, in order for students to have access to computers for their studies.

Table 6.3 also shows results on the use of word processing tools. The number of students with certain skills in the use of this application was 2,265 (97.4%). This showed that they used this package for studies such as typing of classwork, notes, assignments, projects, seminar notes and so on. The knowledge gained in the usage of word processing by these students was aided by the students having their personal computers without depending on the school computers. On the other hand, 62 (2.7%) of the respondents did not have general computer skills.

This study also showed the skill level of students in the use of desktop publishing and graphics software, i.e., 1,762 (75%) and 1,749 (75.1%) respectively. It was revealed that some of these students had learnt desktop publishing and graphics applications such as CorelDraw and Adobe Photoshop privately before gaining admission to the university. Some of them also said they had been using these packages for printing of cards, flyers, and typesetting after class as ex-curricular activities to add to their learning. It was observed that the majority of these students, although they had personal computers, did not use this package for academic purposes.

Students with no skills in the use of both desktop and graphics software, 565 (24.3%) and 578 (24.8%) respectively, indicated that they did not have any reason to learn the applications privately and had no reason to use it since it is not part of school curriculum for their traditional learning, and thus irrelevant to their academic performance.

Table 6.3 indicates that use of the internet to retrieve resources or information stood at 2,290 (98.5%) of the respondents who had a certain level of skill in the use of the internet. The students used the internet wireless connection to get more resources to supplement their face-to-face learning in the classroom and also for their personal purposes. Personal initiatives were often taken in order to access the internet since a Wi-Fi connection was not always stable on the campus and most students depended on their own data (USB modem) or a cybercafé whenever they had a class assignment to do. The findings also show that respondents who did not have any skill in the use of the internet to retrieve resources for their studies (37 or 1.6%), might not have had personal laptops, mobile phones or could not afford the cost of data; whereas the larger percentage (98.5%) of the respondents either used their personal computer and/or mobile phones to browse using their own data.

Findings in the table above also shows the number of students with skills in presentation software (1,973 or 84.7%), smart board (1551 or 66.6%), and multimedia presentations (1,784 or 77.5%). Students without these skills (354 or 15.2%; 776 or 33.3%; and 523 or 22.5%, respectively) may be accounted for by the lack of a computer or due to the university's inadequate infrastructure.

Lastly, the table shows students skilled in application software such as website development – 1,454 (62.5%); Web CT courses – 1,524 (65.5%); using course-related courses software – 1,794 (77.1%); and using a database – 1,788 (49.9%). These students have knowledge in the use of CBT that relates to their studies or lifestyle after class. Other students who were unable to use those tools with their learning, therefore, have low skills in the use of these applications, which again might be the result of students not having access to computer tools in the classroom or laboratory for their learning.

6.4.2 Discussion

Figure 6.1 shows the findings on the skills level variables for students in the use of CBT in the classroom and outside the classroom.

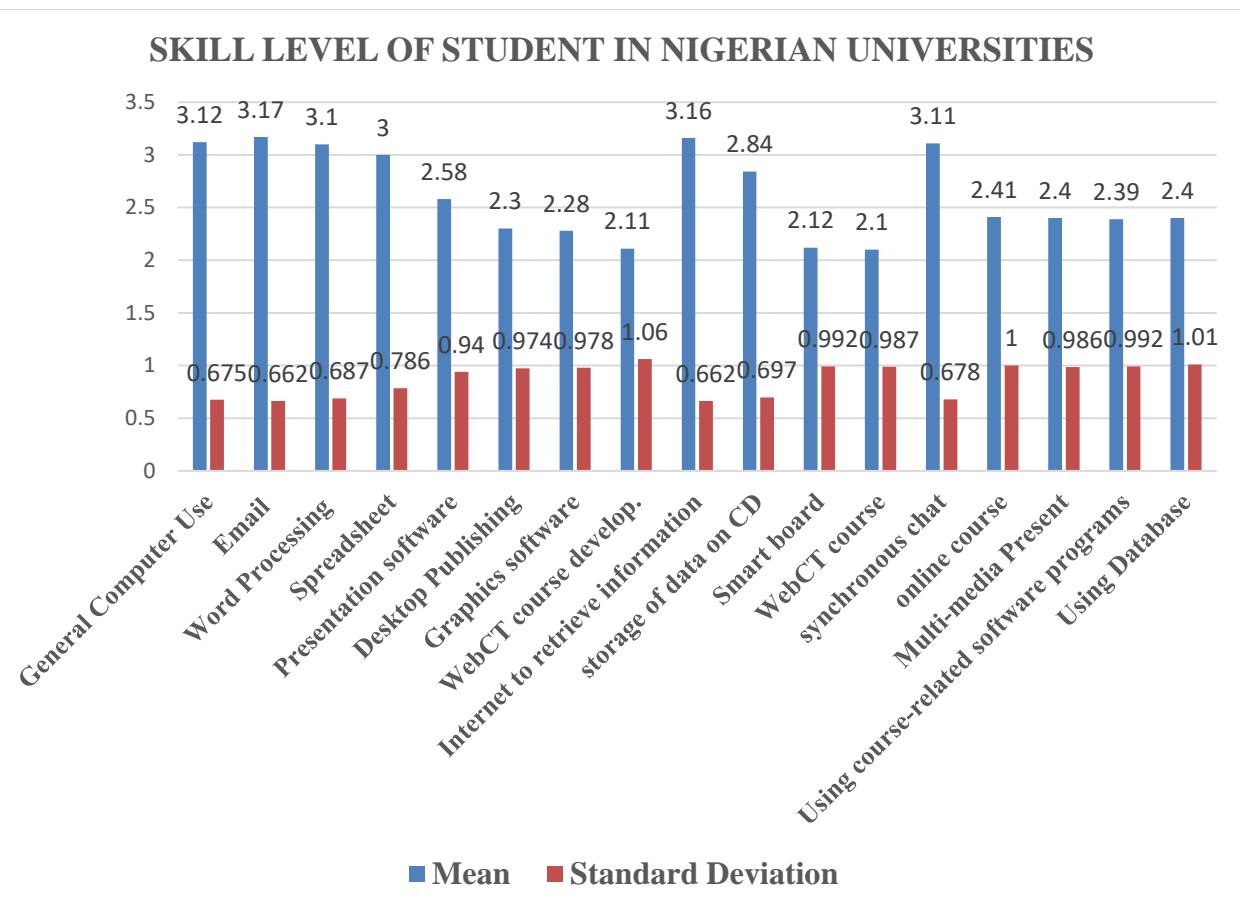


Figure 6.1: CBT skill level of students in the six sampled universities in Nigeria

The mean scores for the variables range from 2.10 to 3.17. Since the Likert scale of ‘not skilled’, ‘weakly skilled’, ‘moderately skilled’ and ‘highly skilled’ was used in the data collection instrument, a calculated mean of scale greater than 2 and 3 was considered moderate and highly skilled among the students in the universities.

The findings revealed every variable item ranked as: Email ($x = 3.17$, $SD = 0.662$), internet retrieve ($x = 3.16$, $SD = 0.662$), General Computer Use ($x = 3.12$, $SD = 0.675$), Synchronous and Asynchronous chat ($x = 3.11$, $SD = 0.678$), Word Processing ($x = 3.10$, $SD = 0.687$), Spreadsheet ($x = 3.00$, $SD = 0.786$), were moderate and highly skilled. While Storage data ($x = 2.84$, $SD = 0.697$), Presentation Software ($x = 2.58$, $SD = 0.94$), Online course ($x = 2.41$, $SD = 1.00$), Multimedia presentations ($x = 2.40$, $SD = 0.986$), Using Database ($x = 2.40$, $SD = 1.01$), Using course-related software ($x = 2.39$, $SD = 0.992$), Desktop Publishing ($x = 2.30$, $SD = 0.974$), Graphic

Software ($x= 2.28$, $SD = 0.978$), Smart board ($x=2.12$, $SD=0.992$), Website development ($x=2.11$, $SD 1.06$), Web CT course ($x=2.10$, $SD = 0.987$), were weakly skilled.

This showed that students' skills in CBT were increased in some tools due to their personal laptops which they depend most on. This seems to enable them to be conversant with their learning in the use of computer technology without depending on school computers which students did not have access to; or were not available for use due to regular power failures. It was observed that the reason for some students having no typing skills or experience in the use of a computer was the inability to access computers or availability of electricity to power systems on the campus, coupled with the financial hurdle of acquiring a personal computer.

The study also revealed that most students had knowledge of the use of CBT that related to and enhanced to their studies. Most participants reported a skill level of either high or moderate in the use of CBT. The following was the evident from focus group discussion quotes:

Use of messages chatting CBT tools actually help students to collaborate and connect with themselves in educational ways. This has forced students to always visit their computer for their learning.. We have groups, let's use WhatsApp for example. We have departmental group, where we share information, where people will do group discussion on their pages. Social media whatever it is, we have group and pages and pages and so many things that people use to get information. So, it depends on what you want to do. It is personal with the students. Some people have systems and they don't watch movie on it. They don't play game. I personally don't play game on my system. So it depends on individual." (FG2:P4).

"Actually, I would say I really see it in them because you can still see the eagerness. We have some that have already got their own personal system due to the fact that they could not access the one we have in school(FG3:P8).

I think I'm moderately skilled because at least I'm in my final year and I've been able to find may way around with my project work (FG1:P4)

I'm moderately skilled because as my level increases my work load also increased so I would say I'm moderately skilled because right now what I've [been]able to do in my past level now due to my CBT resource skill, I've been able to do more in my present level and it has affected my CGPA positively" (FG1:P1)

I feel my CBT skill level is very high. I have access to my PC so I explore at any time I wish to and that is help me a lot in discovering more”(FG2:P6)

Good it has moderately skills and it positively influence on my academic courses because reading more online and research for articles helps to keep on with the CBT skill and its improve my performances in my grades” (FG3:P5)

But for other students who did not have access to the computers, their skill levels were low. This was reported in the following responses:

My CBT level is very low because my parents live in the village and my secondary school too is in the village. So, I did not have access at all, it was in this university that I started to use phones in which my colleague has been teaching me some application (FG1:P9).

Of course my level in the usage of CBT affects my CGPA because at times when we are being given assignment to do there are some of us that you know they are not skilled very well and then they end to come out with an assignment that is not what the lecturer mark but I believe myself have been getting good grade because of my moderate skills in the use of CBT (FG1:P2).

For me, I will say that, in this school my overall CBT level is very lowly skilled. Why did I say this, why I’m saying this that most of our courses especially the practical that we normally do, all those basic skills just because we are not expose to all to see computer equipment before we enter school (FG2:P7).

Going by what my fellow colleagues have said, mine is low.(FG3:P8).

Some of the students don’t have the facility. It is like some students don’t have laptops, some don’t have browsing phone, so they don’t have access to the internet. (FG2:P5).

In the responses from the participants, the researcher observed that students found the use of Android phones and their personal laptops helpful, and they felt it increased their skills and their learning on campus. This is evident from the following quotes:

I would say that the students, my other colleagues, were very eager to learn with CBT tools because a lot of us has gotten our own personal laptops to help ourselves and a lot of us even if the school is not providing internet access, a lot of us have our modem, and data to browse and not even waiting for the school this time around. So, we are eager to learn with this technology (FG2:P3).

The CBT resources is not really fully but we students have gadgets that we use IPhone, our laptop systems. So, I think that solves it in the campus (FG1:P3).

Yes Ma! ... my CBT skill level is moderate but developed on my personal laptop and self-training regular practice, this has been contributing to my academic performance (FG2:P7)

I support the last colleagues because what motivate most of us students is that we have our personal laptop and browsing on our phone (FG2:P4).

The researcher also discovered that some of these students were computer literate, having prior knowledge of the use of computers before gaining admission into their various universities. The participants were also of the view that their prior knowledge before gaining admission into the university motivated them to use CBT tools with their traditional learning. This was evident from their responses as follows:

Even before I gained admission I need ICT knowledge and I've been trying to develop myself in them personally with my laptop and despite the fact that the school is not providing anywhere wither for ICT I'm trying to get along with my study through the online materials (FG1:P1)

My prior knowledge lay the foundation of my CBT skill so when I gained admission all I needed to do was some personal expiration which help to improve my skill to an extent at least now I can type my assignment, I can make presentation (FG1:P10).

Yes! I have prior knowledge before I enter into the university. Right from my secondary school, we've, they've been teaching us how to use computer. So, coming to university I see they don't even have computer here, there's no way to access it because me I already know how to use it, like Microsoft Word, excel, PowerPoint and some other things". (FG2:P10).

I have prior knowledge of CBT before coming into the university but I ... learnt it on my own because I had encouraged myself to learn such like Corel draw, Microsoft office etc. I had the zeal to, and I wanted to know more about the use of computer so I learn a little before coming". (FG3:P3).

What I can say about that question is that I've been able to make power point to present a lot of things to my lecturers because most of our lecturer now in my faculty they make use of presentation, they want to know, they want to test our skill, if we really understand what

they are teaching so I think the prior knowledge of knowing about power point has allowed me to be able to type and also to present” (FG2:P8).

I have prior knowledge too before gaining admission because I still sit at home a while so I did some professional course which is online course and everything then web design and everything. So, I have prior knowledge before gaining admission (FG1:P9).

6.5 Conclusion

This chapter gives the interpretation of the analysed quantitative data collected in relation to the research questions 1, 2 and 3. The analysis revealed that the availability of CBT on campus was problematic. Hence, students had to use CBT resources off campus, which were accessed at their expense. The level of skill in usage of CBT varied depending on student resources and initiative.

Over 98% of students complained that they relied on their personal laptop, mobile phone, a cybercafé and their own data for internet connections whenever they needed to do their assignments or read outside the classroom.

This chapter also used qualitative data. These responses supported the quantitative analysis. In the responses, students revealed that they felt disempowered with regard to CBT usage. They felt that improved access and skill would improve their academic performance.

These results provide a clear indication of some problems that are faced by undergraduate students in Nigerian universities regarding the use of CBT on campus. The next chapter (Chapter 7) deals with the results that address research question 4.

CHAPTER SEVEN: RESULTS AND DISCUSSION: RESEARCH QUESTION FOUR

7.1 Introduction

This chapter provides the analysis of the quantitative data collected regarding the use of CBT skills levels among undergraduate students and their academic performance in the six federal universities in Nigeria. The chapter discusses the six variables that were called CBT core skills, and that were correlated with students' academic performance to address research question 4. Descriptive statistics and Spearman's rho correlation coefficient were used to analyse the data on CBT core skills in relation to their academic performance. The core skills (General Computer use, email, internet, word processing, PowerPoint, synchronous and asynchronous chats) were those mainly used by the students to support their face-to-face learning. These skills are identified and clarified, using the relevant variables. Discussion on each variable is given and also to what extent these CBT core-skill variables influenced the students' academic achievement. A brief explanation of the statistics used, i.e., bivariate correlation in the SPSS package, is provided.

7.1.1 Statistical Analysis Process

In this current study, the statistical data analysis tested the association of two or more variables (i.e., the association between the CBT skill and academic performance of students). The study used SPSS version 20 for primary quantitative data analysis as the researcher sought to test the relationship between the variables and to establish strong or weak correlations. Before data capture, the data was cleaned and the researcher was able to identify the missing values and correct the data accordingly.

7.1.2 The Spearman's rho Correlation

The Spearman's rho correlation coefficient, which is non-parametric, was used to analyse the data collected. The Spearman's rho was chosen because the present study needed a non-parametric correlation analysis; also the Pearson Product Moment Correlation (PPMC) coefficient was not appropriate.

The PPMC coefficient or Spearman's rho correlation coefficient uses the association between two or more variables to ascertain whether they are significant correlated, positively or negatively (Langile et al., 2013; Chok, 2010). Pearson's is parametric while Spearman's rank correlation coefficient is a non-parametric (distribution free) rank statistic which projects as a measure of the strength of the association between two variables. Therefore, these two statistical tools are mainly used to measure association for non-normal or normal data distribution, respectively.

The Spearman's correlation, which was used for the statistical analysis of the findings of this study, was tested to find the association between the use of CBT skills and academic performance of undergraduate students. Chock (2010) states that the descriptive statistic in Spearman's, is one measure that proves the strength or degree of a relationship between the two or more variables in data correlation. This scholar further explains that the correlation between two or more variables are techniques in quantitative research that enable the researcher to measure the degree of association or relationship between variables using the statistical stages for correlation analysis. Therefore, in order to answer research question 4 ('Which CBT skills affect the academic performance of students in the universities?') a Spearman's rho correlation coefficient test on the Likert-scale data was conducted to ascertain if correlations exist between the CBT skill level variables and academic performance (AcadPerfm). The bivariate statistical analysis using Spearman's Correlation Coefficient Test on all quantitative data received from the participants answered the questions regarding the use of CBT skill level and students' academic performance under Section E (see Appendix A1). Seventeen (17) variables were tested, but only six variables were correlated with academic performance. Table 7.1 shows the results of the correlations.

Table 7.1: Spearman's Correlation Coefficient of all CBT skills variables on students' academic performance

Spearman's rho	AcadPerfm		AcadPerfm
		Correlation Coefficient	1.000
		Sig. (2-tailed)	
		N	2327
	Skill general computer use	Correlation Coefficient	.106**
		Sig. (2-tailed)	.000
		N	2327
	Skill email	Correlation Coefficient	.109**
		Sig. (2-tailed)	.000
		N	2327
	Skill word processing	Correlation Coefficient	.100**
		Sig. (2-tailed)	.000
		N	2327
	Skill spreadsheet	Correlation Coefficient	.107**
		Sig. (2-tailed)	.000
		N	2327
	Skill presentation software	Correlation Coefficient	.004
		Sig. (2-tailed)	.859
		N	2327
	Skill desktop Publishing	Correlation Coefficient	.008
		Sig. (2-tailed)	.708
		N	2327
	Skill graphic software	Correlation Coefficient	-.001
		Sig. (2-tailed)	.956
		N	2327
	Skill Website development	Correlation Coefficient	.006
		Sig. (2-tailed)	.762
		N	2327

	Skill internet to retrieve information.	Correlation Coefficient Sig. (2-tailed) N	.108** .000 2327
	Skill storage data on CD	Correlation Coefficient Sig. (2-tailed) N	-.044* .035 2327
	Skill smart board	Correlation Coefficient Sig. (2-tailed) N	-.041 .485 2327
	Skill WebCT course	Correlation Coefficient Sig. (2-tailed) N	.018 .375 2327
	Skill Synchronous & Asynchronous chat	Correlation Coefficient Sig. (2-tailed) N	.099** .000 2327
	Skill Online course development	Correlation Coefficient Sig. (2-tailed) N	-.006 .785 2327
	Skill Multimedia presentation...	Correlation Coefficient Sig. (2-tailed) N	-.009 .655 2327
	Skill course-relate software	Correlation Coefficient Sig. (2-tailed) N	.020 .341 2327
	Skill databases	Correlation Coefficient Sig. (2-tailed) N	.021 .311 2327

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table 7.1 also shows that variables such as the ‘skill of storing data on CD’ did not correlate with academic performance. The students mostly used a flash drive for their learning while a storage data CD might be used for other activities outside of their academic activities. The researcher focused on the six variables that correlated positively with academic performance of undergraduate students. These six variables are discussed below as they address research question 4.

7.2 Research Question 4: Which CBT Skills Affect the Academic Performance of Students in Nigerian Universities?

7.2.1 CBT core-skill level and students' academic performance

The six core-skill variables that correlated with academic performance were: general computer use, email, word processing, spreadsheet (Excel), internet, and synchronous and asynchronous chat.

7.2.2 General Computer Use and Academic Performance

Table 7.2: Spearman's correlation coefficient: general computer use and academic performance

		AcadPerfm	Skill General computer use
Spearman's rho	Correlation Coefficient	1.000	.106**
	Sig. (2-tailed)	.	.000
	N	2327	2327
SKILL General computer use	Correlation Coefficient	.106**	1.000
	Sig. (2-tailed)	.000	.
	N	2327	2327

**. Correlation is significant at the 0.01 level (2-tailed).

A listwise N = 2327

Spearman's correlation was used to analyse the relationship between the general computer use (computer) and academic performance (AcadPerfm) of students. The result gives a correlation coefficient of 0.106 ($r = 0.106$, $p = .000$, $\text{Sig} < 0.01$) as shown in Table 7.1, which is significant but weakly correlated. If the influence of general computer use on students' academic performance is significant, then we may ask whether general computer use significantly increases or decreases the academic performance of the student. Again, the result reveals that general computer use is directly related to their grades (CGPA), and that frequency in use of general computer in their learning will significantly increase students' academic performance if the rate at which students are using a computer is high.

Also, if the rate at which the students use a computer is low, then general computer use will significantly decrease their academic performance. Therefore, it can be concluded that general computer use significantly influences the academic performance of students, and the more they are using computers with their learning the better their academic performance will be. This result concurs with those of scholars that found a positive correlation between the general use of a computer and academic performance of students in the classroom (Van der Kleij, Feskens and Eggen, 2015; Nyambane & Nzuki, 2014; Alharbi, 2014; Vogrinc & Zuljan, 2010).

7.2.3 Email Use and Academic Performance

Table 7.3: Spearman's correlation coefficient: email use and academic performance

			AcadPerfm	SKILL email
Spearman's rho	AcadPerfm	Correlation Coefficient	1.000	.109**
		Sig. (2-tailed)	.	.000
		N	2327	2327
	SKILL email	Correlation Coefficient	.109**	1.000
		Sig. (2-tailed)	.000	.
		N	2327	2327

**. Correlation is significant at the 0.01 level (2-tailed).

A listwise N = 2327

Table 7.3 shows that the correlation coefficient indicates a positive relationship between the use of email and students' academic performance. The Spearman's rho correlation coefficient $r = .109$ computed for email tools and academic performance of students, was a weak result ($r = 0.109$) with significance or p-value = .000 which shows that the result is statistically significant at ($p < 0.01$). The result again suggests that the rate, at which students are emailing each other about their studies, enhances their academic performances. The Spearman's rho correlation coefficient of $r=0.109$, $p=.000$, $N=2327$, as shown in Table 7.3, indicates a positive correlation in the use of the email tool as a resource and instructional tool to support students' learning. Jacobsen and Forste (2011) also found positive a correlation between the use of email among students and their performance, and observed that the use of email helps students to relate to their teachers and colleagues regarding their academic work.

The email tool was used to supplement the conversation or information from face-to-face interaction with their teachers and it enhances their relationship in their learning.

7.2.4 Word Processing Use and Academic Performance

Table 7.4: Spearman's correlation coefficient: word processing use and academic performance

			AcadPerfm	Skill Word Processing
Spearman's rho	AcadPerfm	Correlation Coefficient	1.000	.100**
		Sig. (2-tailed)	.	.000
		N	2327	2327
SKILL wordprocess		Correlation Coefficient	.100**	1.000
		Sig. (2-tailed)	.000	.
		N	2327	2327

**. Correlation is significant at the 0.01 level (2-tailed).

A listwise N = 2327

From the results shown in Table 7.4, a Spearman's correlation determined the relationship between the usage of a word processing application and academic performance. The correlation coefficient indicated that there was a positive correlation ($r=.100$). The correlation shows a statistically significant correlation of ($r = .100$, $p = 0.000$, $N = 2327$), but the strength of the correlation is weak. This might be influenced by other factors in their studies. The finding of this study concurs with Eisenberg (2010) who also found a positive correlation between the use of word processing software and performance. Furthermore, the result suggests that the students' academic performance (CGPA) is limited to their rate of exposure to word processing. This means that the students' academic performance varies according to their rate of exposure to word processing.

7.2.5 Spreadsheet use and Academic Performance

Table 7.5: Spearman's correlation coefficient: spreadsheets use and academic performance

		AcadPerfm	SKILL Spreadsheets
Spearman's rho	AcadPerfm	Correlation Coefficient	1.000
		Sig. (2-tailed)	.000
		N	2327
SKILL Spreadsheets	Correlation Coefficient	.107**	1.000
	Sig. (2-tailed)	.000	.
	N	2327	2327

**. Correlation is significant at the 0.01 level (2-tailed).

A listwise N = 2327

Table 7.5 shows that there is a relationship between students' skill level in the use of spreadsheets and academic performance. Spearman's rank-order correlation was run to determine the relationship between use of spreadsheet applications and academic performance of students and yielded a significant correlation of 0.107 ($r = 0.107$, $p = 0.000$, $N = 2327$) as shown in Table 7.5. Although the relationship is significant, it was weakly correlated. This implies that, as the rate at which students use a spreadsheet application in their learning increases, so their academic performance will improve.

The following scholars also found a positive correlation in the use of the Excel spreadsheet and student performance (Liang & Martin, 2008; Niess et al., 2007; Tubbs, 2012; Ahmed, 2008).

7.2.6 Internet use and Academic Performance

Table 7.6: Spearman's correlation coefficient: internet use and academic performance

		AcadPerfm	SKILL internet to Retrieve Infor.
Spearman's rho	AcadPerfm	Correlation Coefficient	1.000
		Sig. (2-tailed)	.108** .000
		N	2327 2327
SKILL internet to Retrieve Infor.		Correlation Coefficient	.108** 1.000
		Sig. (2-tailed)	.000 .000
		N	2327 2327

**. Correlation is significant at the 0.01 level (2-tailed).

A listwise N = 232

In Table 7.6, the Spearman's rank-order correlation was run to determine the relationship between the use of the internet and academic performance of undergraduate students. The Spearman's rho correlation coefficient $r = 0.108$ computed for students' CBT skill level in the use of internet and academic performance was positive with significance of p-value .000 less than Alpha = 0.01. Therefore, there was a positive significant correlation between internet use and academic performance, with a p-value of 0.108 ($r=0.108$, $p=0.000$, $N=2327$), but the strength of the correlation was weak. The weakness implies that the relationship between academic performances (CGPA) of students and their internet use for their learning is low, though significant. These results suggest that if the students increase their use of the internet for academic purposes it could influence their academic achievement. Other studies have also found a positive significant correlation between the use of internet or online resources and the academic success of students (Tsai et al., 2011; El-Deghaidy & Nouby, 2008; Bawaneh, 2011).

7.2.7 Synchronous and Asynchronous Chat Use and Academic Performance

Table 7.7: Spearman's correlation coefficient: synchronous and asynchronous chat use and academic performance

		AcadPerfm	SKILL Synchronous and Asynchronous
Spearman's rho	AcadPerfm	Correlation Coefficient	1.000
		Sig. (2-tailed)	.099**
	N	2327	.000
SKILL Synchronous i.e. Skype, WhatsApp etc.	Correlation Coefficient	.099**	1.000
	Sig. (2-tailed)	.000	.
	N	2327	2327

**. Correlation is significant at the 0.01 level (2-tailed).

A listwise N = 2327

Table 7.7 reveals that the use of synchronous chat is positively correlated with academic performance (correlation coefficient of 0.099), but the correlation is weak ($r=0.099$, $p= 0.000$, $N=2327$). This result suggests that as the rate of chat usage increases, students will have more opportunity for research during and after classroom lectures, which should improve their academic performance. This finding is corroborated by the literature (King et al., 2001; Miller & King, 2003).

7.3 Conclusion

This chapter presented the results of the analysis of quantitative data addressing research question 4 on the correlation between CBT core-skill levels and the academic performance of undergraduate students in the six samples Nigerian universities. The results revealed positive and significant correlations between the six CBT core-skill level variables and academic performance. These correlations are supported by a large body of literature. The correlations in this study were, however, weak suggesting that improved usage and skill among the students should lead to stronger correlations and improved performance. The next chapter presents an analysis of qualitative data that address research question 5 and 6.

CHAPTER EIGHT: RESULTS AND DISCUSSION: RESEARCH QUESTIONS FIVE AND SIX

8.1 Introduction

Data Collection uses the themes from the qualitative analysis to address research question five and six. These themes were used to support the quantitative analysis, as discussed in those chapters.

After the transcription of the focus-group interviews, the responses were themed according to Saldaña (2015). The themes and a sample of their supporting responses are given in Appendix B2. According to Saldaña a theme is a guide that can be observed across data sets which is essential to the description of an occurrence or phenomenon, and is connected with a particular research question. This present study identified themes that related to CBT usage.

In line with scholarship that shows that themes can be discovered through data expressions (Ryan & Bernard, 2003; Michaelides, 2011), the following themes and supporting quotes reflect the views of participants that digital technology, together with face-to-face classroom learning, could improve their academic performance.

8.2 Research Question 5: How Are the CBT Skills of Students Affecting Their Academic Performance?

8.2.1 Theme 1: Multimedia devices really help learning

Statements from the students coded under this theme show that all respondents agreed that the use of multimedia devices in the classroom really helped in their learning, which is also strongly supported in the literature (Pun, 2013; Rebecca & Porter, 2010; Jyothi, 2007; Nimarathi & Gnanaderan, 2008).

The respondents expressed the following views to support the use of CBT on campus and how it might affect their learning positively:

Thank you for the question, I think students are interested in combining their CBT skills with their studies in order to affect our learning positively, because students always using the computer technology via internet making research on what they are being taught in class. If they go Website like Google, search or ask encyclopaedia to get more knowledge

and understand to widen the all rising of the scope of the work they are being taught in class. How this technology will positively affect students learning is that, if the management or the school authority can make this CBT available and accessible in the campus, students will be eager and more interested in making use of this CBT for their academic activities. (FG1:P1).

We are being integrated to the usage of CBT in PowerPoint application, internet, words and because in our project they advise us to go online to search for journals, articles and all that which we don't have option than to go to the net. Also, in preparation of our seminal PowerPoint, we have to do the presentation with PowerPoint. So, those knowledge in the usage of CBT have to increase and enhance learning positively, most time we students ran to cybercafé to do our assignment which we have to use CBT resources. So, being integrated to use it has surely affect[ed] us positively in our performance in the class. (FG2:P10).

Technology in classroom has been painted black every time, every single time but we fail to know that these computer technologies actually help educationally. Digital tools have been of help in our studies such as synchronous chat, Skype, join.me. For example, we have class groups, in WhatsApp tool, in which we have departmental group, where we share information relating to our course material, where people will do group discussion on their pages. Synchronous chat has also helped us in collaborate with other students in another university. So, it depends on where you are channelling this thing to. The use of CBT with our face-to-face learning help us to have group and pages and pages and so many things that student needs to get information. So, it depends on what you want to do. (FG2:P4).

So, Most of us students here in this university got their individual computer to practise on their own in order to enhance their studies, using spreadsheet application and other tools increase my performance unlike last year, positively they are willing to studies this affects most students to use CBT tools whenever there is access to it. (FG3:P4).

I believe the students are willing to make use of the computer, the internet because of different activities they have to do on the internet. Assignment and seminar presentation has really affected and encourage[d] us to use the CBT resources. (FG3:P10).

The researcher observed that most undergraduate students in the sampled Nigerian universities used synchronous chat to study with their classmates outside of the classroom. Mostly, they used their personal laptop and their purchased data to have access to internet facilities at home in order to develop skills in the use of CBT.

The following quotes indicate this:

Yes Ma! I developed the use of CBT on my personal laptop and training from colleagues this has been contributing to my academic performance (FG2:P7).

Yes! I'm moderately skilled on computer in the area of MS word applications, MS thing I know how to use it then, it also need encouragement and I do learn on myself through the help of my colleagues. During the weekend I practise those application on my Personal laptop and do visit cybercafé to learn more on YouTube, this has help[ed] my studies.(FG3:P9)

I would say that the students, my other colleagues, were very eager to lean because a lot of us [have] gotten our own personal laptops to help ourselves and a lot of us even if the school is not providing internet access a lot of us have our modem, and personal data to browse and not even waiting for the school this time around. So, we are eager to learn more usage of CBT ” (FG2:P3).

Truly, on the matter of ICT, I would say it is not very satisfactory because ... actually we have some in the department but they are not enough and we've all [resorted] to having our own personal system. So, due to the fact that we already have our personal system we don't really make use and we don't really see the need for that of the department. (FG3:P2).

The CBT is inadequate basically because most times we don't readily have access to using computer gadgets that are being owned by the university due to power failure and inadequate resources in the campus. But we have our own personal laptop and computer system, with our own purchased data for internet. (FG1:P2).

Based on the response of the participants, their skill in the use of computers and the internet (as part of their CBT tool use) has enhanced their assignment work and seminar presentation during their studies. Sajid et al. (2016) also report that the use of PowerPoint during seminar presentation in the classroom enhances and improves teaching and learning.

8.3 Research Question 6: How Can We Ensure the Effective Use of CBT in Learning with a View to Improving Academic Performance?

8.3.1 Theme 2: Students are motivated to use CBT

Some of the student responses during the focus group interviews suggested that the use of multimedia resources – such as embedded videos, audio tracks and visual images – during lectures facilitated learning.

Nimarathi and Gnanaderan (2008) stress that the use of multimedia in the classroom enhances students' learning; and those students who receive learning through this technology appear to perform better than those students learning in conventional ways. Also, it is important to provide different learning media to accommodate different learning styles among students. The students stated that they were motivated by the use of CBT in learning, and it made their learning more enjoyable both in the classroom and outside the classroom (for example, searching for materials relevant to their studies). The students had the following to say:

To ensure the effective and develop in the use of CBT skill I use CBT tools for assignments and project ... given to us by our lecturers and it is just a must for you to explore ... the CBT tools in order to catch up to meet up. This improves my score in the assignment and examination (FG1:P1).

It has affected my academic performance because well ... I would say I was very poor in that [that is when he was in 200L] but now that I have this CBT resources knowledge it has helped me. For instance, there was a time our lecturer made us [do] a quiz in class and then he asked us to create something for him and that will earn us about 15 marks and me being somebody that was poor in my last level I had to because I had the knowledge of CorelDraw I was able to create the drawing make the Microsoft typing and also the PowerPoint as it has assisted me then I later ended up having 15 marks and it has boosted my CGPA (FG1:P7).

One of the method for effective use of CBT in learning is that incentives. Lecturers can organise quizzes in class and just say the first person who can access this online I will give the person maybe five marks just to boost the person's morale, that is one of the motivating factors(FG2:P3).

To me the motivating factor in ensuring the regular use of CBT is that government can provide laptops for each undergraduate student and charge the cost into their fees which

will give all student[s] opportunity to effectively use CBT in their personal learning. (FG2:P7).

Well, I will start from motivating factors, my own motivating factor personally initially when I first came to this school system, ICT we use it for social media and stuff like that but then, now, when you get to have a little problem in school, they will teach you, you don't know what they are saying. They would talk, you don't know where it's coming from is it last thing. But then you go to the internet and then you read up. You'll see new thing, new innovation that are up-to-date. Even from the past thing they are teaching you. Then you see an improvement and gradually you realise that if your limit yourself to what they are given you in class you might have problem. So then to improve your academic performance ICT has helped in so many ways. You have Google, you have pages you have lot of information available to us so it has helped increase our academic performance. (FG2:P4)

These responses support the findings of Gilakjani (2017) who stresses the following: (i) It has been observed that in this information age, there is an urgent need to learn technology; and (ii) Learners are motivated through technology that ultimately enhances academic engagement time.

The following statements deal with how CBT usage alongside classroom learning could improve students' skill in CBT and their academic performance:

What I can say here is that, having to pay for typing of assignment, to pay a lot of money for that, Is something that bothers me a lot but motivate me that ... Me too I can, I need to learn how to do this thing myself. I think that's what I can say on that (FG1:P1).

I think lecturer teaching us, they go to the internet to get more detail information about my chosen field. I think prior knowledge which is moderate cannot be enough in doing this. I have to develop myself in typing and in going to the internet to get more details (FG1:P10).

Lecturer should be giving an assignment often to students this will enable use [of] CBT easy with internet is the great one that motivate me to use CBT always and it really added value to my skills.(FG3:P6).

What I feel motivated me was most assignment I have to do on my own and getting materials through the searching engine like Google and downloading materials that I can read for more understanding on my lecture after classroom(FG3:P9).

Another way to make it effective is for government and the management of school to make availability of CBT tools to students use this is one of the motivating factor[s] that can be useful to research because we don't have sufficient CBT skills, it's going to affect research, Yes for materials that we need and also due to the fact that due to the age we are in it's very vital for every student to have sufficient CBT skills and the grades that are attach to assignment every one of us see that our skill being improved (FG1:P4)

The above responses indicate that, for the effective participation in the use of CBT by students at universities, the government and the management have a role to play by supplying adequate CBT tools on the campus, provision of computer systems with modern software and hardware, internet with sufficient bandwidth, power supply, and so on. Without these some of the students without personal computers may lag behind in their learning:

To me I feel personal interest could aid the use of CBT and also passion. I believe that a man with passion doesn't need alarm clock to wake up in the morning. He has that drive He knows what he wants, so, passion with personal interest you will definitely want to know more. You don't need any external factor to force you to know more. So once you have that personal interest in you, definitely the sky is just your stepping stone (FG1:P7).

I feel motivated to use ICT gadgets whenever we are given [an] assignment to do online or any or whenever I need materials that I can't find in hard copies. So we have to go online. That's for that (FG1:P4).

The main thing that motivates and encourages and contributes to my effective use of CBT with my learning in this campus is that, since I already know that in our test and in our exams we are to make use of all these computer gadgets or all other things. So, I have to be close to where, I have to understand it the more so that when the exams time comes I will be like... I will understand more on questions given and I will get my marks so that I will get everything and the reason why I'm encouraged to develop CBT skill again is that all the assignment that's being given to me, I have to go online to check more about it and so as to understand better (FG2:P7).

I believe for me ... IT world is my passion. So, being my passion ... I tend to want to learn more, want to know more, to want to develop more skills in CBT. And the impact it has had on my academic performance, I would say, it kind of negative in one way, because to me academic is not the only thing what see is that I need to pursue my passion and make something out of it for myself. Make a living out of it (FG3:P6).

The motivating factor for me, is that I think it help to want to want to do new things that to think of something and be able to bring it into.... to bring it and let people see it. I think for that but then I think is still ... it's still affecting my academic negatively because I have to learn those things how to bring this things to reality, I've to go and learn it by myself. It's not like being taught in the four walls of the school. So, then it's me going about doing me all those things, then then inn! A way or the other, it affect[s] my academic performance. That's all I have to say (FG3:P3).

I feel like for a lazy man now ICT [pause] has brought a way that a lazy man can survive even because in the world of ICT now, you can be in your house and be making a lot of money. So, that alone if you are a lazy man, ICT will still give you hope that you can still make it because a lazy man would love lazy things and there are lot of lazy things that can make you money in ICT. So, that's another motivating factor. (FG3:P4)

It has been observed that most students are motivated by computer and internet facilities on campus; and this motivation can help students to develop CBT skills in order to boost their academic performance (Bulman & Fairlie, 2016). The findings of these authors are supported by the findings of this study. However, these facilities should be available and accessible to the students, and with regular power supply, which was difficult to achieve in the context of this study. Lecturers should also be encouraged to use CBT as literature indicates that computer and internet use with teaching and learning play a positive role in students' performance (Edmunds et al., 2012, Kirschner & Karpinski, 2010; Ellison et al., 2007; Suhail & Bargees, 2006).

8.3.2 Theme 3: Prior knowledge has a positive effect on CBT use

Those students with prior knowledge in the use of a computer and the internet commented that their prior knowledge of these tools enhanced their studies in the classroom and contributed positively to their academic performance:

Well! As for me it has really gone a long way in what I love to do, apart from normal academic work. In making research to what I have personal interest in and I think I use of these computer and internet technology which has really affected my studies and learning (FG2:P4).

I would say the previous knowledge in the use of computer affect my academic positively because I've doing assignment you can use it to type assignment, get online, search for materials to use and all that stuff. I think it's been helping. (FG3:P3).

For me, use of computer prior knowledge has helped me in my academic because ... e-tools and use of computer helping more research and get articles that relating to my studies and I think it has affect[ed] my studies positively because I can, I'm able to make more research in a particular topic that I can read and understand. (FG1:P5).

My prior knowledge of CBT affect[ed] my academic because actually before I know how to browse I know that I have to get information on net. When I get to school anytime I'm bored, I'm confused, I have to go to the net again to search for information (FG2:P8).

I would say it affected me positively like, most time, what teacher teaches, you don't expect them to break it down to the very simple stage and sometimes their methods are too abstract for you to understand. So, you just go online, you check for the simplest methods and you know your own method. You can even teach the lecturer. So, that's what I gain from that. (FG2:P9).

Yes! I think it affected me positively, ... in the area of assignments, doing my assignment by myself, typing it by myself, going online to search through research to know more about what the lecturer has taught in class and all that.. (FG2:P4).

It affects me positively because most time when I'm given assignment, I go online to get more information and number two; I type my assignment by myself. This is the fact that I've learnt a little about the Microsoft Word and spreadsheet and how to download some materials on internet. (FG3:P8).

What I can say about that question is that I've been able to make PowerPoint to present a lot of things to my lecturers because most of our lecturers now in my faculty they make use of presentation, they want to know, they want to test our skill, if we really understand what they are teaching so I think the prior knowledge of knowing about PowerPoint has allowed me to be able to type and also to present (FG2:P2).

This is how it affected me in the place of downloading materials. Like now there are some text book IIII There are some ENS, there is a course in this school called General Studies (GNS), GNS 101 and GNS 102. For every [one] of the things they do there, they do tell us to download materials. Some people they are always meeting their friends, can you help me to do this but because of the prior knowledge I ... already had, I downloaded it myself. I did the assignment on myself which will earn me good grades. (FG3:P4).

Yes! The prior knowledge has affected my study in a positive way because most of the assignments may be projects that we have been doing things like that we try to use CBT

that are available so we make use of them and it help like it makes work easy and like faster. (FG1:P4).

Like she said in assignments and projects, most often when we are preparing for exams like I've experienced it before when I was preparing for exams the internet was a great tool I used too. (FG1:P3).

Apart from the assignment and things like that I think for the future reference because I believe in 10 or 15 years to come computer will take over everything we won't be doing paper work again in 10 or 15 years to come. (FG2:P3).

Yes! I have prior knowledge because during my secondary school we have access to computer stuff and then I have an uncle that usually teaches some application and packages before I got admission to the university (FG2:P1).

The above responses from the qualitative analysis revealed that students perceived that their prior knowledge of CBT has improved their academic performance. It is also likely that past experience of CBT, like job experience, former training, and internships play significant role in students' learning.

8.3.3 Theme 4: Access to CBT resources in the campus helps to ensure development

The low level of access to CBT resources by undergraduate students in the selected Nigerian universities hinders their use of these tools in their studies. The difficulty in accessing these CBT resources was confirmed during the interviews:

I think the infrastructure is just not much and they are few in number because ... if as a student you really can make access to some vital ... Computer-base system to really enhance your performance in academic then, to me it's not really, it's not really available enough. For me ... I would just say that the resources are not really much available. And the issue of accessibility is also a big threat because ... when you look at students complaining about, even to check your result, sometimes it is a big problem. So, the accessibility is a threat and the availability is also a threat. So, to me the school is not really doing enough (FG1:P6).

There are a lot of problems in accessing the CBT resources because they are inadequate at first and then some of us here we don't have the skill to access these CBT resources (FG2. P3).

Well, the problem we have with CBT mostly here is population. We have a lot of students and we have limited resources for those students and even for example courses like CSC 201 for example. We have maybe it's just once in four years that we get to do. So it's not incorporated into our daily activities and daily work. It's just that practicals throughout the session. So, the issue of population too comes into play (FG2:P4).

I think the resources in this university are inadequate because we have, for instance, the Wi-Fi in our halls is not accessible, each time, it's always locked. They only open it once and it was just for a short period of time. So, the WI-FI in my hall is not accessible and the one in the faculty, they place password and these passwords are only known to lecturers. Even the few students that know it cannot access, cannot use it, two student cannot use one password at a time. So, you have to wait for a student to be free before you can actually use the password of another student. So, that's why I think it is not adequate (FG2:P4).

The reason [pause] we can say is one, the number of the resources are not in adequate to number of students in the university so, it won't be enough and there's even probability that there will be, the available ones might [be] damaged or due to the inadequate of the resources (FG3:P4).

I do not think the CBT resources in this campus is available for the use of students, in the department like where we need them and in our lectures class, computers are not adequate (FG3:P4).

The computer and other ICT gadgets in the classroom are not adequate to access in most time due to unstable electricity (FG2:P6).

In addition, the researcher observed that as the student population increases, there is no corresponding increase in CBT resources on the campus:

Over the year we discover that the population of students on campus has increased and the resources are kind of stagnant. The resources are not improved upon. The resources are not increased. So, we find out that number of students ratio to the available resources is getting wider. Like students to CBT resources is not enough. I think it should be looked into or else it might really affect accessibility of CBT (FG2:P5).

I think the issue of power supply is part of the problems and also we should, we should work on the Wi-Fi in the hall. So, they would be accessible. (FG2:P5)

One of the problems [pause] that one of the problem we are facing here is unstable or irregular power supply so if there's irregular power supply for instance if my phone should just go off or my laptop should go off, I cannot do anything online (FG1:P6).

I think the major problem we're facing is power but outside that, the Wi-Fi in our departments and our halls had been passworded. So, it is difficult to have access to them ... because you must actually know the password and the password is only given to lecturers. So, this is the major problem (FG1:P7).

One of the problems I think is affecting us is that, the issue of electricity. We don't really have adequate supply of electricity in this school and we hardly, we hardly see light self. I think that's one of the problem. (FG2:P3)

The problem we are facing in this institution is the problem of light, we don't have light. Most of when we are having our papers we do make use of the powered gen. So, and then sometimes, it is ... what do they call it ... they have power failure and this sometimes, when we are logging in we need to restart or and most of our test we are doing or most of examination we are doing we need to restart and this thing keep on affecting us sometimes and ... Meanwhile in that process, some of us, the exam do just ..! What do they call it don't submitted and some of us were asked, we are asked say okay we are the one that first enter and we are and they will ask us to go, to go back for the next year and thing is really affecting the students (FG3:P7).

The problem that I see that can affect the accessibility of these CBT resources number one is the non-adequate power like presently now there is no power and like there's we have projector in our lecture hall and lecture theatre but they are not being use[d] because I can think of particularly one of the reasons that could hinder the usage of some of these resources is the fact that we don't have ... constant power through the day on the campus (FG1:P3).

The problem we have is power failure, like most of the time when we want to use them, there won't be electricity to power the system to even put it on to work with it. And then we are being restricted, it is only until we are having exams that we are allowed to it. All these lab technicians, they don't allow us to use it. So, that's it (FG3:P3).

The researcher observed that it was not only inadequacy of CBT tools, but also the issue of unstable power failure on the campus. Respondents stated that most of the time when they wanted to use the CBT resources, there would be a power failure.

Also, power supply through generators has not been helpful:

And what I want to say is that, talking about the accessibility of this CBT resources, I think maintenance is also part of it. The CBT resources of our campus are not well maintained. You see us working on system and the system will just go off or you see us working on the system and they have to redirect us. We have problem about maintenance (FG2:P3).

The only problem that I know is upkeep, the system is not maintained, if it is maintained the students will have access to it and ... will be easy for us to use (FG2:P6).

Another problem is that [the] majority of our CBT resources ... are not working... (FG2:P6).

I think the resources in this university is inadequate because we have, for instance, the Wi-Fi in our halls is not accessible, each time, it's always locked. They only open it once and it was just for a short period of time. So, the WI-FI in my hall is not accessible and the one in the faculty, they place password and these passwords are only known to lecturers. Even the few students that know it cannot access, cannot use it, two student cannot use one password at a time. So, you have to wait for a student to be free before you can actually use the password of another student. So, that's why I think it is not adequate (FG2:P4).

The computer and other ICT gadgets in the classroom are not adequate to access in most time due to unstable electricity (FG2:P6).

I do not think the CBT resources in this campus is available for the use of students, in the department like where we need them and in our lectures class, computers are not adequate (FG3:P4).

The researcher also discovered that accessing CBT was a challenge because of the poor maintenance of the few CBT tools available. The CBT tools in the campuses were not well maintained, as indicated by responses above. Students added:

I think the problem there is funding. Lack of fund. I think we need to encourage funding in our university. We need to encourage private bodies to participate in the funding of the ... CBT resources (FG2:P6).

Part of the problem is that, there's no funds from the government. Most times, they don't pay lecturers and they don't pay staff generally all the time and when they will pay them,

maybe half salary. So, the, the there's no more, when they don't even pay them, they won't even give enough found for computers, for more computers or laptops. (FG2:P4).

As well as accessibility and funding, the Wi-Fi network was unreliable:

Actually, okay! The problem I have with the CBT available on campus is probably the network. Most likely the network. For places like, there are some places on campus like in the library, there's no network to browse on our phone but I think the resources there can work on that and all that. ... Yeaah that's the problem I have with them (FG2:P3).

University libraries, which the researcher thought would have been an alternative venue for students to access CBT facilities, did not help matters. Unlike libraries in some foreign universities where adequate provision is made for students to access CBT facilities at no cost, it was not so in the Nigerian university libraries in this study, where CBT is only made available at a cost to students, as one student commented:

Taking the issue in library in my university as sample, there are some facilities of these CBT resources in the library, but then accessibility is low in that you have to pay most time to have access (FG2. P5).

Students believed that there should be necessary action from the management of the university and the government of Nigeria to improve the CBT skills of undergraduate students in Nigerian universities; and that this could effectively increase their academic performance. This was evident from the following submission:

I feel ... in our country the electricity here is very bad so even if we have the gadgets we cannot power them and then it actually affect us, so our management should look into the way of getting stable electricity in the campus. (FG2. P4)

I can say that what government can do or the school management is to enlarge, to increase the space and to bring more computer systems into this university so that everybody will have access to it without any problem, without any clashing of ... When, if the computer system is adequate and is many there we won't be any problem in accessing the system again (FG2:P8).

I think another solution is that school management can put in place is that, they should enlarge the ... the hall, capacity of the infrastructure, they should enlarge it (FG3:P6).

The problem that we are facing is the accessibility to the CBT resources because it is off campus. We have an ICT but it's off campus before we can get there to access it, is kind of! Is stressful for we students but we are trying our best to make it accessible (FG2:P5).

And I think for this problem to be solved, for to improve the accessibility, then ICT centre should be moved to somewhere that is accessible, more accessible to the students, that is, computer should be put in the ICT that is inside the school on our campus. It should be well equipped and then students should be grained access to it under supervision so that we will be able to improve our ICT skill (FG2:P7).

What I feel can be done is by, the school should provide more computer in school, enhance the students to learn more computer-based programs that is all for now (FG2:P6).

In spite of students' enthusiasm to use the technology with their learning in the classroom, they commented that their lecturers did not use technology in their teaching. This might due to lack of skill or available resources and the challenge of stable power failure on the campus. Some participants from various campuses said:

Not all the teachers, I don't believe not all of them are skilled in the usage of CBT because even when they are teaching us, you can imagine them doing a programing course but they are writing it on the board. Instead of us to be using computer to run the program and stuff, so that's it (FG3:P7).

I would like to really talk on this, like I said since the time I gained admission on this campus till now, till this very moment ... none of my lecturer has ever and not always make use of computer or CBT to teach us or to impact knowledge because of challenges of power failure and unstable Wi-Fi in the campus. What they ought to do or what they normally do is just hard copy, paper, black and white is what they bring to class and note to dispatch knowledge (FG1:P8).

On the part of the lecturers, I do not believe it's completely their fault because the school has not make any provision to use maybe visual aids projects and computers to teach us in the academic I think it will be going out of their way for them to make this facility available and then make the class but some lecturers still try their best to get visual aid available and they are not encourage by the fact that most time during lecture there's no light in the school to be able to use projector and other stuff. So, I do not believe it's their fault and then management of the university should play part in this issue (FG3:P5).

If you observe our lecture rooms, you will see overhead projectors which shows it is expected of them to make use of this CBT but they rarely make use of it but most times there will be challenges with electricity which [is] not stable. which means we still have a long way to go (FG1:P6).

Well, I think, when it comes to CBT and stuff like that, I think there is a thing like personal development such that there's a need for them to get skilled and trained in this CBT for them to be able to use it and pass it across. I feel that the university management can actually make an avenue or forum where these lecturers can be trained with the latest technology and upgrade themselves so that they can be able to use it effectively and communicate effectively to the student (FG2:P8).

My other colleagues have said that there are some of our lecturers that even don't use that tools. Like today in class we advised a lecturer to give us the CBT version of our note and she refused. Actually, I don't think she is encouraging us to use it (FG1:P10).

8.4 Conclusion

The focus group responses revealed that students were willing to use the CBT facilities if they are made available and if there was no hindrance to the accessibility of these resources. The participants indicated that they were eager to blend CBT with traditional learning in the classroom. They also felt that, if computer and internet facilities were available on campus, their academic performance would benefit, but that most of these CBT resources were not adequate at their universities. They also felt that their lecturers could be doing more to utilise CBT.

It is unlikely that students will use CBT frequently and optimally, as well as develop skill and self-confidence, without the availability of the necessary resources. The lack of necessary CBT resources on the campus, especially during teaching and learning, would make it very difficult for the students to increase their skills in the usage of these digital tools, thus preventing adequate blending of their classroom work with CBT. In the literature review, a large body of research was discussed in support of the argument that availability and accessibility of CBT combined with classroom teaching and learning enhances the academic performance of students. The challenges identified in the student responses, therefore, have serious implications for tertiary education in Nigeria.

CHAPTER NINE: INTERPRETING RESULTS ACCORDING TO THE WST MODEL

9.1 Introduction

The WST conceptual model as applied in this study shows the three independent variables and how they interrelate to influence the dependent variable. The dependent variable was the academic performance of students in the sampled Nigerian universities. These variables and their relationship to the WST model are shown in Figure 9.1 below (repeated from Chapter 4).

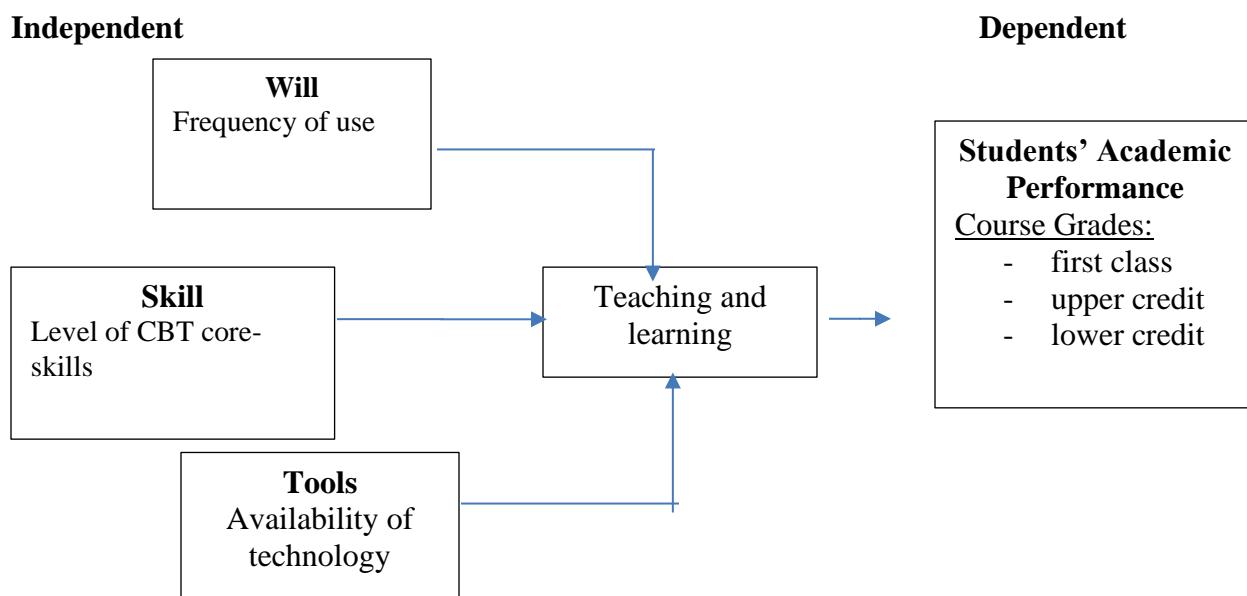


Figure 9.1: The WST model as applied in this study

9.2 Results through the lens of the WST model

As discussed in Chapter 4, the WST conceptual framework can be used to describe Will (positive attitudes), Skill (competency in technology) and Tool (technological tools access), which are all crucial prerequisites for the use of technology in the classroom by both teachers and students. Much recent research in educational technology has used the WST model to study technology integration and its impact on students' performance (Niederhauser & Lindstrom, 2018; Knezek & Christensen, 2016; Knezek et al., 2000).

As applied in this study, **will** is the willingness of students to integrate technology into the academic exercise that can lead to, or affect, academic performance. In addressing research questions 5 and 6, four themes emerged from the analysis of the qualitative data that strongly support the students' willingness to engage in the use of CBT; and to integrate CBT into their traditional learning. Theme 1-4 established that students felt that multimedia devices really help learning; that they were motivated to use CBT; that they found their prior knowledge of CBT very useful; and that access to CBT resources assisted their academic development and achievement.

Skill is the computer literacy skills that form the fundamental knowledge and basic ability to use CBT resources in the everyday life, while **tools** are the availability of hardware, software and competent educators. These two variables are, by necessity, reciprocally linked. Quantitative data analysed to address research questions 1-3 revealed some level of availability of computer resources for the use of students in the classroom, but most students complained that they did not have direct access to the available resources on campus, due to irregular power supply and outdated CBT tools on campus; otherwise they relied on their personal computers or phones. They purchased their own data when necessary or relied on cybercafés. Quantitative analysis of frequency of use and level of skill supported the finding that students had to use their own initiative and resources to access CBT; and to increase their frequency of usage and level of skill. However, not all students could afford these additional expenses, and were consequently placed at an academic disadvantage. Focus group discussions supported these quantitative results.

The influence of CBT skill level on **academic performance** was explored in research question 6, which showed a correlation between CBT core-skill levels and the academic performance of undergraduate students in the six samples Nigerian universities. The correlational analysis revealed positive and significant correlations between the six CBT core-skill level variables and academic performance. These correlations are supported by a large body of literature, as discussed in Chapter 2. The correlations in this study were, however, weak suggesting that improved usage and skill among the students should lead to stronger correlations and improved performance.

9.3 Discussion

The conceptual “Will, Skill, Tool” model that was used in this research showed that most of the students in the sampled Nigerian universities are willing to use the CBT tools with their traditional

education. It was revealed in the quantitative results that students were willing to use the CBT facilities if they were made available and if there was no hindrance to the accessibility of these resources.

In regard to the focus group interviews, the participants indicated that they were eager to use CBT in conjunction with traditional learning, if computers and internet facilities were available on campus, and that this would make teaching and learning more effective. But that most of these CBT resources were not adequate in their universities.

Those participants from the qualitative analysis explained that most of their classmates who had prior knowledge in the use of computers performed better in the usage of CBT. Those who were not computer literate expressed an interest to learn as they were realised the benefits of technology with their face-to-face learning.

In spite of students' enthusiasm to use the technology with their learning in the classroom, they commented that their lecturers did not use technology in their teaching. This might be due to lack of skill or unavailable resources, and the challenge of stable power on the campus.

These comments suggest that there should be training and retraining for the lecturers in the new modern technologies, that related for their teaching in the classroom. The skill and its sub-components variables include – prior computer education, preparation and use of technologies in education has changed the way students use these technologies; and their educational expectations (Barak, 2017; Bartoheme, 2008).

In this present study, the skill variables show that students developed interest in the usage of CBT with their learning in the classroom. From the results of the findings, most of the participants were moderately competent in the use of some technological tools, but that they had to depend on their personal devices and data.

Students will not be able to optimally use CBT for development of their skill and confidence without the availability of resources needed to support their learning. Most students that participated in the focus group interviews expressed concern about unstable electricity and low internet facilities, which they found discouraging. It is likely that most undergraduate students

might not have the necessary CBT skills to perform at their academic best. Daramola (2011) and Hall (2005) stress that the optimal use of computers in blended learning can improve performance over traditional education.

The lack of necessary CBT resources and skill-development programmes on the campus make it very difficult for the students to increase their skills level in CBT usage and thus their academic performance, also noted by other researchers such as Bankole and Stephen (2012), and Geer and Sweeney (2012). Kayode (2016) and Delen and Bulut (2011) concur that the enhancement of CBT skills in computer-based education promotes the learning of students in campus-based education.

Access to these resources would most likely improve the academic development of the students since the results show that students were eager to embrace CBT. This is agreement with previous studies (Donnelly et al., 2011; Junco et al., 2011; Sadaf et al., 2012). Vickova (2010), Mairaj (2012), and Lei and Zhao (2007) show that the will to use CBT correlates positively with the frequency of use of CBT in teaching and learning, and consequently academic performance.

The positive relationship between knowledge and frequency of use of CBT is borne out by many studies. For example, Candy (2000); King et al. (2000); Lee et al. (2001); Attali (2011); and Fu (2013) report that students' prior knowledge in the use of computer applications had a positive influence on their academic performance. Other researchers stress that there is positive relationship between the students' academic achievement and their use of computer technology, with prior CBT knowledge providing a major academic advantage (Li, 2008; Lee, Brescia & Kissinger, 2009; Margareth, 2009; Mehmet, 2010; Sagarmay, 2014).

The present study, therefore, is corroborated by a large body of literature that report that CBT skills, usage and prior knowledge have a positive influence on students' academic performance.

Unfortunately, as Evoh (2007), remarks, the low financial priority in most educational systems in Africa, and insufficient infrastructural CBT resources on campuses, has affected teaching and learning. The academic disadvantage of students with no personal computer and internet access was also noted in this study.

9.4 Conclusion

This present study uses the WST model to examine the level of CBT usage in Nigerian universities. It was found students were willing to combine the use of technology with their traditional education, but complained about problems encountered on campus that hindered their usage and skills development. This is in accordance with the research conducted by Onasanya et al. (2011) who showed that there was inadequate usage of computer-based technologies in health education in Nigeria. Thus, even if students are eager to use modern technology, they did not have adequate access to CBT tools, due to unstable electricity, obsolete tools and lack of a modern computer laboratory.

Hence, this model could be used to elucidate how the usage of CBT can be blended with face-to-face traditional learning in all universities in Nigeria by identifying the specific areas needing improvement. Recommendations in this regard are made in Chapter 10 that follows.

CHAPTER TEN: **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

10.1 Introduction

The purpose of this study was to examine the relationship between the use of CBT skills and academic performance of undergraduate students in selected universities in Nigeria. Factors influencing the use of CBT were investigated in six federal universities in South West Nigeria, and the researcher sought to understand if factors such as availability of CBT, frequency of use of CBT, and CBT skill level of students affected their academic performance. In collecting data, a mixed method approach was used involving a structured Likert-scale questionnaire to collect quantitative data; and a semi-structured interview schedule to collect qualitative data from focus group interviews. The quantitative data was analysed using descriptive frequency and Spearman's rho correlation coefficient; and the qualitative data was analysed using coding and theming according to Saldaña (2015).

10.2 Summary of Findings

10.2.1 Research Questions Revisited

The current study sought to answer the following research questions:

1. What CBT tools are available in selected universities in Nigeria?
2. What is the frequency of usage of CBT applications in these universities?
3. What is the level of CBT skill among students in these universities?
4. Which CBT skills affect the academic performance of students in these universities?
5. How are the CBT skills of students affecting their academic performance?
6. How can we ensure the effective use of CBT in learning with a view to improving academic performance?

For research question one, it was revealed that the availability of CBT tools were considered by participants to be important and to be a factor that aids teaching and learning in the classroom. However, a number of factors hindered the use of CBT in various universities. The study revealed that students were eager to use these digital tools to support their face-to-face traditional learning, but they were hindered by inadequate infrastructure.

The findings also indicated that most CBT tools that were available could not always be used due to unstable electricity on their campus. Most students made use of their own devices and data whenever the internet on campus was unavailable. These findings are consistent with those of Zuljan and Vogrinc (2010), who stress that CBT resources must be available in the educational environment. This includes tools such as computer hardware, software, utility programs, network, internet devices, video technology, and other devices that aid teaching and learning.

Research question two was concerned with the frequency of usage of CBT tools among students on the campus. Those tools that were frequently used by the students for their learning in the classroom were identified. The findings were based on responses to the 19 indicators of ‘frequency of use’ of CBT resources in universities. The mean score for all the items in the scale range from 1.85 to 3.28. Not all the tools were used with students’ class work. The findings revealed that undergraduate students in the six campuses mainly used CBT tools such as the computer for general use, their personal email for effective communication with their colleagues and sometimes their teachers, as well as a word processing application to type their assignments and other class work. The students also indicated that spreadsheets were used for coding of analysed data while PowerPoint slides were used during seminar presentations. Responses also indicated that synchronous and asynchronous chats were effectively used among the students. Using a WhatsApp group was, reportedly, very useful in assisting them with their studies. The researcher observed that most students regularly relied on their personal laptop or a cybercafé for their learning and assignments. Whenever students needed to use CBT facilities, most students used their own computers or mobile phones, without depending on the limited resources available on campus.

Research question three was concerned with the skills level of students in the use of CBT. The findings revealed that most students had knowledge of some applications related to their learning after class. Students who were not able to use the CBT tools well were eager to learn how to use these technologies, especially when they were given assignments in class. It was noted that the majority of students used their Android phones, laptops, and even a cybercafé to learn more about the use of CBT in order to augment their traditional learning. Those students who had poor CBT skills attributed this to lack of access to computers, the internet and other devices on campus.

Many of the students complained about not having a personal computer or money to buy data in order to connect with the internet, but they also emphasised that when they were able to use technology, it made their learning easier and the content clearer.

Research question four sought to identify a relationship between ‘core skills’ and students’ academic performance in the universities. Spearman’s rho correlation coefficient statistics were used to analyse the relationship between CBT skills level and the academic performance of students.

The findings revealed that only six CBT core skills correlated positively with undergraduate students’ academic performance in the selected Nigerian universities. These six variables were: general computer use, synchronous and asynchronous chat, email, spreadsheets, word processing and internet. The correlation between these skills and academic performance produced a low but positive correlation coefficient (0.106**, 0.109**, 0.100**, 0.107**, 0.108** and 0.099**), indicating a weak relationship between the variables. However, the correlations were significant at $p<0.01$ indicating that, even though it is small, these CBT skills do have an impact on students’ academic performance.

Research question five asks how the CBT skills of students affect their academic performance. It was revealed that the use of technology in the classroom as a method to support teaching and learning affects students positively. It was also clear from the participants in the focus group interviews that university managements should make CBT available for students’ optimum use or, alternatively, provide a constant power supply using generators, increased bandwidth services for internet connection, etc., in order to promote the use of computer technology on the campus.

The last research question sought to explore how to ensure effective use of CBT in learning to improve the academic performance of students. The analysis of the qualitative data indicated the following: lecturers should adopt the use of online media to send assignments to the students; material should be given to students via the school website online submission, including lecture slides, quizzes and past question papers; and a group page should be created for students. The findings also suggest that an uninterrupted power supply (solar, industrial generator) could increase the effective use of CBT in learning and improve the academic performance of students.

10.2.2 Conceptual Framework Revisited

As discussed in Chapter four, the WST model was applied to the current study due to its relevance to the research questions. The WST model proved useful in framing the findings in terms of Will (positive attitudes), Skill (competency in technology) and Tool (technological tools access), which are all crucial prerequisites for the use of technology in the classroom by both teachers and students. The findings revealed that participants had positive attitudes towards the use of CBT and were willing and eager to learn CBT skills. However, the lack of availability of CBT and access to the internet proved major barriers.

The researcher concludes, therefore, that if the barriers related to Tool (technological tools access) are addressed, Skill development will follow as the students show a strong Will for the use of CBT. This process would have to be facilitated by management. Firstly by providing the facilities needed, and then providing capacity building opportunities and policies for lecturers and students.

10.3 Recommendations

The current study has revealed some of the factors that positively or negatively affect the use of CBT on campus in selected Nigerian universities. The qualitative data, in particular, show that students are ready and eager to engage with CBT tools to enhance their learning. Based on the findings of this study; and of the literature and researcher experience in this area, the following recommendations can be made:

10.3.1 Blended learning

Blended learning, which is the combination of traditional learning and online learning experiences, gives a chance for students to supplement their classroom-based learning anywhere and at their own pace. It encourages independent learning and it is cost effective for a student, and prepares them for work or further study in this digital era.

It is recommended, therefore, that university administrations, attempt to ensure that all the students have access to personal computers and a reliable internet connection. If this can be done, preferably from the first year of study, students will be able to become conversant with the technologies needed for blended learning.

10.3.2 CBT skills

From this study, it was revealed that only six CBT skills levels were predominantly used and correlated with the student's academic performance. These skills were: general computer use; email; Word processing; internet use; and synchronous and asynchronous tools. Ideally both students and lecturers should have a certain level of computer literacy for blended learning to be effective. For this to occur, both funding and policy change is needed. For example, UNESCO has recommended that between 15% and 20% of budgetary provision should be made for education in developing countries. In contrast, Nigeria allocated about 7.05% to the educational sector in the 2019 budget.

Government subsidies for CBT devices and facilities would also help in promoting CBT usage and blended learning. Government policy in this respect should ideally involve all stakeholders, such as university management, lecturers and student representative bodies; as well as potential ICT funding partners.

10.4 Limitations of the Study

The study was undertaken in federal universities in Nigeria. Because of the long distances between universities in Nigeria, the researcher was only able to sample six universities in South West Nigeria. Therefore, any prediction or generalisations can only be applied over these six universities.

10.5 Further Studies on the Research Work

For a research study to contribute to a growing knowledge base, further related studies need to be carried out. The researcher, therefore, suggests further studies in this field. The current study only examined the use of CBT skills and academic performance among undergraduate students in South West geopolitical zone in Nigerian federal universities. Similar studies could be conducted in other geopolitical zones in Nigerian to ascertain if the results of the current study are corroborated or not. Comparative studies on the use of CBT skills and academic performance among undergraduates could also be conducted in other African countries.

Further research could be done to identify other CBT variables that influence the effective use of CBT among undergraduate students; as well as other variables that correlate with academic performance. Further study could also help to identify other CBT tools that contribute positively to students' learning in other universities – state and public. In addition, a framework could be developed for addressing factors that negatively affecting the use of CBT in the classroom.

10.6 Final Conclusion

This study has provided empirical data on the use of CBT in a traditional teaching and learning by undergraduate students in six Nigerian universities. The findings of this study have revealed the six CBT skills most often used by the students for improvement of their academic performance, and which correlate with their performance. This research has attempted to fill a knowledge gap in the literature about those CBT skills that are predominantly used by undergraduate students in Nigerian universities to enhance their academic performance.

It has been extremely challenging to get funding to connect, sustain and keep these technologies in classroom-based learning. Availability of CBT resources and infrastructure has always been underfunded in most universities in Nigeria. Findings from this study suggest that lecturers should inculcate effective use of CBT while teaching in the classroom, and assignments should be given via university web pages to the students. The Ministry of Education could liaise by way of networking with management of universities in Nigeria to build a model that will make the use of CBT available for all students from their first year of study.

This study also proposed an alignment framework using WST to analyse the relative positioning of the usage of CBT on both independent and dependent variables with their sub-components and how students may use them to enhance their academic performance in classroom learning.

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APPENDIX A1: QUESTIONNAIRE

Dear Participant

Thank you for agreeing to participate in this study. The main objective of this study is to determine if issues such as socio-demographic factors, availability of computer-based technology (CBT) infrastructure, frequency of use of CBT, students' previous qualification and CBT skill level would affect academic performance of students in Nigerian universities.

The information you will provide will be treated with the utmost confidentiality and be used purely for academic purposes. Please spare some of your valuable time to answer these questions.

Thank you.

Yours sincerely,



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Section A: Socio-demographic characteristics

Please use a tick () to indicate an appropriate choice.

1. What is your gender? a. Male [] b. Female []

2. Which category below includes your age?
 - a. 16 – 20 yrs []
 - b. 21 – 25 yrs []
 - c. 26 – 30 yrs. []
 - d. 31 – 35 yrs. []
 - e. above 35yrs []

3. Religion
 - a. Christianity []
 - b. Islam []
 - c. Other []

4. Marital Status
 - a. Married []
 - b. Single []
 - c. Divorced []
 - d. Never married []

5. Family Structure
 - a. Monogamous []
 - b. Polygamous []

6. Home background
 - a. Rural []
 - b. Urban []
 - c. Semi-urban []

Section B: Students' Status and Grades

7. Prior Level of Education before admission
 - a. O'Level []
 - b. A'Level []
 - c. OND []
 - d. NCE []

8. Present faculty of study/school

S/n.	Items	Option
A	Social Sciences/Natural Science	
B	Science/Management Science	
C	Technology/Envr. Management	

9. Year of study

S/n	Items	Option
A	Year 1	
B	Year 2	
C	Year 3	
D	Year 4	

10. Course of Study (Please specify your study).....
11. Matric. No. :.....
12. What is your CGPA

Section Ci: Availability of ICT Resources

13. To what extent do you agree or disagree on the availability of the following ICT tools in your university?

S/n	Items	Not Available	Fairly Available	Available
a	Computer/PC in classroom			
b	Internet			
c	Email			
d	Mobile phone			
e	Digital camera			
f	Data Projector			
g	On- and off-shelf software			
h	Computer laboratory			
i	Video conferencing			
j	Scanner			

Accessibility of ICT Resources

14. How many hours a day are you connected to the internet?
- a. 0–2 hours []
 - b. 3–5 hours []
 - c. 6–8 hours []
 - d. more than 8 hours []
15. How many hours a day do you interact with social networks (Facebook, twitter, etc.)?
- a. 0–2 hours []
 - b. 3–5 hours []
 - c. 6–8 hours []
 - d. more than 8 hours []
16. How many hours in a day do you spend using your computer for your studies ?
- a. 0–2 hours []

- b. 3–5 hours []
- c. 6–8 hours []
- d. more than 8 hours []

Section Cii: Campus CBT Location

17. Where are most of the ICT resources located in the University for Student use?

S/n.	Items	Never at all	Not sure	Sometimes	Always
a	Library				
b	Lecture rooms				
c	Resource centre				
d	Residence halls				

18. Section D: Frequency Use of CBT

Please indicate using a tick () how often you use each of the following CBT tools

S/no.	Items	Never	Once in a while	Almost everyday	Always
A	General computer use				
B	Email (Google, Yahoo, Hotmail, etc.)				
C	Word Processing (i.e. MS Word, Notebook)				
D	Spreadsheets (i.e. Excel, SPSS, STATA)				
E	Presentation Software (i.e. PowerPoint)				
F	Desktop Publishing (i.e. MS Publisher)				
G	Graphics Software (i.e. CorelDraw, Adobe Photoshop)				
H	Google Scholar				
I	Internet to retrieve information				
J	Storage of data on a CD				
K	Smartboard				
L	Web CT course development (or similar program)				
M	Synchronous chat (i.e. MSN, Yahoo)				
N	Online course development				
O	Multimedia presentations				
P	Skype				
Q	Twitter				
R	YouTube				
S	Google Docs (for document creation)				

19. Section E: CBT skill level

From the under listed CBT carefully tick () the column that best describes your level of CBT skills using the following scale: HS= Highly skilled, MS = Moderately Skilled, WS = Weakly Skilled and NS = Not Skilled.

S/no.	Items	HS	MS	WS	NS
A	General computer use				
B	Email				
C	Word Processing (i.e. MS Word, Word Perfect)				
D	Spreadsheets (i.e. Excel, SPSS, STATA)				
E	Presentation Software (i.e. PowerPoint)				
F	Desktop Publishing (i.e. MS Publisher)				
G	Graphics Software (i.e., CorelDraw, Adobe Photoshop)				
H	Website development				
I	Internet to retrieve information				
J	Storage of data on a CD				
K	Smartboard				
L	Web CT course development (or similar program)				
M	Synchronous chat (i.e., MSN, Yahoo)				
N	Online course development				
O	Multimedia presentations				
P	Using course-related software programs				
Q	Using Database				

20. Section F: Computer-base Technology Willingness

S/no.	Statement	SA	A	D	SD
A	Students use the computer to complete their projects, reports				
B	ICT allows students to learn independently				
C	Students use the computers to type course work and assignments				
D	Acquisition of knowledge and skills				
E	ICT improves students organizational skills				
F	ICT makes students develop interest in the learning content				
G	Students use the internet to collaborate with others/team				
H	ICT provides students with some of the pre-requisite skills for workplace preparedness				
I	Technology can help students' link academic subjects to work place demands.				

21. Section G: Students' CBT Proficiency

S/no.	Statement	No Proficiency	Less Proficiency	Moderate Proficiency	High Proficiency
A	Operating a computer				
B	Using the internet for learning				
C	Using a scanner				
d	Using a spreadsheet				

E	Using a search engine, for example Google				
F	Submitting assignments via email				
G	Using a PowerPoint presentation				
H	Using any social media platform, for example, Skype				
I	Communicating via email				
J	Using a Learning Management System, for example Moodle				
K	Downloading materials from the internet.				

Source: Govender, 2016 and Kayode, 2014)

APPENDIX A2: DETAILS OF THE MEASURES AND CODES FOR THE VARIABLES

Dependent Variable	Definitions
Students' Academic Performance	<p>5 = 1st Class (4.5 above) A</p> <p>4 = 2nd Class Upper (3.5 – 4.49) B</p> <p>3= 2nd Class Lower (2.5 – 3.49) C</p> <p>2 = 3rd Class (1.5 – 2.4) D</p> <p>1= Pass (below 1.5) E</p>
Independent Variables	Definitions
Section A : Socio-Demographic	<p>1. Gender</p> <p>Male=1</p> <p>Female =2</p> <p>2. Age</p> <p>16 – 20yrs. =1</p> <p>21 – 25yrs. =2</p> <p>26 – 30yrs. =3</p> <p>31 – 35yrs. =4</p> <p>Above 35yrs =5</p> <p>3. Religion</p> <p>Christian = 1</p> <p>Islam = 2</p> <p>Others = 3</p> <p>4. Marital Status</p> <p>Married=1</p> <p>Single=2</p>

Dependent Variable	Definitions
	Divorced = 3 Never Married =4 5. Home Background Rural= 1 Urban = 2 Semi-Urban=3
Section B – Students’ Entry level of Education/ Faculty/Year of study	1. Entry of Education O’level =1 A’level =2 OND= 3 NCE = 4 2. Faculty of Study Social Sciences/Natural Science= 1 Science/Management Sc.= 2 Technology/Envr. Management =3 3. Year of Study Year 1=1 Year 2 = 2 Year 3 = 3 Year 4=4
Section C ₁ – Availability of CBT Tools	Available =3 Fairly Available = 2 Not Available=1

Dependent Variable	Definitions
Section C2 – CBT campus Resources	Always=4 Sometimes=3 Not sure=2 Never at all =1
Section D – CBT Frequency Use	Always =4 Almost every day=3 Once in a while=2 Never =1
Section E -CBT skill level	Highly skilled= 4 Moderately skilled = 3 Weakly skilled = 2 Not skilled=1
Section F – CBT students' Willingness	Strongly Agree= 4 Agree = 3 Disagree = 2 Strongly Disagree= 1
Section G=CBT Students' Competency	High Proficiency = 4 Moderate Proficiency= 3 Less Proficiency= 2 No Proficiency =1

Source: Researcher's computerised records

APPENDIX B1: FOCUS GROUP INTERVIEW QUESTIONS

1. Do you consider the CBT resources adequate (infrastructures available) on your campus and why?
2. Do you foresee any problems with the accessibility of these CBT recourses on your campus?
3. What (if any) are the problems with the accessibility of these CBT resources on your campus and why do you think this is so?
4. What can be done to improve accessibility to these CBT resources, if necessary?
5. What do you think is your CBT skill level and does it contribute to your academic achievement and how?
6. Do you observe the usage of CBT among the lecturers during their teaching and do you feel it is adequate? If yes, elaborate, if not say Why not.
7. What is your own perception about the student's integration of CBT in their studies?
8. Did you have prior knowledge/engagement of CBT before your admission for your studies at university?
9. Did this prior engagement/knowledge of CBT affect your studies in any way? How?
10. What are the motivating factors that encourage you to develop CBT skills while on campus and do you see any impact on your academic performance?

APPENDIX B2: SAMPLE OF THEMED RESPONSES

THEME 1: MULTIMEDIA DEVICES REALLY HELP LEARNING

“To me, the use of video via YouTube use to deliver lectures by our lecturers increase my skill in the knowledge of CBT especially practical aspect, thereby, improve my skill in digital tools”
(FG1:P2)

“ I believe the animation used along with my power point presentation during seminar, made my assignment presentation looked more attractive and interested and this earned me more score than my classmates” (FG3:P7)

“ Use of multimedia devices with traditional teaching and learning enable we students understand and learn more in working as group to do our assignments”, thereby help develop our skill in the use of CBT. (FG2:P5)

“Using multimedia devices with our traditional learning has made students to learn dependently on ourselves and therefore, improve our academic performance somehow”. (FG3:P2)

“ Sometimes, I do record (audio) the teaching in the class using my audio devices and play over when I get to my hostel to listen again and again... this has enabled me to make proper notes and its improve my performance on my courses”. (FG1:P4)

“I think I am skilled with computer application, especially on use of multimedia and social media such like WhatsApp, Skype, and YouTube to listen to lectures. After my class for the day, I do listen more on YouTube to get more knowledge on what lecturer has taught’. (FG2:P2)

“I can say that government should encourage the use of multimedia and other CBT devices along with the traditional teaching and learning. And also school management is to enlarge, increase the space and to bring more computer systems into this university. This will enable students to be more conversant in the use of CBT devices. Thank you”(FG1:P8)

THEME 2: STUDENTS ARE MOTIVATED TO USE CBT

“What motivate me sometime is when I see my friends operating this thing and I just try to evaluate myself, I try to test myself you know and give myself a time limit to do some certain things and I think that has helped me to improve. (FG1:P3).

“Hnnnmm! Part of the motivating factors is like for example there was this day I came across a roommate of mine and I realized that he was actually eemh doing a test online where students from other schools in Nigeria also participating in the quiz competition and it really motivated me because I feel if I now I to use my laptop very well, I can also apply for a test like this and also engage myself in quizzes of which will help me further in my studies, thank you”. (FG2:P7).

“What motivate me is that in the there time in class when lecturer give us assignment in their slide they use in lecturing us eeemh the best way you can have access to the slide is to get it on your system and read your note on your system and it helping a lot”. (FG2:P8).

“What actually motivated me is the fact that we are in the technology age and for me to actually be at my best I have to know these things so that I can excel in anything I want to do for now”. (FG2:P10).

“Of course, some of the things that have been motivating me to learn more about CBT because if you look at the world we are going to now, it’s IT world and if you are not IT incline then you are no where to be found in the world. So, that’s one of the basic things that have been motivating me to lean more about CBT”. (FG1:P10)

“Well! Okay! Thank you, we are in the computer world now and I believe in order to be at far with our colleagues in other countries of the world, we have to be ICT service we have to be ICT computer science and talking about its impact on our academic performance. When we are taught something in class we are expected to have a broader knowledge to go and learn more about it and it is this CBT that has been helping us either to get more knowledge of what we are being taught in class. So I would say the CBT has a positive impact on our academic performance”(FG1:P9)

“.... Motivating factor for me is concerning that we live in a CBT age, ICT age sorry. Everything is computer if you are not a CBT person oriented person, you cannot work in this present age”(FG2:P3)

“Seeing my classmate also around the world doing great exploit with CBT, I was like, are we not of the same age. So, that push me to learn something more about CBT”(FG1:P4).

“What really motivated me was that when I was preparing for my SSCE exam and my UTME exam I said it that I used the computer to study and it really helped me and because of that, that I said has motivated me also”. (FG1:P8)

“Me, I would say the environment, it motivated me because most of the things we see now, they are computerized. Even everything that is shown on TV was base to the computer. So, if someone can imagine and do that, what motivate me most is that I can, also do that. That’s why I work towards that”(FG2:P9).

“Surely, I will say, what motivates me is the rate how people were using this computer online and making good out of it, and it really assist me in my assignment and examinations which add to my academics performance positively”.(FG3:P2).

“What motivated and add positive influence on my academics in the area of YouTube which tutor more on lectures taught in the class”.(FG3:P5).

“The first motivating factor that I know personally for myself is the watching of video and youtube concerning my practicals. For example how to prepare boffer solution. In my research I would need to get buffer solution. So when I go through some materials and some methods For example, sometimes I watch this video on desktops and how they make their own presentation. I love it so much that I want to grow up and make presentations like that”. (FG2:P5)

“Eeemh! what motivate me more is like what Abraham Linchol said dare to learn more. So, if nobody can boast of knowing anything about a particular area of study. So what motivate me is like I need to know more about this, know more, even knowing more about what I’ve already known not just having a (little pause) little knowledge about it”.(FG1:P3).

“What encourage me to know more about CBT is because most of our assignment we are given, it is base on CBT. Any assignment you are given to you have to make use of the CBT. So I’m always eager because when they give us I want to know what I want to know what to do to be able to do my assignment very well” (FG2:P8)

“Yah! I can say I am encourage to develop my CBT skills because just like my colleagues have said, we have our projects to be done and it’s CBT, we have presentations that we do and it’s CBT and also looking at the world, the world is a global economy looking at our other colleagues in other university so that we will be able to go out and stand. And eeemh to be eeemh to be able to go and stand with them and then to present ourselves as also a student from a university. So, those are my motivations”(FG2:P3) .

THEME 3: PRIOR KNOWLEDGE HAS A POSITIVE EFFECT ON CBT USE

“emh! My prior knowledge lay the foundation of my CBT skill so when I gained admission all I needed to do was some personal expiration which help to improve my skill to an extent at least now I can type my assignment, I can make presentation”.(FG1:P10).

“Well! As for me it has really gone a long way in what I love to do, apart from normal academic work. In making research to what I have personal interest in and I think I use of these computer technology has affected my studies and I do appreciate it at that...”(FG2:P4).

“Yeaah! For me, use of Computer prior knowledge has helped me in my academic because eeemh! e-tools and use of computer helping more research and get articles that relating to my studies and I think it has affect my studies positively because I can, I’m able to make more research in a particular topic that I can read and understand”. (FG1:P5).

“Well, actually it affects in positive way because some people came, like now when we wanted to enter the school for PostUTME or let me say few people did not have knowledge about the use of computer which did not which really affected them during their exam. and also some people came into the school also without having prior knowledge about CBT and is affected some of them negatively. For me personally it affected me positively”. (FG3:P2).

“I would say its affect my academic positively because I’ve doing assignment you can use it to type assignment, get online, search for materials to use and all that stuff. I think its been helping.” (FG3:P3).

THEME 4: ACCESS TO THE CBT RESOURCES IN THE CAMPUS HELPS TO ENSURE DEVELOPMENT

“I believe that with the accessibility, the problem with the accessibility of the resources is mostly a mismanagement issue on the part of the school and I don’t believe there’s a proper body

monitoring the use of the CBT resources in my school. When you try to use it for any purpose before you can meet someone in-charge, they would keep dismissing you, meet this person, meet that person, is like they don't know their duty and responsibility concerning the use of CBT resources in the, in this university". (FG3:P5)

"Eeemh! Thank you for the question. I believe the management can still do a lot to enhance our accessibility to the computer system in other to get eeemh! Academic and educational materials that will enhance our academic performance. All of those things they can do is to make the cost of theeee..... price of these intercool card cheaper, so that students can afford it and they should also make this intercool available to all hostels so that we can be you'll be able to browse from the comfort of our room even without In the comfort of our room and not necessarily going as far as the computer centre to access any material to check our result. So, I think this is, these are some of the things the management can do to improve our technological our ICT". (FG1:P4)

"I think when coming to the university, the university should enable a student have gadgets when coming in and enable them to use it properly". (FG1:P3)

"Since major problems we're facing is power I think the management of the school should find a way of installing sola inverter or generator to bring stable electricity in the campus". (FG1:P7)

"What I think can be done is that, School management should give us power supply, give us light and then, I think everything will be, everything can be done easily". (FG2:P8)

"What I think is, they should make WFI available everywhere. You can just expect me to be in one hostel and I should go to class to use WFI that will be nothing. It does not make any sense WFI should be everywhere in the campus". (FG2:P5)

"What I feel can be done is by, the school should provide more computer in school, enhance the students to learn more computer base programme that is all for now". (FG2:P6)

"I think they the change and the improvement we want should begin with us students because when we do things that will made them trust us, at least the little that are available, they would make it open to us and we would be able to make use of it. But if we don't made them trust us, if we still behave the way we've always been behaving like spoiling things and not maintaining it the way we should maintain it then there won't be able to open even the few that are available for us". (FG2:P8)

"To my own view, what I think the maybe they should buy enough computer and then they should allow the students to go there and be working on it whether they have, maybe they can operate it or not by doing that the students would be having, would be encourage to operate the computer". (FG1:P6)

"I think the management should employ more workers at the computer resource lab because there are (pause) some workers that are, they still take lecturers they go to class. They won't be able to attend to people that may want to use the computer. So, I think they should employ more people that would be there just like attendants to the computer. So, anybody can go at any time of the day, even there may be night workers. In case you want to read throughout the night and

do some assignments throughout night. So, once they do that, I think all these problems would be settled". (FG1:P5)

"I can say that what government can do or the school management is to enlarge, to increase the space and to bring more computer systems into this university so that everybody will have access to it without any problem, without any clashing of eeemh! maybe practical or examination. When, if the computer system is adequate and is many there we won't be any problem in accessing the system again. Thank you". FG2:P8)

"Our school should make Wifi available in everywhere in the campus in which it will help student to browse for any materials needed"(FG2:P5)

"There should be employment of IT staff that will guide students whenever there is practical". (FG2:P2)

"I think the first thing that the management should consider is that we are students and we are paying for the services. This is our right it's not something we have to beg for, therefore, to ensure development and accessibility to these resources, at first we must be recognized as authorized users of these resources, so that we can have access to them regularly". (FG3:P6)

"Another problem is that majority of our CBT resources they are not working" ... (FG2. P6)

"If the problem of electricity is solved in the campus, I believe it will improve accessibility to use ICT tools for teaching and learning"

APPENDIX C: SAMPLE LETTERS OF REQUEST



UNIVERSITY OF
KWAZULU-NATAL

5 October, 2015.

The Deputy Vice-Chancellor (Academic),
University of Ibadan
Ibadan.

Dear Ma,

Request to conduct Research Study in your University in Nigeria

This is to request for your permission to allow me to conduct a research study in your University. I am currently doing my PhD programme (as a part-time student) at the University of KwaZulu-Natal, South Africa.

My research area is ***Computer-based Technology (CBT) Skill and Academic Performance of Students in Nigeria Universities*** and the study aims at investigating the use of CBT Skill and academic performance of students in selected Federal Universities in South Western Nigeria and thereafter to develop a model that can be used to enhance academic achievement of students.

The findings from the research will be useful to:

- Nigeria Universities' policy makers, Stakeholders, Educators, University management and the Ministry of Education when determining what policies and strategies that may improve academic performance of Students in Nigeria Universities.
- Development of the society and Nigeria at large because the nation cannot afford to lag behind in the area of ICT and this will enable us to meet the dynamic educational demands of the 21st century.
- Provision of additional knowledge to the field of technology-enhanced learning environments, which may benefit university decision-makers, academic advisors, faculty, and students

I hereby request to conduct a study in all the selected universities by collecting information in the form of questionnaires and focus group interview which will assist me to answer the research questions. The sample for the study will involve your undergraduate students.

To achieve all of this, I request to be allowed to collect data from the University for a period of six (6) months between April and October, 2016 for the research study.

Kindly note that:

- Attempts will be made not to disrupt the day to day operations of the school programme.
- The privacy, anonymity and confidentiality of the University shall be upheld.
- Data that will be collected from the University will not be used against the University, but rather it will be used for purposes of this research study as well as any other publication that might arise from the study.

I look forward to your positive response.

Thank you, Ma.

Yours sincerely,

A handwritten signature in blue ink, appearing to read "Aderinsola".

Aderinsola E. Kayode (Mrs.)

St. Number: 215081971

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: School of Education

Private Bag X03, Ashwood, 3605. Durban, South Africa.

Tel: +234-8035654998. Email: aderin12002@gmail.com or 215081971@stu.ukzn.ac.za

Original copy received
by me
Edgewood
9/10/15

A handwritten note in blue ink. It includes the date "9/10/15" and the location "Edgewood". The text "Original copy received" is written twice, once above "by me" and once above "Edgewood".

The Deputy Vice-Chancellor (Academic),
Obafemi Awolowo University, Ile-Ife.
Osun State.



Dear Sir,

Request to conduct Research Study in your University in Nigeria

This is to request for your permission to allow me to conduct a research study in your University. I am currently doing my PhD programme (as a part-time student) at the University of KwaZulu-Natal, South Africa.

My research area is **Computer-based Technology (CBT) Skill and Academic Performance of Students in Nigeria Universities** and the study aims at investigating the use of CBT Skill and academic performance of students in selected Federal Universities in South Western Nigeria and thereafter to develop a model that can be used to enhance academic achievement of students.

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- Development of the society and Nigeria at large because the nation cannot afford to lag behind in the area of ICT and this will enable us to meet the dynamic educational demands of the 21st century.
- Provision of additional knowledge to the field of technology-enhanced learning environments, which may benefit university decision-makers, academic advisors, faculty, and students

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Kindly note that:

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- The privacy, anonymity and confidentiality of the University shall be upheld.
- Data that will be collected from the University will not be used against the University, but rather it will be used for purposes of this research study as well as any other publication that might arise from the study.

I look forward to your positive response.

Thank you, Sir.

Yours sincerely,

Aderinsola E. Kayode (Mrs.)

St. Number: 215081971

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: School of Education

Private Bag X03, Ashwood, 3605. Durban, South Africa.

Tel: +234-8035654998. Email: aderini2002@gmail.com or 215081971@stu.ukzn.ac.za



UNIVERSITY OF
KWAZULU-NATAL

The Deputy Vice-Chancellor (Academic),
University of Lagos,
Lagos State

Dear Sir,

Request to conduct Research Study in your University in Nigeria

This is to request for your permission to allow me to conduct a research study in your University. I am currently doing my PhD programme (as a part-time student) at the University of KwaZulu-Natal, South Africa.

My research area is ***Computer-based Technology (CBT) Skill and Academic Performance of Students in Nigerian Universities*** and the study aims at investigating the use of CBT Skill and academic performance of students in selected Federal Universities in South Western Nigeria and thereafter to develop a model that can be used to enhance academic achievement of students.

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- Development of the society and Nigeria at large because the nation cannot afford to lag behind in the area of ICT and this will enable us to meet the dynamic educational demands of the 21st century.
- Provision of additional knowledge to the field of technology-enhanced learning environments, which may benefit university decision-makers, academic advisors, faculty, and students

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Kindly note that:

- Attempts will be made not to disrupt the day to day operations of the school programme.
- The privacy, anonymity and confidentiality of the University shall be upheld.
- Data that will be collected from the University will not be used against the University, but rather it will be used for purposes of this research study as well as any other publication that might arise from the study.

I look forward to your positive response.

Thank you, Sir.

Yours sincerely,

Aderinsola E. Kayode (Mrs.)

St. Number: 215081971

University of KwaZulu-Natal: Edgewood Campus

College of Humanities: School of Education

Private Bag X03, Ashwood, 3605. Durban, South Africa.

Tel: +234-8035654998. Email: aderini2002@gmail.com or 215081971@stu.ukzn.ac.za

A copy received.
mrs yakuw 15/10/15

APPENDIX D: CONSENT LETTER

Dear Participant,

INFORMED CONSENT LETTER

Invitation to Participate in a Survey (Quantitative and Qualitative)

I am a Doctoral Student in the Department of Computer Science Education, University of KwaZulu-Natal, Edgewood Campus, South Africa. I wish to invite you to participate in a study entitled: ***Computer-based Technology Skill and Academic Performance of Students in Nigerian Universities***. My target areas for the study are Lagos, Oyo, Ekiti, Ondo, Ogun and Osun States. Your university is one of my case studies.

To gather the information, I am interested in asking you some questions both in a quantitative (questionnaire) and qualitative (focus group interview) approach. You are requested to kindly answer all questions to the best of your ability.

Please note that:

- Your confidentiality is guaranteed as your inputs will not be attributed to you in person, but reported only as a population member's opinion.
- The interview may last for about 1 hour and may be split, depending on your preference.
- Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. You will not be penalized for taking such action.
- The research aims at investigating the use of computer-based technology skill and academic performance of students at selected universities in South West Nigeria and develops a model that can be used to enhance academic achievement of students.
- Your involvement is purely for academic purposes only, and there are no financial benefits involved.
- If you are willing to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

Instrument	Willing	Not willing
Audio equipment		
Photographic equipment		
Video equipment		

If you have any questions or concerns about participating in this study, please feel free to contact me or my supervisor through email or telephone.

Email: aderini2002@gmail.com or 215081971@stu.ukzn.ac.za

Skype: aderinsola.kayode ; Phone no.: +2348035654998 or +27718071159

My Supervisor is Dr. Desmond W. Govender ;Email: govenderd50@ukzn.ac.za Tel: (+27312603428

APPENDIX E: APPROVAL LETTERS



Deputy Vice-Chancellor (Academics & Research)
Professor Babajide I. Alo
B.Sc. Hons. Chem., Ph.D. (Ibadan), FCSN, FIPAN, FNES, FICCON, FAS

Deputy Vice-Chancellor's Office,
Room 901 - 903,
9th Floor,
Senate House,
University of Lagos,
Akoka, Yaba, Lagos.
Tel.: 234-1-2802412,
Ext.: 1018, 2896
Mobile: 01-7346351
e-mail: balo@unilag.edu.ng
dvc-ar@unilag.edu.ng

16th September, 2015.

Mrs. Aderinsola, E. Kayode
St. Number : 215081971
University of KwaZulu-Natal: Edgewood Campus,
College of Humanities: School of Education,
Private Bag X03, Ashwood, 3605. Durban,
South Africa.

Dear Mrs. Kayode,

Re: Request to conduct Research Study in your University in Nigeria

Please refer to the letter on the above matter to the Deputy Vice-Chancellor (Academics & Research), Professor Babajide Alo, FAS.

I write at the instance of the Deputy Vice-Chancellor (Academic & Research) to inform you that your request for permission to conduct a research study in the University of Lagos, Nigeria by collecting information in the form of questionnaires and focus group interviews that will assist you to answer the research questions is hereby granted.

Please contact the office of the Deputy Vice-Chancellor (Academics & Research) on your arrival for the Research Study.

Thank you


Kehinde, Folasade Funmilola (Mrs.)
Senior Executive Officer
Deputy Vice – Chancellor (A & R) Office

The University of 1st Choice and the Nation's Pride



FEDERAL UNIVERSITY OYE-EKITI

OFFICE OF THE REGISTRAR

Federal University Oye - Ekiti, Ekiti State, Nigeria
Tel: +234(0)806-243-4663, E-mail: registrar@fuoye.edu.ng
Website: www.fuoye.edu.ng

Ref: FUOYE/REG/SU/152/Vol.01/025

9th October, 2015

Mrs Aderinsola E. Kayode
College of Humanities: School of Education
University of KwaZulu: Edgewood Campus
Durban
South Africa

Dear Ma,

RE: REQUEST TO CONDUCT RESEARCH STUDY IN YOUR UNIVERSITY IN NIGERIA

I refer to your letter dated 8th October, 2015 on the above subject by which you requested for permission to conduct a research study in the University.

This is to convey the University Management's approval of your request to obtain necessary data required for your research titled; "**Computer-based Technology (CBT) Skill and Academic Performance of Students in Nigerian Universities: Case Study of Selected Universities in South West Nigeria**".

On arrival, you are requested to please contact the Ag. Dean, Student Affairs.

Thank you.

Alajelu I. O.
Admin. Officer, Registrar's Office
For: Registrar



The stamp is circular with the text "FEDERAL UNIVERSITY" at the top and "OYE-EKITI" at the bottom. In the center, it says "REGISTRAR'S OFFICE". Below the stamp, there is handwritten text: "SIGN: [Signature]", "DATE: 7/1/15", and "FILE NO: [Redacted]".

.....Innovation & character for national transformation

10/22/2015

Gmail - Re: Request to conduct research study in your university

Ife.



aderinsola kayode <aderini2002@gmail.com>

Re: Request to conduct research study in your university

3 messages

Prof. Ayobami T. Salami <ayobasalami@yahoo.com>

Thu, Oct 22, 2015 at 3:15 PM

To: aderini2002@gmail.com

Cc: 215081971@stu.ukzn.ac.za, Aderounmu Adesola <gaderoun@yahoo.com>

Dear Aderinsola Kayode,

Please, refer to you letter on the above subject matter. In principle, the University is willing to allow you to collect your data but without any financial implication for the University. Furthermore, the Centre of Excellence on ICT-Driven Knowledge Park will be the organ of the University that would facilitate your work during the period. Please, contact the Deputy Centre Leader, African Centre of Excellence on ICT-Driven Knowledge Park (Prof. G. A. Aderounmu) for further details. I am copying this mail to him.

Best wishes

+++++
Professor Ayobami T. Salami,
Deputy Vice Chancellor (Academic),
Obafemi Awolowo University, Ile-Ife, Nigeria.
Phone: +234 803 376 1041
Fax: +234 36 232401
E-mail: ayobasalami@yahoo.com, asalami@oauife.edu.ng



Gbemisola A. OKE
BDS (Ibadan) MPH (UCLA),
Ph.D. (Ibadan), FMCDS (Nig.)
Professor of Community Dentistry

UNIVERSITY OF IBADAN IBADAN, NIGERIA

OFFICE OF THE DEPUTY VICE-CHANCELLOR (ACADEMIC)

GSM: +234(0) 803 412 3279

E-mail: gbemioke2001@yahoo.co.uk

gbemisola.oke@ui.edu.ng

8 October, 2015

Mrs. Aderinsola E. Kayode,
University of Kwazulu-Natal,
Edgewood Campus, College of Humanities,
School of Education,
P.M.B. X03, Ashwood, 3605,
Durban,
South Africa.

Re: Request to Conduct Research Study in the University of Ibadan

I write to acknowledge receipt of your letter dated 5 October, 2015 and addressed to me on the above issue. You specified in the said letter that you wish to conduct a study on the topic titled "**Computer-based Technology (CBT) Skills and Academic Performance of Students in Nigeria Universities**" and will like to do field research on the topic in our University for a period of 6 months covering April-October, 2016.

I wish to convey an approval for you to do the field work as proposed in our University. Kindly note however, that this approval will be without any financial implication whatsoever on the University.

I wish you every success in your research endeavour.

Thank you.

DEPUTY VICE-CHANCELLOR

(Academic)

S/ UNIVERSITY OF IBADAN

Professor Gbemisola A. Oke
Deputy Vice-Chancellor (Academic)

Our Vision:
To be a world-class institution for academic excellence geared towards meeting societal needs

Our Mission:
• To expand the frontiers of knowledge through provision of excellent conditions for learning and research.
• To produce graduates who are worthy in character and sound judgement.
• To contribute to the transformation of society through creativity and innovation.
• To serve as a dynamic custodian of society's salutary values and thus sustain its integrity



THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE, NIGERIA

(www.futa.edu.ng)

Vice-Chancellor
PROF. ADEBIYI G. DARAMOLA, *fnaae*
B.Sc, M.Sc, Ph.D.

Ref. No. VC. GEN/229

Aderinsola E. Kayode,
St. Number. 215081971,
University of KwaZulu-Natal: Edgewood Campus,
College of Humanities: School of Education,
Private Bag X03,
Ashwood, 3605,
Durban,
South Africa.

P.M.B. 704, Akure
Ondo State, Nigeria.
Tel: +234 803 333 0057
+234 807 676 7200
e-mail:vc@futa.edu.ng;
agdaramola@futa.edu.ng
daramoladebiyi@gmail.com

21st October, 2015

RE: REQUEST TO CONDUCT RESEARCH STUDY IN YOUR UNIVERSITY IN NIGERIA

I write to acknowledge the receipt of your letter dated 28th September, 2015, requesting for permission to conduct a research study in the Federal University of Technology, Akure, as part of the requirements for your training as a Ph.D student at the University of KwaZulu-Natal, South Africa.

After a careful consideration of your request, the Vice-Chancellor has graciously approved that you should be allowed to conduct the research work in FUTA under the following guidelines:

- i. the research should be carried out within six months (April – October);
- ii. the research should be limited to research questions in the form of questionnaire and focus group interview of FUTA staff and students;
- iii. the conduct of the research should not disrupt the academic activities and the general business of the University;
- iv. it should be strictly ensured that the privacy, anonymity and confidentiality of respondents and the University, as well as data collected are protected;
- v. data to be collected should strictly mean for academic research purposes, and must not be released to any unauthorised person or group of persons;
- vi. access to documents in the course of the research must not be copied or reproduced in any form for any unauthorized purpose or to person(s) and data collected must not be used against the University.

Kindly acknowledge this letter in writing, stating your acceptance to carry out the research study under the above stipulated guidelines. This will enable us to inform appropriate quarters of the University of your research activities.

Thank you,

David S. Daramola
for: Director
Vice-Chancellor's Office

■ *Technology for Self Reliance* ■



Telex: 24676 UNAAB NG
www.unaab.edu.ng
dvcacadunaab@yahoo.com
dvcacadunaab@gmail.com
waheedma@unaab.edu.ng
adekojo.waheed@daad-alumni.de
+234 806 120 2421

**FEDERAL UNIVERSITY OF AGRICULTURE,
ABEOKUTA, NIGERIA**
P.M.B. 2240, Abeokuta, Ogun State, Nigeria

7th October, 2015

Mrs. A.E. Kayode
St. Number: 215081971
University of KwaZulu-Natal: Edgewood Campus
College of Humanities: School of Education
Private Bag X03, Ashwood, 36005, Durban
South Africa

Dear Mrs. Kayode

**RE: REQUEST TO CONDUCT RESEARCH STUDY IN YOUR
UNIVERSITY IN NIGERIA**

Kindly refer to your letter dated 29th September, 2015 on a request to conduct research work in our University.

I write to inform you that your request for permission to conduct a research study in the Federal University of Agriculture, Abeokuta, Ogun State by collecting information in the form of questionnaires and focus group interviews which will assist you to answer the research questions accordingly is hereby granted.

Please contact the Office of the Deputy Vice-Chancellor (Academic) on your arrival for the research study.

Thank you.

Yours sincerely

[Signature] 07/10/15
DEPUTY VICE CHANCELLOR(ACADEMIC)
FED. UNIVERSITY OF AGRICULTURE AND
P M B 2240 Prof. Adekojo Waheed
(M. Eng., Ph.D, MNSE, R.Eng COREN)
Deputy Vice-Chancellor (Academic)

APPENDIX F: TURNITIN REPORT

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