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Faculty Access, Attitudes, and Use of Instructional and Web-Based Technologies in Nigeria's Teacher Preparation Program: A Mixed Method Study

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FACULTY ACCESS, ATTITUDES, AND USE OF INSTRUCTIONAL AND WEB-BASED TECHNOLOGIES IN NIGERIA'S TEACHER PREPARATION PROGRAM: A MIXED METHOD STUDY

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Faculty in many developing countries are in the early stages of utilizing technology for teaching. This study seeks to describe faculty access, attitudes, and use of instructional and web-based technologies at five Federal Teacher Preparation Colleges (Federal Colleges of Education) in the north-west zone of Nigeria. Using an explanatory sequential design, quantitative data were gathered from 190 randomly selected faculty members; following which qualitative data were collected from ten volunteers.

Data were analyzed in two phases. In phase one, quantitative data were analyzed using the Statistical Program for the Social Sciences (SPSS, v.25), and in phase two, qualitative data were analyzed using Nvivo (v.12). Descriptive statistics show that respondents have access to some instructional and web-based technologies. Despite this, technology continues to be underutilized across the different colleges. Respondents indicated that they had not used several technologies for teaching, even though, they have access to these technologies and had favorable attitudes towards technology integration for teaching.

Inferential statistics reveal that access to instructional and web-based technologies significantly influenced respondents' attitudes and utilization. Similarly, faculty teaching experience, years of teaching with technology, and level of education significantly influenced respondents' technology utilization. Respondents' gender and age have no impact on their technology utilization. Qualitative findings corroborate the quantitative findings in many ways.

Interviewees revealed that access to technology professional development was varied and limited. Recommendations for practitioners include attending technology conferences, reading books written by experts, especially in best practices of teaching with technology, conducting mini-departmental PD, and utilizing Open Educational Resources (OER) and free Learning Management Systems (LMS) like Moodle, Dot Learn, Schoology, Canvas, and Edmodo, to the maximum. It is also recommended that administrators and policymakers should increase their efforts to provide sufficient access to relevant technologies and service centers across all teacher preparation colleges in Nigeria.

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CHAPTER ONE

INTRODUCTION

The world is experiencing a wave of rapid growth in the information and communications technology industry. According to Bon (2010), around the world, technological advancements, global telecommunications, and automation have contributed immensely to economic growth; however, some countries in other parts of the world have not benefited equally from the advancements experienced in the information age. Bon (2010) maintains that industrialized countries had reached enormous economic growth digits, while the developing countries were at a disadvantage, and did not benefit equally regarding favorable conditions for deployment of technological innovations. Bon (2010) further elucidates that researchers have explained the difference in access to information technology as a digital divide. This has eventually widened the digital divide between developed and developing countries. Like many developing countries, Nigeria faces myriads of challenges regarding technology integration in education. These challenges are multifaceted. Some are due to infrastructure, some are institutional, and some are related to the workforce. This study seeks to describe faculty access, attitudes, and use of instructional and web-based technologies for teaching in Nigeria's teacher preparation program. This chapter provides a succinct overview of the study. This includes the background of the study, statement of the problem, the purpose of the study, and research questions. This chapter also briefly describes the theoretical framework, significance of the study, the research design, data collection, delimitations of the study, and limitations of the study. It concludes with the operational definition of the terms utilized within the study.

Background of the Study

Toward the end of the 20th-century, rapid growth in technology prompted educational leaders to recommend integration of technology into education (Henson, 2010). These technologies included but were not limited to computers, tablets, internet connection, and one-on-one initiatives. Nigeria's Federal Government recognizes the influence of Information and Communication Technology (ICT) across all sectors of society. In 2007, the government under the Federal Ministry of Education endorsed the integration of ICT in the country's educational institutions across all levels (Garba & Alademerin, 2014). Additionally, the government recognized that "education is a viable tool for the attainment of national development" (Garba & Alademerin, 2014, p. 336).

The Federal Government took some steps to provide ICT infrastructures and fortify faculty competence toward meeting the national development goal. To attain this development, the Federal Ministry of Education (Department of Education), the National Educational Resource Center (NERC) and the National Universities Commission (NUC) worked out a wide-range of strategic plans. The NUC in 1992 introduced general studies courses in computer science (Introduction to Computer and Computer Application) as core and required subjects across all levels of educational institutions (Universities, Colleges of Education and Polytechnics) (Garba & Alademerin, 2014). Additionally, the federal government, through the Education Tax Fund (ETF) equipped higher institutions (Universities, Colleges of Education and Polytechnics) with working computers as an intervention program to provide a technology-rich learning environment. Through "these institutions' administrators, Education Trust Fund (ETF), and Petroleum Technology Development Fund (PTDF) provided computer labs and high-speed cable and wireless internet services, as well as e-libraries for students' use" (Garba, 2014; Garba &

Alademerin, 2014, p. 337). The government has made a tremendous effort in the recruitment (hiring) of competent teachers that can teach in technology-rich learning environments. The National Policy on Education (NPE) decree authorizes the provision of ICT tools to faculty (lecturers) in all tertiary institutions (FRN, 2004; Garba & Alademerin, 2014).

In addition to these efforts and developments, Garba & Alademerin (2014) explained the statement of the revised NPE (2004) by saying that

> Computer science as a compulsory subject for all students in primary and junior secondary schools; making it mandatory for state governments and the private sector education to make provisions for the technology-rich learning environment in all states and privately-owned schools as part of their accreditation requirements. (p. 338)

Furthermore, Garba and Alademerin (2014) pointed out that the revised National Policy on Education (2004) recognizes the teaching of computer science as a necessary step towards ensuring that 1) students at the end of their three years of junior secondary (junior high school) education should be competent in the use of technologies for educational and personal use; and 2) students at the end of their studies should acquire necessary ICT literacy skills as a sound basis for the use of information technology in higher education (Garba & Alademerin, 2014, p.340).

Garba and Alademerin (2014) explain the different trainings teachers receive and this training form the basis of their recruitment into teaching profession by saying that

> Candidates with Nigeria Certificate in Education (NCE) and specialization in Computer Science were recruited to teach in primary schools, while university graduates with Bachelor of Education (B. Ed.), Bachelor of Science Education (B.S. Ed.), and Bachelor of Science (B.S. Computer Science) were recruited to teach in secondary school. (p. 336)

The federal ministry of education introduced an introduction to computers course in higher education (Polytechnics, Teacher Preparation Colleges, and Universities) as a general study course unit. This course was designed to provide students with necessary computer operation skills, knowledge of word processing, applications, and database management (Garba & Alademerin, 2014). A Computer Assisted Instruction (CAI) course was introduced in teacher preparation colleges as a method course in educational technology. This course is aimed at providing pre-service teachers with the technological and pedagogical knowledge that will enable them to teach effectively in the technological environment (Garba, 2014).

The National Policy on Education (NPE) emphasizes the importance of technological and pedagogical knowledge in education. The NPE charges stakeholders in education with the responsibilities of providing 1) in-service training and workshops for school teachers in pedagogical skills and competence in effective ways to use technology for teaching; and 2) training the pre-service teachers on how to integrate and utilize ICT tools in their pedagogical practices (Garba, 2014). Despite the government's efforts to equip schools with technological facilities, many faculty are reluctant to incorporate these technologies into teaching (Adeyemi & Olaye, 2010; Garba, Ranjit-Singh, Yusuf, & Ziden, 2013).

Statement of the Problem

Technology provides many opportunities for both faculty and students. Technology serves as an avenue for the expansion of educational access (Fu, 2013). Consequently, technology makes learning possible at any time, wherever there is access. Teaching and learning are no longer dependent on face-to-face interaction or learning from printed documents. Learners with the guidance of instructors can access multiple resources (tutorials, presentations, audios, videos, eBook, and print resources) on the internet, that way, making knowledge accessible

anywhere (Fu, 2013). Castro- Sanchez, and Aleman (2011) studied teachers' opinions on the use of ICT tools to support attendance-based teaching. They found that technology plays an integral role in transforming teaching and learning atmosphere into a more learner-centered one.

Technology-rich classrooms support active learning. Teachers serve as guides by directing learners to make decisions, plan, and take control of their learning (Lu, Hou & Huang, 2010). There is empirical evidence to show that technology sustained education enhances learning process and develops students' skills for lifelong learning. Onyia and Onyia (2011) conducted a mixed methods study that investigated faculty perceptions of technology integration across Nigerian universities. The researchers used Pearson product-moment correlation to analyze quantitative data from 60 faculty and used the constant comparison method to analyze interview data. The researchers found that there was a strong relationship between faculty perception of technology integration and their self-efficacy (Onyia & Onyia, 2011). They recommended among other things, a need to expose faculty to opportunities and possibilities of what technology offers in education, as well as to devise a means to deal with faculty fears regarding the adoption of instructional technologies.

Currently, faculty in Nigeria's teacher preparation program are still in the early stages of utilizing technology for teaching (Garba, Ranjit-Singh, Yusuf, & Ziden, 2013). A majority of faculty have low education and technology literacy levels (Garba, Ranjit-Singh, Yusuf, & Ziden, 2013). There is a lack of awareness about the capabilities of the technology and the absence of skills needed to develop technology-based instruction. This, in turn, has caused a significant obstacle to adoption and utilization of ICT facilities for teaching (Garba, Ranjit-Singh, Yusuf, & Ziden, 2013; Owolabi, Oyewole, & Oke, 2013). Owolabi, Oyewole, and Oke (2013) maintain that even though some professional development workshops and conferences were organized on

a regular basis, a majority of faculty that use instructional technologies for teaching are those that have studied computer science and related disciplines.

Many of Nigeria's faculty were trained before technology became a major component of education and the learning process, except for some educators trained overseas. Faculty are uncomfortable or unskilled in using instructional technologies (Onyia & Onyia, 2011). As a result, many faculty tend to use traditional didactic methods. Therefore, this may have the potential to affect pre-service teachers' ability to learn how to integrate technologies into their teaching and eventually may lead to the production of unskilled and unprofessional teachers at various levels of education in the country where services of these teachers are required (Onyia & Onyia, 2011).

More than a decade ago, the National Policy on Education (2004) required that Nigeria's education develop a computer literate society and produce a generation of schoolchildren who would appreciate the potential of computer technology and be able to use it in various aspects of their lives. However, Nigeria has not realized this vision. At all levels of education, including teacher preparation program, ICT and web-based technologies continue to be underutilized (Garba, Singh, Yusuf & Zaiden, 2013; Onasanya, Shehu, Oduwaiye & Shehu, 2010). Understanding faculty access, attitudes, and the use of instructional and web-based technologies would facilitate the government's, administrators', and stakeholders' ability to predict faculty use of technology as they become available.

Purpose of the Study

This study uses Rogers's Diffusion of Innovation Theory (1995) and Davis, Bagozzi, and Warshaw's (1989) Technology Acceptance Model (TAM) to describe faculty access, attitudes,

and the use of instructional and web-based technology for teaching at Nigeria's Teacher Preparation Colleges.

Research Questions

This study is guided by the following research questions:

1. Which instructional and web-based technologies do faculty have access to and to what extent do they use them for teaching?
2. What are faculty attitudes toward the utilization of instructional and web-based technologies for teaching?
3. What relationships exist between faculty access to technology, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization for teaching?
4. Are there group differences in technology utilization among faculty across gender, age, teaching experience, years of teaching with technology, and level of education?
5. Does access to technology, technology attitudes, perceived usefulness, and perceived ease of use impact faculty technology utilization for teaching?

Theoretical Framework

For this study, the researcher used Rogers's Diffusion of Innovation Theory (1995) and Davis, Bagozzi, and Warshaw's Technology Acceptance Model (1989). As evident from the research questions, this study is grounded in the theoretical and empirical works related to three areas,

1. Faculty access to technology,
2. Faculty attitudes toward technology, and

3. Faculty use of technology for teaching.

The researcher used the Diffusion of Innovation Theory and explained how the theory applies to faculty in Nigeria. Rogers (1995) defines diffusion as the "process by which an innovation is communicated through certain channels over time among members of a social system" (p. 5). Rogers maintains that diffusion has distinctive characteristics because of the newness of the idea in the message content. An individual's degree of uncertainty can be reduced by obtaining information. Rogers explains that adopting or rejecting an innovation is dependent on the following five stage,

1. Knowledge,
2. Persuasion,
3. Decision,
4. Implementation, and
5. Confirmation (p. 36).

These stages demonstrate the sequence of processes involved in the decision to accept or reject any innovation. The decision to use technology in education and especially for teaching is dependent on faculty decision to accept the technology and their readiness for adoption. Figure 1 shows the stages of the decision innovation process created by Wikipedia contributors.

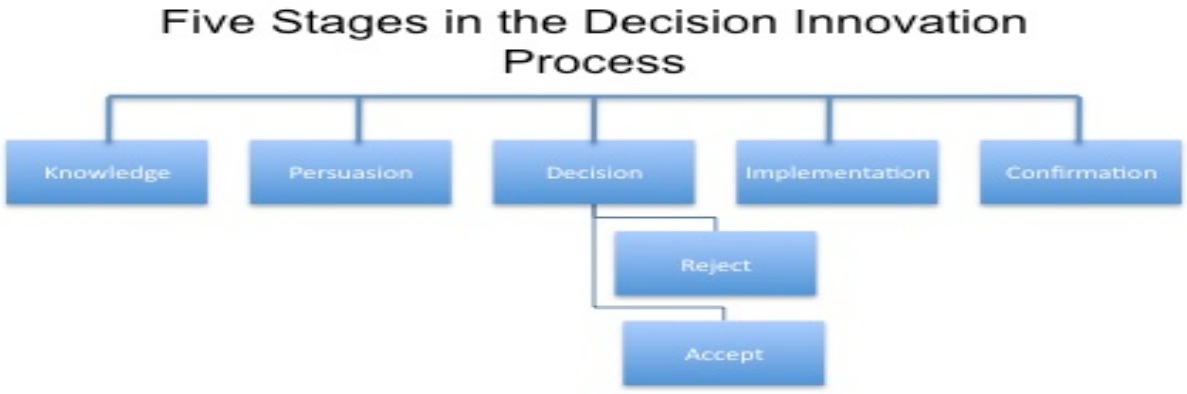

Figure 1. Five stages in the decision innovation process. Adopted from "Diffusion of Innovation" in *Wikipedia*, The Free Encyclopedia. Retrieved June 24, 2019 from https://en.wikipedia.org/w/index.php?title=Diffusion_of_innovations&oldid=884169271

Additionally, the researcher used Davis, Bagozzi, and Warshaw's Technology Acceptance Model (TAM) (1989) to explain how faculty adopt technology for instructional purposes. Figure 2 shows the various elements of the TAM. Faculty are the key players in this study. TAM is composed of six elements which depict the process of attitude formation and the actual system use. They include external variables, perceived usefulness (PU), perceived ease of use (PEU), attitude toward (A), behavioral intention to use (A), and actual system use. In this study, the external variables are ICT tools available in schools, and faculty are the key players.

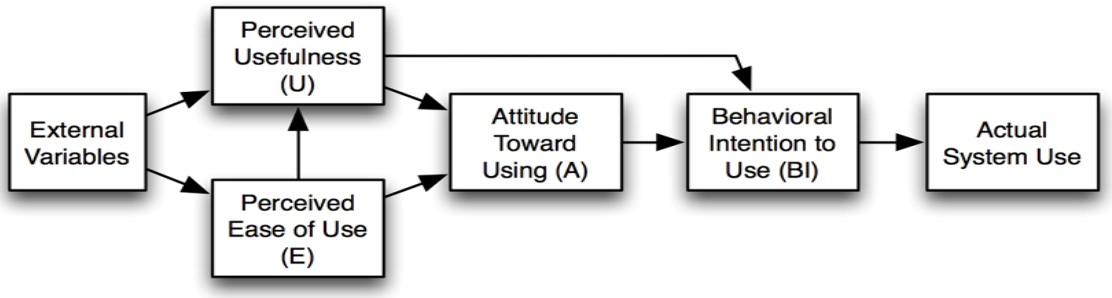

Figure 2. Technology acceptance model. First Modified Version Adapted from "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," by F. Davis, R. P. Bagozzi and P. R. Warshaw, 1989, *Management Science, 35*(8), p. 985. Used with permission.

Faculty perceived usefulness and ease of use of available technologies leads to attitude formation on the acceptance or rejection of technologies. Venkatesh, Morris, Davis, and Davis (2003) define attitude as "individual's positive or negative feeling about performing the target behavior (e.g., using a system)" (p. 426). TAM provides a conceptual framework for predicting facilitating conditions on the acceptance and use of technology.

Significance of the Study

The findings of this study would be useful to administrators, practitioners, and policymaker in the following ways:

1. The literature would provide faculty with valuable information on how attitudes may influence the decision to incorporate instructional and web-based technologies in the delivery of instructions in the classroom.
2. The study would provide faculty with the knowledge of how their perceptions about the benefits of technology integration may affect the adoption of technologies for teaching.
3. The study would enable faculty and administrators to understand the relationship between technological competence and integration for teaching.
4. The study would aid administrators, practitioners, and policymakers to understand the interrelationships between access to technology and integration in the classroom, thus enabling them to shift from traditional instruction to technology-enriched cooperative learning.
5. The study would allow administrators (Provosts, Registrars, Deans, and Chairs of departments) in teacher education settings to plan outstanding professional

development program for faculty to enhance their knowledge and self-efficacy toward the integration of these tools for instructional purposes.

Research Design

The researcher used a mixed method approach with an emphasis on explanatory sequential design and investigated faculty access, attitudes, and use of instructional and web-based technologies for teaching. In this study, the researcher used the flowchart of the explanatory sequential design by Creswell (2012) with permission. Figure 3 shows the explanatory sequential design. The researcher first used surveys and obtained quantitative data for the study. Following this, the researcher used the interview protocol (semi-structured) and generated qualitative responses from volunteered participants. The interview portion gave respondents the ability to express their ideas about the topic of discussion in detail. The researcher interpreted how qualitative data explained and strengthened the quantitative results (Creswell, 2013).

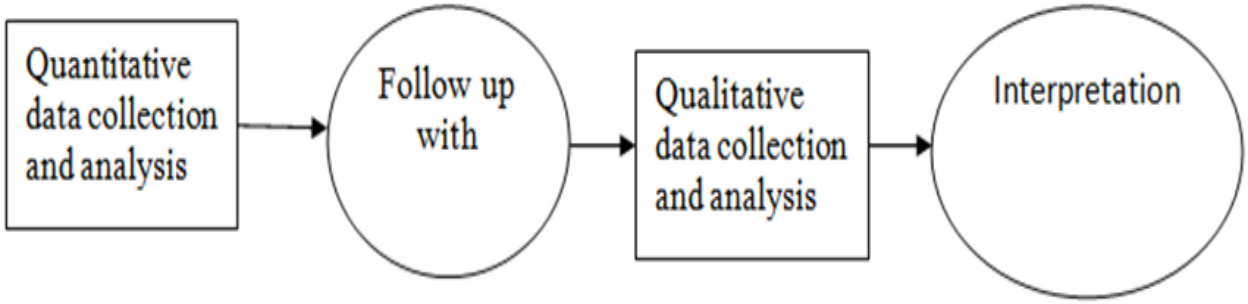

Figure 3. Explanatory sequential design. Adopted from "Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research," 4th, by J. W. Creswell; ©2012. Reprinted by permission of Pearson Education, Inc., New York, New York.

Population, Samples and Sampling Techniques

There are 22 federal teacher preparation colleges in Nigeria. The population for this study included faculty from only five colleges located in the north-west geopolitical zone. The north-west zone consists of seven states, namely: Jigawa, Kano, Katsina, Kebbi, Sokoto, and Zamfara

State. The researcher chose to conduct the study in this zone only due to lack of time and resources to cover all colleges in six geopolitical zones. The researcher used a proportional sampling technique and selected quantitative samples for the survey, and non-probability sampling technique (volunteer sampling) (Creswell, 2012; Gay, Mills, & Airasian, 2009) for interviews.

Data Collection

The researcher used a self-developed survey and interview protocol and obtained quantitative and qualitative data respectively. The researcher administered the survey online through Qualtrics and analyzed data generated using appropriate statistical tests in the Statistical Package for the Social Sciences (SPSS, v.25). Additionally, the researcher conducted one-on-one interviews (through phone calls or Skype) and obtained qualitative data. Interviews enable the researcher to get in-depth information regarding faculty access, attitudes, and use of instructional and web-based technologies for teaching. Both versions of the interview protocol were face validated by representatives of Applied Research Lab (ARL) and five faculty who were actively involved in teacher preparation but varied regarding their expertise with instructional technology (Trochim, 2006). The researcher transferred interview data into Nvivo software, created codes, generated meaning units, and analyzed responses for interpretation.

Delimitations of the Study

The following delimitation set the boundaries for this study:

1. Currently, Nigeria has 85 teacher preparation colleges. These include 22 Federal Colleges of Education owned by the federal government, 47 state-owned colleges, and 16 private owned colleges. Including all these colleges within this study would be very difficult, if not impossible. As such, this study includes faculty

from only five teacher preparation colleges (Federal College of Education) located in seven north-western states.

2. This study does not include state and privately-owned teacher preparation colleges in Nigeria.
3. The study is not designed to investigate the influence of ICT use in teaching on students' success.
4. This study is not intended to investigate preservice teachers' attitudes towards their professors' use of technology.

Limitations of the Study

This study is limited in the following ways:

1. The study is limited to faculty in only five of the twenty-two federal teacher preparation colleges in Nigeria's north-west geopolitical zone, comprised of seven north-western states. As such, findings from this study should be generalized with caution.
2. The qualitatile findings were limited by the interviewees' abilities to interpret and respond to questions.
3. Qualitative data did not reach the satisfaction of the researcher. Interviewees were not willing to talk extensively on various topics during the interviews. This affected immensely the quality of qualitative data obtained.
4. Sources of data variation may arise because these colleges may be at different stages of technology integration. The sample comprised of many more males than females. Therefore, the findings are not generalizable but could be transferrable with caution.

Operational Definition of Terms

The researcher operationally defined the following terms used in this study:

1. Attitudes: Faculty's positive or negative feeling about the use of ICT for teaching.
2. Technology Integration: Efficient use of computer technology to enhance instructional delivery.
3. Technology Utilization: The use of computer and web-based technologies to facilitate teaching.
4. Web-Based Technologies: Online-based technologies that allow for collaboration, transfer, and creation of content and knowledge. They include Learning Management System (LMS) like Desire2Learn (D2L), Moodle, and web 2.0 technologies (Google Documents, Wikis, Zaption, Zoom, Nearpod, and YouTube).
5. Teacher Preparation Colleges: These are teacher-training colleges (Colleges of Education) that offer minimum teaching certification in Nigeria.
6. Instructors/Lecturers: The title used by faculty who teach in the teacher preparation program in Nigeria.
7. Years of Service: The number of years spent by faculty (Instructors/Lecturers) teaching in college.
8. Geopolitical Zone: A major division in Nigeria created during the regime of President Babangida. It forms the basis for sharing Nigeria's economic, political, and educational resources across the country (Eze, Okpala & Ogbodo, 2014).

Summary

Even though the federal government is investing in the procurement of technology at all levels of education (primary, secondary and higher education), Nigeria's faculty lag behind in regard to technology use for teaching at all levels. The researcher used a mixed method approach with an explanatory sequential design to study faculty access, attitudes, and use of instructional and web-based technologies for teaching. Faculty in teacher preparation program underutilize instructional technology. The researcher used Rogers's Diffusion of Innovation Theory and Davis, Bagozzi, and Warshaw's Technology Acceptance Model as the theoretical framework for this study. The researcher used a convenience sample drawn from five federal teacher preparation colleges in the north-west geopolitical zone. The researcher used a proportional sampling technique to select survey respondents and a non-probability sampling technique (volunteer sampling) to select interviewees. In chapter 2, the researcher presents the review of related literature that guides the design of this study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Instructional technology has the potential to empower faculty members in educational settings. Nigeria's teacher educators make limited use of instructional and web-based technologies for teaching (Garba, Ranjit-Singh, Yusuf, & Ziden, 2013). In Nigeria, there is the absence of relevant empirical studies that explore faculty access, attitudes, and use of instructional and web-based technologies for teaching. This study was designed to describe faculty access, attitudes, and use of instructional and web-based technologies in Nigeria's Teacher Preparation Program. This chapter begins with a brief overview of the historical development of teacher preparation program in Nigeria. It then synthesizes research on ICT in education, web-based technologies in the classroom, and ISTE standards. Furthermore, the chapter discusses research on ICT and web-based technologies in Nigeria's Teacher Preparation Program and faculty attitudes towards technology integration. This chapter concludes with a synthesis of literature related to the theoretical framework (DOI and TAM) for this study.

A Brief Overview of the Historical Development of Teacher Preparation in Nigeria

The definition and understanding of teacher preparation (teacher education) are standard around the globe. Fallon (2006) describes the field of teacher education as "those programs of instruction based at colleges and universities that are designed to prepare college students or graduate students for careers as K-12 teachers, and that lead to certification as professional teachers" (p. 140). Darling-Hammond (2010) explains teacher preparation as an array of learning and training before and during the development of a teacher. Darling-Hammond went on to explain further that teacher preparation contains a formalized educational opportunities and

training of pre-service teachers getting ready for the world of the teaching profession. Of course, this conceptualization provides a link between teacher preparation and teacher development.

According to Labree (2008) "teaching existed long before teacher education" (p. 291). In the early nineteeth century, before the arrival of western civilization, there existed a traditional system of education in Nigeria (African traditional education or indigenous education) where functionalism was the primary guiding principle (Fafunwa, 1974). This system of education took place in some ways and settings. For example, teaching at home, church, public gatherings, and apprenticeships all acted with functionalism. The setting in one way or another determines the expertise and identity of the trainer (teacher). These trainers could be fellow members of the community. They could be a parent, a pastor (preacher), an artisan, a leader of an association, an official, or an adult in the community (Labree, 2008).

Western education (formal education) began to penetrate African societies in the 15th century through the activities of British and French Christian Missionaries. These activities paved ways for the initiation of western culture, which resulted in the beginning of western education (formal education) across the continent at large (Adeyemi & Adeyinka, 2003). The arrival of Christian Missionaries in the 1840s marked the beginning and development of western education (formal education) in Nigeria (Fafunwa, 1974). The rapid expansion of missionary activities on the west coast, which transformed into formal education through the ministries (churches), prompted the need for teachers (Jibril, 2007). Between the 1840s and 1860s, various church missions were present in Nigeria. They included the Wesleyan Methodist, the Church Missionary Society (CMS), the Baptist, the Presbyterian (Church of Scotland), and the Roman Catholic (Jekayinfa, 1999). These church missionaries contributed immensely to the development of formal education as well as teacher training (Fafunwa, 1974; Jekayinfa, 1999).

At that time, the missionaries invested their time and resources to establish primary (elementary) schools around the west coast. They "trained their teachers through the pupil-teacher system" (Jekayinfa, 1999, p. 1). Under this system, teachers took on the responsibilities of teaching and training older students (of about 15 years of age) to become teachers after writing and passing the Standard Five (V) Examination. These students would later serve as pre-service teachers in their communities. Continuing this system, headteachers would offer a one-hour daily teaching training class to those pre-service teachers. This initial training course would last for two years, after which pre-service teachers would take a certification test (pupil-teacher examination) and become certified to teach (Fafunwa, 1974; Jekayinfa, 1999).

The Expansion of Earlier Teacher Training in Nigeria

Western education came to Nigeria from the activities of Christian Missionaries. There is an abundance of literature that traces the origin of the teacher preparation program back to the very beginning of formal education in the days of early Christian Missionaries' education system. Jekayinfa (1999) explains that the Church Missionary Society established the first teacher preparation college called the Training College in Abeokuta in 1859, and in 1896, this Training College relocated to Lagos. A year later, in 1897, the Baptist Mission established another college called the Baptist Training College at Ogbomoso (Fafunwa, 1974; Jekayinfa, 1999).

In 1905, the Wesleyan Methodist Missionary Society founded an institution for the training of catechists and teachers in Ibadan (Fafunwa, 1976; Jelayinfa, 1999). Thirteen years later in 1918, the institution was renamed the Wesleyan College, where pre-service teachers were provided with adequate training to become effective teachers at that time (Ogoyinka, Okeke, & Adedoyin, 2015). The missionaries simultaneously organized teacher preparation colleges in the

west coast and extended their activities to the eastern part of Nigeria by providing education and training to teachers in pre-colonial Nigeria (Fafunwa, 1974; Ogoyinka, Okeke, & Adedoyin, 2015).

Western (formal) education was offered in only some parts of Northern Nigeria due to several factors. First, Islamic practices and education dominated the region (Fafunwa, 1794). Children were enrolled in Islamic schools as early as when a child began to talk and walk. There was no official documentation for children to get enrolled in Islamic schools. Younger children could go with their older siblings for part of the day. These practices prevented early acceptance of western education across the region. At that time, northerners viewed western education as anti-cultural and un-Islamic because of its origin. It was for these reasons that British colonial masters were only able to start schools in Nassarawa in 1909 (Fafunwa, 1974; Jekayinfa, 1999).

The arrival of British colonial masters in 1861 marked another significant period in the development of education and teacher preparation colleges (Fafunwa, 1974; Jekayinfa, 1999). The British colonial masters expressed the need for reviewing the education system and teacher training in general as a result of rapid development and educational expansion. The review was aimed at uniting the juvenile education system at that time (Ogoyinka, Okeke, & Adedoyin, 2015). A sequel to this was the inauguration of the Phelp-Stocks commission, which was charged with the responsibility of reviewing the current teacher preparation program and the colleges in general (Fafunwa, 1974; Ogoyinka, Okeke, & Adedoyin, 2015). The Phelp-Stocks commission's report criticized the Christian Missionaries' teacher preparation colleges system at that time. The commission's report addressed the criticism and recommended the following:

1. The establishment of two types of teacher training (teacher preparation) institutions, i) the Elementary Training Colleges (ETC), charged with the duty of

training early childhood education teachers, and ii) the Higher Elementary Training Colleges (HETC), for the training of primary and middle level education teachers.

2. The training in both schools (ETC and HETC) should last for two years with the award of Grades II and III certification. This type of training and certification has been the practice until the establishment of the Ashby Commission (Fafunwa, 1974; Jekayinfa, 1999, Ogoyinka, Okeke, & Adedoyin, 2015).

Ashby Commission and the Renaissance in Teacher Preparation Program

The Sir Eric Ashby Commission (The Ashby Commission) marked the beginning of an important era in the development of teacher preparation program in Nigeria. In 1959, the central government established this commission and assigned the responsibility of investigating the workforce requirements of Nigeria within the teacher preparation program and education system as a whole (Ogoyinka, Okeke, & Adedoyin, 2015). The report produced by this commission describes education as the driving force for achieving national development and a vital tool for national cohesion (Fafunwa, 1974; Jekayinfa, 1999). Regarding teacher preparation, the Ashby Commission in their report recommended the following:

1. The government should open more universities.
2. The beginning of more degrees in education that would lead to teacher certification. For example, Bachelor of Arts in Education (B. A. Ed.) and Bachelor of Science Education (B.S. Ed.), as this will enable the universities to produce teachers that are more efficient.

3. The training of in-service teachers to acquire relevant and adequate training in teaching through the acquisition of a Post Graduate Diploma in Education (PGDE) (Fafunwa, 1974; Jekayinfa, 1999; Ogoyinka, Okeke, & Adedoyin, 2015).

Ogoyinka, Okeke, and Adedoyin (2015) explain that the report and recommendations of the Ashby Commission of 1960 were significant milestones in the development of teacher education.

Nigeria gained independence on October 1, 1960, from the British Colonialists. A few years later, in 1967, the newly independent Nigeria embarked on an unfortunate civil war, which lasted until 1970. The civil war started because some southern states claimed to be an independent state called Biafra (Ogunyinka, Okeke, & Adedoyin, 2015). This rather unfortunate event had a devastating effect on Nigeria's socio-economic development and the juvenile educational system. Ogunyinka, Okeke, and Adedoyin (2015) explain that the experience of the civil war and the repercussions that followed revived Nigeria's trust in using education as a significant instrument for national unity, nation-building, and patriotism.

The post-civil war Nigeria period witnessed a rapid expansion of teacher education and education at large. The post-independence decade ended with yet another critical document: "the report of the National Curriculum Conference of 1969" (Jekayinfa, 1999, p. 130), and the National Policy on Education (NPE) document emerged in 1977. The NPE document marked the beginning of the new era of education and teacher training in particular (Ogunyinka, Okeke & Adedoyin, 2015). This policy document is still in use in present-day Nigeria with some revisions to fit in the technological challenges of the twenty-first century (Jekayinfa, 1999).

Teacher Preparation Colleges in Nigeria

In Nigeria, teacher education programs are entirely under the care and supervision of the National Commission for Colleges of Education (NCCE). The federal government established

the NCCE in 1990 (NCCE, 2016). The NCCE is responsible for setting minimum standards for all federal, state, and private colleges of education across the country (NCCE, 2016).

The NCCE in collaboration with some departments in the federal ministry of education (Department of Education) developed and set standards for the teacher certification. The federal, states and private colleges must strictly adhere to these established standards to maintain their license to provide licensure to teacher candidates. The NCCE is responsible for conducting accreditation of all teacher preparation colleges (Federal, State and Private) across the country (NCCE, 2016). This commission also set the requirements for admission (acceptance) into the teacher preparation program. NCCE (2016) states that the minimum entry requirements are at least three credits in addition to Math and English from high school certificate examination (West African Certificate Examination, National Examination Council, or National Business and Technical Examinations Board).

Currently, there are 85 Teacher Preparation Colleges in Nigeria. The federal government owns 22 Federal Colleges of Education (FCE), the state governments own 47, and private individuals own 16 (NCCE, 2016). The federal government funds the federal colleges of education through the federal ministry of education (Department of Education), while the state governments fund the state colleges, and individuals fund the private colleges.

Pre-service teachers obtain National Certificate in Education (NCE) after completion of three years of training. NCE is the minimum required licensure for teaching in elementary schools, junior secondary schools, and technical schools (Junaid & Maka, 2015). According to NCCE (2016), in 1998, NCE became the lowest licensure for primary and pre-primary (Pre-K to 8th grade). Over the last decade, NCCE is expecting pre-service teachers to be technology competent in addition to competence in pedagogy. The following section is devoted to discussing

ICT trends around the world and Nigeria in the context of teacher preparation programs regarding the past, present, and prospects.

Information and Communication Technology (ICT) in Education

We have left behind the agricultural age of the nineteenth century, the industrial age of the early twentieth century, the post-industrial age of the final quarter of the 20th century (Henson, 2010). We are now in the twenty-first century. We are witnessing the period of substantial changes that were never experienced by any civilization before. We have entered a new information age that challenges education leaders, the existing schooling, and our way of thinking about learning. Education systems shifted into a new paradigm by embracing technology as an important tool to address this change (Henson, 2010).

The education system has embraced technology due to the nature of students in our classrooms. Prensky (2006) explains that the education of children born in the digital age (digital natives) is significantly affected by this change. Conversely, Cuban (2001) recognizes the change but argues that the education system is not ready to go with the innovation. In his book, *Oversold and Underused: Computers in the Classroom,* Cuban (2001) explains the idea and the rate at which technology integration movement in education is gaining momentum. Cuban (2001) emphasizes at that time that computers in the classroom might be regarded as a failure due to lack of evidence to show that technology in the classroom enhances teaching and learning. Ferending (2003) points out that, in the United States, the topic of technology integration in education was politically driven in the late 1990s. The election of President Bush in 2001 and the passage of the No Child Left Behind (NCLB) Act may have a significant influence on educators' decisions regarding technology integration (Ferending, 2003).

The No Child Left Behind (NCLB) Act of 2001 created a significant drawback in technology integration in K-12 classrooms (Ferending, 2003). The NCLB Act rendered schools and teachers more hesitant to try an innovation in school buildings and classrooms (Ferending 2003). The NCLB Act changed and obliterated many of the national educational goals of 1999. The NCLB claims that "if the educational technology is not being used to raise standardized test scores, there is no need for the technology or its funding" (Franklin & Bolick, 2007, p. 14). Because of this claim, the federal government cut funding, which resulted in long-lasting effects not only to schools' technology integration initiatives but also to research on the prospects of technology integration in schools (Franklin & Bolick, 2007).

In 2004, "the U.S. Department of Education undertook a strategic review and revision of the National Education Technology Plan (NETP) of 1999" (U.S. Department of Education, 2004, p. 64) and came up with a document entitled *Toward a New Golden Age in American Education: How the Internet, the Law, and Today's Students Are Revolutionizing Expectations.* In the document, the U.S. Department of Education (2004) emphasizes the shift brought about by technology

> We have reached a turning point. All over this country, we see evidence of new excitement in education, a new determination, a hunger for change. The technology that has so dramatically changed the world outside our school is now changing the learning and teaching within them. (p. 6)

Since 2004, the United States has accepted technology integration at all levels of education (U.S. Department of Education, 2004).

The United States public schools experienced a significant change in infrastructure and internet access. Franklin and Bolick (2007) argue that "without internet access, the usability of

technology for instructional purposes is significantly limited" (p. 36). This prompted the federal government to provide more funding for the procurement of high-speed internet connection across schools. In 2014, the Federal Communications Commission expanded the E-rate's annual spending from $2.4 to $3.9 billion (Herold, 2015). The aim of this budget increase was "prioritizing broadband and WiFi, increasing price transparency, and enacting new rules designed to help rural districts get access to fiber-optic cable" ("94 Percent of School Districts," 2017, p. 2). However, with the increased in budget and procurement of new technologies across US public schools, access to technology and internet connection is still not efficient. Bushweller (2017) reported that

> Access to reliable, high-speed internet connectivity, has become an essential element of many digital tools and strategies. Yet, internet access still varies widely from school to school, and district to district. Amid new leadership at the Federal Communications Commission, the future of the E-rate program been called into question, with particular concerns about impacts on rural and low-income districts. (p. 1)

Furthermore, in the National Science Board (2018) Harrigan (2014) reported that

> Students in high-minority schools were half as likely to have high-speed internet as students in low-minority schools, and students in low-income schools or remote areas were twice as likely as students in affluent schools or their urban and suburban peers to have slow internet access at their schools. (p. 87)

Accessibility is certainly an issue, but perception about technology integration is also a problem. Around the world, several researchers have conducted studies to investigate technology accessibility and integration across all levels of education.

In the United States, several researchers have conducted studies on teachers and faculty access to and use of instructional technologies in both K-12 and higher education classrooms. These studies covered a broad range of topics that included technology beliefs (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sandurur, 2012), technology access (Pittman & Gaines 2015), technology acceptance and use in teaching (Blackwell, Lauricella, & Wartella 2014). Other researchers have studied the variability in attitudes between urban and rural school teachers (Howley, Wood, & Hough 2011).

Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sandurur (2012) conducted a qualitative study that examined critical relationships between teacher's beliefs and technology integration in a K-12 setting. The researchers adopted a multiple case study method and studied 12 K-12 teachers. They found that there was a significant relationship between teachers' beliefs about technology and its actual use in the classroom. They also found that access to technology did not influence teachers' beliefs and technology use. Blackwell, Lauricella, and Wartella (2014) conducted a quantitative study and investigated factors that influence early childhood educators' use of technology for teaching in the U.S. Researchers used path modeling and explored the extrinsic and intrinsic factors that determine early childhood educators' use of digital technology in teaching. The researchers restricted the study to only participants associated with the National Association for the Education of Young Children (NAEYC). They found that teachers' attitudes toward technology have the strongest effect on technology use. Additionally, technology support available in schools also was a significant influence on teachers' use of technology. The researchers also found that teachers' confidence levels and teaching experience influenced their use of technology for teaching.

Pittman and Gaines (2015) used a quantitative approach and investigated how teachers integrate technology in 3rd through 5th grades in Florida. The researchers examined the possible effects of teacher technology access, attitudes and beliefs, and professional development on technology utilization. They reported that 18.7% of teachers who responded to the survey were at a high level of integration. Additionally, the researchers found that teachers' attitudes and beliefs and technology access have a significant correlation with technology utilization, mainly when students have direct access to computers.

Rural and urban teachers' attitudes toward technology vary. Howley, Wood, and Hough (2011) studied rural school teachers' use of technology by comparing rural and non-rural school teachers' attitudes toward technology integration. They used simple random sampling and disseminated surveys to 3rd-grade teachers in Ohio. Of the 514 teachers, 157 were rural, and 357 were urban. They found that rural teachers have more positive attitudes as compared to teachers' attitudes toward using technology for teaching in non-rural schools. Overall, the researchers found that teachers' attitudes and technology access have a significant relationship with technology use; however, there was no connection between school locations (rural or non-rural).

In higher education, researchers had conducted several studies and explored several aspects of faculty technology integration. Marzilli, Delello, Marmion, WcWhorter, Roberts, and Marzilli (2014) used a mixed methods approach to examine faculty attitudes toward the use of technology for teaching at a regional university in the United States. They used a convenience sample method and selected 72 full-time faculty members across 32 departments in five colleges within the university. They found that faculty have positive attitudes toward technology. Overall faculty have a high frequency of technology usage in their classrooms. Interestingly, they found that faculty technology skill levels have a significant correlation with technology use in the

classroom. Georgina and Hosford (2009) used a non-experimental quantitative study and examined the impact of faculty technology competence and training on their technology adoption in 15 peer universities in North Dakota. They discovered that there was a significant correlation between faculty technology competence and integration into teaching. Additionally, findings highlighted that there was no relationship between faculty technology training and utilization for teaching.

Mueller and Wood (2012) used a qualitative approach and studied the influence of teachers' beliefs, attitudes, and characteristics of computer integration across Canadian elementary and secondary schools' teachers. The researchers used an open-ended questionnaire and generated data. They found that the majority of teachers had positive beliefs and attitudes toward computer integration for teaching, but there was limited access to technology resources across schools. Also, they found that several teachers are faced with challenges regarding expertise in using these technologies for teaching by indicating having limited technological pedagogical skills to use technologies for teaching. Saxena (2017) maintains that Canadian teachers experienced issues while using technology for teaching. These problems included teachers' inability to put technological and pedagogical knowledge into practice. Moreover, there was a lack of access to up to date technologies across Canadian schools. Saxena (2017) argues that these impediments influenced teachers' attitudes and use of technologies for teaching.

In the United Kingdom, studies have shown that teachers are making limited use of ICT tools for teaching. Morley (2011) studied the impact of gender, age, and experience of primary school teachers use of ICT for teaching. The researcher found that teachers make limited use of technology, and they lack the necessary skills and confidence to use ICT in classrooms effectively. Also, the researcher found that gender and age do not determine teachers' technology

use in the classroom. Conversely, the researcher reported that teaching experience was most influential and determined to a large extent teachers' technology use for teaching and learning. Hennessey, Ruthven, and Brindley (2005) used a qualitative approach and studied teachers' perspective on technology integration for teaching in secondary schools. The researchers conducted 18 focus group discussions and studied teachers' commitment, constraint, and change in technology adoption. They used thematic analysis and analyzed responses generated. They found that teachers use ICT for teaching and attributed findings to enormous access to technology resources and schools' commitments to providing teachers with support and training.

The UK government increased its financial investments to equip schools with ICT tools. The government has spent £576.8 million ($728,409,600) and £556 million ($703,117,600) in 2009-10 and 2010-11 respectively and provided state schools with technology for effective learning (Nut, 2010). However, despite government's technological, infrastructural investments across UK public schools, the majority (60%) of teachers were at the lowest level of technology use for teaching (Rudd, Teeman, Marshall, Mundy, White, Lin, Morrison, Yeshanew, & Cardozo, 2009). In the following section, the researcher presents literature discussing different ways faculty have used web-based technologies for teaching.

Web-Based Technologies in the Classroom

Across all levels of education, students today differ significantly from the type of students that were present decades ago. Technological advancements present an excellent opportunity for students to access information at the time they want to, follow and share ideas, and make meaning of their world in ways that are meaningful to them (Solomon & Schrum, 2014). In this information age, it is vital for faculty to take advantage of these innovations and utilize them in teaching and learning. Integrating web-based technologies into teaching and

learning has become prominent over time. Henson (2010) maintains that using web-based technologies for teaching is beyond control. Solomon and Schrum (2014) argue that using web-based technologies for teaching is due to changing faces of a generation of students in our classrooms today. Solomon and Schrum (2014) maintain that "using tools that students find appealing can make a difference in their learning now and help them prepare for the future" (p. 1).

Devedzic (2006) asserts that web-based technologies are useful to learners and teachers. Learners use web-based technologies to access extensive information and knowledge sources. For teachers, web-based technologies present a unique opportunity for access to numerous tools for "developing web-based courseware, and cheap and efficient storage and distribution of course materials, hyperlinks to suggested readings, digital libraries, and other sources of references relevant for the course" (Devedzic, 2006, p. 2).

Technology continues to bring opportunities in the field of education to both students and teachers. In the United States, "the Common Core State Standards mandates technology use for learning and assessment" (Solomon & Schrum, 2014, p. 2). Additionally, in 2013, the United States government introduced the initiative "ConnectED" that aimed at enhancing digital learning in the United States (Solomon & Schrum, 2014).

Several researchers conducted studies that addressed different aspects of web-based technology use for teaching. Some researchers conducted their studies in preK-12 and ultimately at higher education levels. Capo and Orellana (2011) conducted a study and investigated high school teachers' perception and adoption of web 2.0 technologies in Florida. The researchers used convenience sampling and selected six out of 53 secondary schools in the region. Five of the six principals granted permission to conduct the study. Capo and Orellana found that over

60% of the 137 respondents indicate that web-based technologies might have the potential to improve student-teacher communication, but only a small fraction (10%) of teachers use those tools in their classroom on a regular basis. Otieno, Schulz, Tankovich, and Wang (2013) conducted a study in a K-12 setting to examine teachers' perceptions and use of web-based tools for student collaboration. The researchers only targeted teachers that used Facebook and their friends in a k-12 setting. They found that there was no relationship between teachers' perceptions of web-based technologies and use for teaching. They reported a strong correlation between teachers' usage of web-based tools outside the classroom and the subsequent usage in the classroom for instructional purposes.

Pritchett, Wohleb, and Pritchett (2013) conducted a quantitative study of certified educators' perceived importance of web-based tools in teaching in southeastern states in the United States. They examined the frequency at which educators used web-based tools and their perceived importance. Respondents include certified educators in some designated districts. The researchers used the Pearson product-moment correlation and analyzed responses regarding the frequency of using the listed web-based tools, and ANOVA to analyze responses from the perceived level of importance of web-based tools. They found that most frequently web-based tools used by educators are "virtual learning network, video sharing, and online event scheduling tools. Additionally, they found that educators perceived the use of web-based tools as essential for teaching.

There is a gap between developed and developing countries regarding the availability and use of web-based technologies (Acılar, 2011; Cruz-Jesus, Oliveira, & Bacao, 2012; Garba, 2014). Garba (2014) explains that, in Nigeria, government, policymakers, and stakeholders put forward efforts to bridge the gap regarding access and use of web-based technologies for

teaching. In the next section, the literature on the use of ICT and web-based technologies in Nigeria's teacher preparation program is discussed.

International Society for Technology in Education (ISTE) Standards

Today, we depend on technology more than ever before. Technology has been evolving faster than we could ever imagine. We continue to see new ways and opportunities that technology is offering in the field of education. We see the emerging technologies evolving and the "existing technologies becoming improved and extended" (Dugger, 2001, p. 1). Dugger (2001) opines that "it is particularly important in this technological world that people understand and are comfortable with the concepts and working with modern technology" (p. 1). This idea ignites the need for educators and policymakers to ponder on possibilities of including technological literacy into education. Dugger (2001) clarifies that "a growing number of voices worldwide have called for the study of technology to be included as a core subject in the elementary, middle, and secondary schools" (p. 2).

The growing confusion about educational technology and technology education necessitates the development of technology standards for educational technology and technology education. These standards were developed in the United States (Bybee, 2000; Dugger, 2001; Martin, 2015). The International Technology Education Association (ITEA) developed the Standards for Technological Literacy: Content for the Study of Technology. These standards focus on technology content knowledge for students in K through 12 grades. Teachers around the United States worked together to spell out what technology content that every student in K through 12 grades should know (Dugger, 2001). In the document, "Technology for All Americans Project," the ITEA along with National Research Council (NRC), and the National

Academy of Engineering (NAE) reviewed and set the Standards for Technological Literacy (Dugger, 2001).

The International Society for Technology in Education formally called the International Council for Computers in Education was founded in 1979. The mission of this organization "inspires educators worldwide to use technology to innovate teaching and learning, accelerate good practice and solve tough problems in education by providing community, knowledge and the ISTE standards, a framework for rethinking education and empowering learners" (ISTE, n.d.). The work of ISTE is benefited worldwide by stakeholders in education, policymakers, organizations, schools, administrators, educators, and students.

To guide the proper and effective use of technology for teaching, ISTE developed standards for students, educators, administrators, coaches, and computer science educators (ISTE, n.d.). The ISTE standards respond to the needs such as "inspiring student learning, model digital age work, and develop authentic learning experiences for students; and emphasize the importance of teacher as a facilitator of knowledge construction and aim to foster continued improvement in the field of education" (Martin, 2015, p. 16). The ISTE standards were designed to work with various learning models and support the implementation of content-area standards (ISTE, n.d.). Table 1 and 2 present the summary of ISTE standards for educators and education leaders adapted from the ISTE website with permission (Appendix M: Permission to Adopt International Society for Technology in Education [ISTE] Standards).

Table 1

ISTE Standards for Educators

S/N	Standards	Description
		Empowered Professional
1.	Learner Educators continually improve their practice by learning from and with other and exploring proven and promising practices that leverage technology to improve student learning.	Educators: a. Set professional learning goals to explore and apply pedagogical approaches made possible by technology and reflect on their effectiveness. b. Pursue professional interests by creating and actively participating in local and global learning networks. c. Stay current with research that supports improved student learning outcomes, including findings from the learning sciences.
2.	Leader Educators seek out opportunities for leadership to support student empowerment and success and to improve teaching and learning.	Educators: a. Shape, advance and accelerate shared vision for empowered learning with technology by engaging with education stakeholders. b. Advocate for equitable access to educational technology, digital content and learning opportunities to meet the diverse needs of all students. c. Model for colleagues the identification, exploration, evaluation, curation, and adoption of new digital resources and tools for learning.
3.	Citizen Educators inspire students to positively contribute to and responsibly participate in the digital world.	Educators: a. Create experiences for learners to make positive, socially responsible contributions and exhibit empathetic behavior online that build relationships and community. b. Establish a learning culture that promotes curiosity and critical examination of online resources and fosters digital literacy and media fluency. c. Mentor students in the safe, legal and ethical practices with digital tools and the protection of intellectual rights and property. d. Model and promote management of personal data and digital identity and protect student data privacy.
		Learning Catalyst
4.	Collaborator Educator dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources and idea, and solve problems.	Educator: a. Dedicate planning to collaborate with colleagues to create authentic learning experiences that leverage technology. b. Collaborate and co-learn with students to discover and use new digital resources and diagnose and troubleshoot technology issues. c. Use collaborative tools to expand students' authentic, real-world learning experiences by engaging virtually with experts, teams and students, locally and globally. d. Demonstrate cultural competency when communicating with students, parents and colleagues and interact with them as co-collaborators in student learning.
5.	Designer	Educators: a. Use technology to create, adapt and personalize learning experiences that foster independent learning and

	Educators design authentic, learner-driven activities and environments that recognize and accommodate learner variability.	accommodate learner differences and needs. b. Design authentic learning activities that align with content area standards and use digital tools and resources to maximize active, deep learning. c. Explore and apply instructional design principles to create innovative digital learning environments that engage and support learning.
6.	Facilitator Educators facilitate learning with technology to support student achievement of the 2016 ISTE Standards for Students.	Educators: a. Foster a culture where students take ownership of their learning goals and outcomes in both independent and group settings. b. Manage the use of technology and student learning strategies in digital platforms, virtual environments, hands-on maker spaces or in the field. c. Create learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems. d. Model and nurture creativity and creative expression to communicate ideas, knowledge or connections.
7.	Analyst Educators understand and use data to drive their instruction and support students in achieving their learning goals.	Educators: a. Provide alternative ways for students to demonstrate competency and reflect on their learning using technology/ b. Use technology to design and implement a variety of formative and summative assessments that accommodate learner needs, provide timely feedback to students and inform instruction. c. Use assessment data to guide process and communicate with students, parents and education stakeholders to build student self-direction.

Note. ISTE standards for educators guide the practices of educators and describe the various roles of educator can play a as learner, leader, citizens, collaborator, designer, facilitator, and analyst in a learning environment. Adapted from "ISTE Standards for Educators" by ISTE (n.d.) with permission. Retrieved from https://www.iste.org/standards/for-educators

Table 2

ISTE Standards for Administrators

S/N	Standards	Description
1.	Visionary Leadership Administrators inspire and lead development and implementation of a shared vision for comprehensive integration of technology to promote excellence and support transformation throughout the organization.	a. Inspire and facilitate all stakeholders a shared vision of purposeful change that maximizes use of digital age resources to meet and exceed learning goals, support effective instructional practice, and maximize performance of district and school leaders. b. Engage in an ongoing process to develop, implement and communicate technology-infused strategic plans aligned with a shared vision. c. Advocate on local, state and national levels for policies, programs and funding to support implementation of a technology-infused vision and strategic plans.
2.	Digital Age Learning Culture Administrators create, promote and sustain a dynamic, digital age learning culture that provides a rigorous, relevant and engaging education for all students.	a. Ensure instructional innovation focused on continuous improvement of digital age learning. b. Model and promote the frequent and effective use of technology for learning. c. Provide learner-centered environments equipped with technology and learning resources to meet the individual, diverse needs of all learners. d. Ensure effective practices in the study of technology and its infusion across the curriculum. e. Promote and participate in local, national and global learning communities that stimulate innovation, creativity and digital age collaboration.
3.	Excellence in Professional Practice Administrators promote an environment of professional learning and innovation that empowers educators to enhance student learning through the infusion of contemporary technologies and digital resources.	a. Allocate time, resources and access to ensure ongoing professional growth in technology fluency and integration. b. Facilitate and participate in learning communities that stimulate, nurture and support administrators, faculty and staff in the study and use of technology. c. Promote and model effective communication and collaboration among stakeholders using digital-age tools. d. Stay abreast of educational research and emerging trends regarding effective use of technology and encourage evaluation of new technologies for their potential to improve student learning.
4.	Systemic Improvement Administrators provide digital age leadership and management to continuously improve the organization through effective use of information and technology resources.	a. Lead purposeful change to maximize the achievement of learning goals through the appropriate use of technology and media-rich resources. b. Collaborate to establish metrics, collect and analyze data, interpret results and share findings to improve staff performance and student learning. c. Recruit and retain highly competent personnel who use technology creatively and proficiently to advance academic and operational goals. d. Establish and leverage strategic partnerships to support systemic improvement.

		e. Establish and maintain a robust infrastructure for technology including integrated, interoperable, teaching and learning.
5.	Digital Citizenship Administrators model and facilitate understanding of social, ethical and legal issues and responsibilities related to an evolving digital culture.	a. Ensure equitable access to appropriate digital tools and resources to meet the needs of all learners. b. Promote, model and establish policies for safe, legal and ethical use of digital information and technology. c. Promote and model responsible social interactions related to the use of technology and information. d. Model and facilitate the development of a shared cultural understanding and involvement in global issues through the use of contemporary communication and collaboration tools

Note. ISTE standards for administrators guide the practices of educators and describe the various roles of leaders through visionary leadership, digital age learning culture, excellence in professional practice, systematic improvement, and digital citizenship. Adapted from "ISTE Standards for Education Leaders" by ISTE (n.d.) with permission. Retrieved from https://www.iste.org/standards/for-education-leaders

Information Communication Technology and Web-Based Technologies in Nigeria's Teacher Preparation Program

As new technological innovations continue to emerge, new instructional strategies that require the use of technologies are also evident in education (Duran, 2006). Teacher preparation program need to equip pre-service teachers with skills needed to integrate innovations into their classroom practices so that their students can learn effectively in this twenty-first century learning environment (Coggshall, Bivona, & Reschly, 2012).

The literature suggests that pre-service teachers need additional training on how to integrate various technologies for instructional purposes (Liu, 2012; Schimidt, Baron, Thompson, Koehler, Mishra, & Shin 2009). The situation is the same in Nigeria's context and could be attributed to many factors. For example, Garba, Ranjit-Singh, Yusuf, and Abu-Ziden (2013) explain that the majority of Nigeria's teacher preparation colleges are not up to date with ICT facilities. Onasanya, Shehu, Oduwaiye, and Shehu (2010) attribute this to faculty's low level of ICT knowledge regarding pedagogy and content delivery. While critically accessing the use of ICT facilities for teaching and learning in Nigeria's teacher preparation colleges, Onasanya,

Shehu, Oduwaiye, and Shehu (2010) criticize that faculty have limited access to ICT facilities, and this may have affected the level at which they incorporate them for teaching and learning.

In Nigeria, there is a limited, but growing body of studies related to technology integration in education. Idowu and Esere (2013) conducted a quantitative study on ICT and the higher education system in Nigeria. The researchers administered surveys to respondents who are IT specialists in university communities, ministries of education, and private organizations. Idowu and Esere (2013) found that there are nine ICT-for education initiatives in the country's education system. They include:

1. The Nigerian Universities Network (NuNet) project;
2. The Polytechnics Network (PolyNet) project;
3. The School Net project;
4. National Open University of Nigeria (NOUN) project;
5. National Virtual (Digital) Library (NUC);
6. The Nigerian Education, Academic and Research Network (NEARNet);
7. The Teachers Network (Teach Net) project;
8. National Virtual Library (Ministry of Science and Technology); and
9. National Information Communication and Education program of the Presidency (p. 22).

Idowu and Esere (2013) also found that these ICT initiatives provide services to different sectors of education. For example, in 1994, the National Universities Commission (NUC) proposed the Nigerian Universities Network (NuNet) solely to provide high-speed internet connections across all Nigerian universities (Idowu & Esere, 2013). The NUNet initiative which started in 2000, operates under some stipulated objectives such as

1. End the intellectual isolation of Nigerian students, teachers, and researchers.
2. Expand Internet access to higher education at minimal capital costs.
3. Improve standards education and currency of knowledge.
4. Optimize utilization of Nigeria's academic resources regardless of their physical location.
5. Encourage local and worldwide academic and research collaborations (Ibrahim, 2004, p. 2).

Several stakeholders put forward some efforts to provide technology access in Nigeria's education sector. In their effort to provide a technology-rich learning environment, the Education Trust Fund (ETF) initiated an ETF "DigitNet" project in 2005, which provides ICT facilities to schools to deal with the problem of ICT infrastructure. Also, the project provides professional development programs to build capacity and technological pedagogical knowledge in specific subject areas (SchoolNet, 2003). Furthermore, the Tertiary Education Trust Fund (TETFund) enacted by the TETFund act of 2011, established technology centers across tertiary institutions (universities, colleges of education, polytechnics) (TETFund, 2016). These centers are equipped with computers and high-speed internet connections to provide easy access to web-based resources to faculty and students across campuses (Onwuagboke, Ranjit-Singh & Soon-Fook, 2015; TETFund, 2016).

In 2006, Intel launched the initiative "School Access Program" in partnership and in an effort by the Nigerian educators and policymakers. This partnership aims to use ICT to "transform teaching and learning, improve basic literacy, and create a new generation of leadership with twenty-first century digital skills" (Takang, 2012, p. 2). The School Access Program (SAP) equipped and continues to provide "internet connectivity, teacher training,

improved learning methods and a digital curriculum to nearly 3000 schools across Nigeria" (Takang, 2012, p. 3). Within six years of its initiation, this 1:1 initiative has recorded a tremendous amount of success in creating efficient and sustainable ICT integration in education. The results in various districts also showed a rise in students' test scores, increased attendance, and teacher effectiveness.

Ajoku (2014) maintains that access to technology in schools is the primary determinant of technology integration and utilization of tools in the classroom. Conversely, several researchers argue that access to technology in schools or classrooms do not guarantee the integration of these tools and web-based resources for classroom instruction. Garba, Singh, Yusuf, and Ziden (2013) conducted an exploratory conceptual study that explored several kinds of literature on the state of technology integration in Nigeria's teacher preparation colleges. The researchers used content analysis to analyze the documents. They found that access to computers, the internet, and web-based technologies did not guarantee classroom utilization. Okolocha and Nwadiani (2015) used a survey approach and studied business educators' use of ICT facilities for teaching. They found that faculty adoption and utilization of available ICT facilities are at a minimum. They conclude that availability or access to technology tools might not guarantee the integration and use for teaching. Likewise, Ifegbo, Onwuagboke, and Ukegbu (2015) conducted a quantitative study of teacher educators' adoption and utilization of current educational technologies, in southeastern Nigeria. They used Roger's *Diffusion of Innovation Theory* (1995), and Massey and Zemsky's Level of Technology Adoption Model (1995) to describe 184 faculty's adoption level and use of current educational technologies (CET). The researchers correlated the degree of technology adoption of instructors (teacher educators) and availability of technologies across institutions (teacher preparation colleges). They found that

there is low adoption of current educational technologies across institutions. They also found that close to a third of the respondents fell into the "Late Adopter" category, and there was no relationship between the availability of technologies and adoption/utilization in the instructional delivery.

Several scholars have studied technology integration in teacher education program in Nigeria. They identified access and accessibility as two significant challenges (Ajayi & Ekundayo, 2009; Jude & Dankaro, 2012; Onwuagboke, Ranjit-Singh, & Soon Fook, 2015). Jude and Dankaro (2012) studied ICT resources utilization and availability for instructional development at north-central Nigeria's colleges of education. They found that ICT facilities are not readily available in most of the colleges around this region. The researchers attributed the lack of access to ICT facilities to the fact that they are state government-owned colleges and there was a lack of proper government funding. Among other things, the researchers recommend that the state government should double up their efforts to equip these colleges with necessary ICT facilities to meet the challenges of teaching and learning in the twenty-first century in Nigeria.

Researchers have documented poor power supply as one of the biggest challenges facing technology integration. Like many developing countries, Nigeria is experiencing an unstable power supply. A large number of higher education institutions rely heavily on standby generators for their power supply. Researchers have documented power failure as a significant impediment to integration of ICT into teaching and learning in Nigeria (Ajoku, 2014; Onwugboke, & Singh, & 2015; Oye, Salleh, & Iahad, 2011). Also, Asiyai (2014) identified poor power (electric) supply as one of the major problems, especially in state-owned schools where they are grappling with poor funding from state governments.

Having discussed the state ICT integration in the Nigerian education system in general, and the teacher preparation program in particular, the section that follows will present literature on faculty attitudes toward technology integration in Nigeria's teacher preparation program.

Faculty Attitudes Toward Technology Integration in Nigeria's Teacher Preparation Program

Upmeyer and Six (1989) define "attitude" as a mental disposition to an action expressed by evaluating an entity with some degree of acceptance or rejection. Oskamp (1991) explains that individuals' attitudes are attached to a mental orientation toward concepts and are composed of four components namely, cognitions, effects, behavioral intentions, and evaluation. Evaluation is the central component of attitudes. Oskamp (1991) maintains that "evaluations consist of the imputation of some degree of goodness or badness to an attitude object" (p. 75). On the evaluative components of attitudes formation, Sevilla, Punsalan, Rovira, and Vendivel, (2006) explain that

> When we speak of a positive or negative attitude toward an object, we are referring to the evaluative component. Evaluations are a function of cognitive, affective and behavioral intentions of the object. Evaluation is stored in memory often, without the corresponding cognitions and effect that were responsible for its formation. (p. 358)

Ajzen (1989) in the Theory of Planned Behavior argues that "attitudes are determined by one's evaluation of the possible consequences of performing the behavior" (Crisp, 2015, p. 6). Van-Giesen, Fischer, Van-Dijk, and Van-Trijp, (2015) believe that attitudes come about as a result of previous experience regarding knowledge and functions, and this shapes individuals' decisions toward attitude formation.

Globally, researchers have conducted several studies to explore teachers' attitudes toward technology integration at different levels of education (Hart & Laher, 2015; Liu, 2016; Pittman & Gains, 2015; Varol 2012). Buabeng-Andoh (2012) conducted a review of the literature on factors influencing teachers' adoption and integration of information and communication technology for teaching in Ghana. In this review, Buabeng-Andoh (2012) maintains that "attitudes of teachers towards technology greatly influence their adoption and integration of computers into teaching" (p. 138). Additionally, Buabeng-Andoh (2012) identifies several factors that influence teachers' attitudes towards the use of technologies in the classroom. They include computer experience, technology competency, self-efficacy, and years of teaching experience. These were not unique to developing countries like Nigeria and Ghana, but also developed countries face these problems as well in their early stages of technology integration into education.

Existing literature confirms that technology integration is in its infancy in Nigeria (Garba, Singh, Yusuf, & Ziden, 2013; Owolabi, Oyewole, & Oke, 2013). Therefore, there is an absence of enormous empirical studies on educators technology integration at all levels of education. Aremu and Adediran (2011) explain that faculty's technology attitudes and self-efficacy determined to a large extent the adoption for teaching. Aremu and Adediran (2011) also argue that fruitful and effective technology integration in the classroom depends mostly upon teachers' positive attitudes toward that technology and their level of competence and readiness. Onwuagboke and Singh (2016) conducted a quantitative study of faculty attitudes and use of ICT in instructional delivery in southwestern Nigeria. The researchers found that faculty acceptance and use of technology is highly related to their attitudes toward technology integration as a result of their perception of benefits derived from integrating technologies for instruction. Onwuagboke

and Singh (2016) also found that there was no significant difference in attitudes of male and female faculty; yet, there was a strong positive correlation between ICT use and the curriculum. Kenechukwu and Oboko (2013) studied preservice teachers' perspectives on their professors' attitudes toward the use of ICT for teaching. They highlight that 25% of respondents agree upon their professors having a positive attitude toward technology for teaching, and 75% report their professors having negative attitudes toward incorporating technology into teaching. The researchers related findings to the idea that these professors might not use engaging teaching strategies by integrating technology as a tool.

Faculty's negative attitudes toward technology may affect the level at which they integrate technology for teaching. Ajoku (2014) states that faculty's negative attitudes toward technology might influence the progress of curriculum, content and ICT alignment, and therefore, recommends that intensive technology professional development should be mounted for faculty to enable them to become efficient in the use of ICT for teaching. Owolabi, Oyewole, and Oke (2013) maintain that there is an urgent need to address teachers' negative attitudes to ICT, especially at the primary and secondary levels. They suggest that administrators and policymakers should address and find out ways to conduct professional development in capacity building for faculty in terms of computers and web-based technologies for teaching. While these studies identify a gap in the empirical research conducted related to faculty access, attitudes, and use of instructional and web-based technologies in Nigeria, they do add to this literature review. At this point, it is necessary to move forward in this literature review and discuss the theoretical framework for the study.

Theoretical Framework

In the early 20th century, since the beginning of the expansion of technological innovations, studying why faculty reject or accept technology in teaching and learning has been an area of interest in the field of instructional technology. Venkatesh, Morris, Davis, and Davis (2003) describe two streams of research that have emerged in this regard: acceptance and integration. They explain that technology acceptance is subjected to a wide range of social influences. This section presents a discussion related to Rogers's Diffusion of Innovation Theory (DOI) and Davis, Bagozzi, and Warshaws' Technology Acceptance Model (TAM).

Rogers's Diffusion of Innovation Theory and Technology Integration

Rogers (1995) defines "diffusion" as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Rogers (1995) maintains that "diffusion" provides an avenue for the circulation of information about innovation. Technological innovation provides information that reduces uncertainty about cause-effect relationships in problem-solving. Rogers asserts, "when new ideas are invented, diffused, and are adopted or rejected, leading to certain consequences, social change occurs" (p. 6). In the sense of technology, adoption and integration are two different things. According to Eneh (2010), technology adoption is "the stage in which technology is selected for use by an individual or an organization," while technology integration "connotes a sense of acceptance and perhaps transparency within the user environment" (p. 1815). Eneh (2010) maintains that teachers' adoption of technology for educational purposes designates confidence in the potential benefits that technology may have offered in the field of education.

Diffusion of innovation theory emanates from ideas across multiple disciplines such as economics, marketing, sociology and anthropology (Aizstrauta, Ginters, & Eroles, 2015). Rogers

(1995) categorizes and organizes the field of research in diffusion of innovation theory to include 1) innovation-development process, 2) innovation-decision process, 3) attributes of innovations and their rate of adoption, and 4) different adopter categories (Aizstrauta, Ginters, & Eroles, 2015; p.73).

Diffusion of Innovation Theory is a versatile theory that it has been used by scholars to understand and describe different types of phenomenon. Aizstrauta, Ginters, and Eroles (2015) claim that scholars have used this theory in its entirety or by focusing on an aspect of the study from a unique perspective. In this study, the researcher focuses on *the Innovation-Decision Process*. Rogers (1995) explains that the innovation-decision process is,

> The process through which an individual (or another decision-making unit) passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. (p. 165)

Rogers (1995) elaborates that the innovation-decision process proceeds through five different stages. These stages are timely and proceed in a sequence. An exception to the sequential flow may emanate as the decision stage preceded by the persuasion stage. At each stage, the potential adopter will go through a decision-making process before proceeding to the next level. Figure 4 shows the stages in the innovation-decision process.

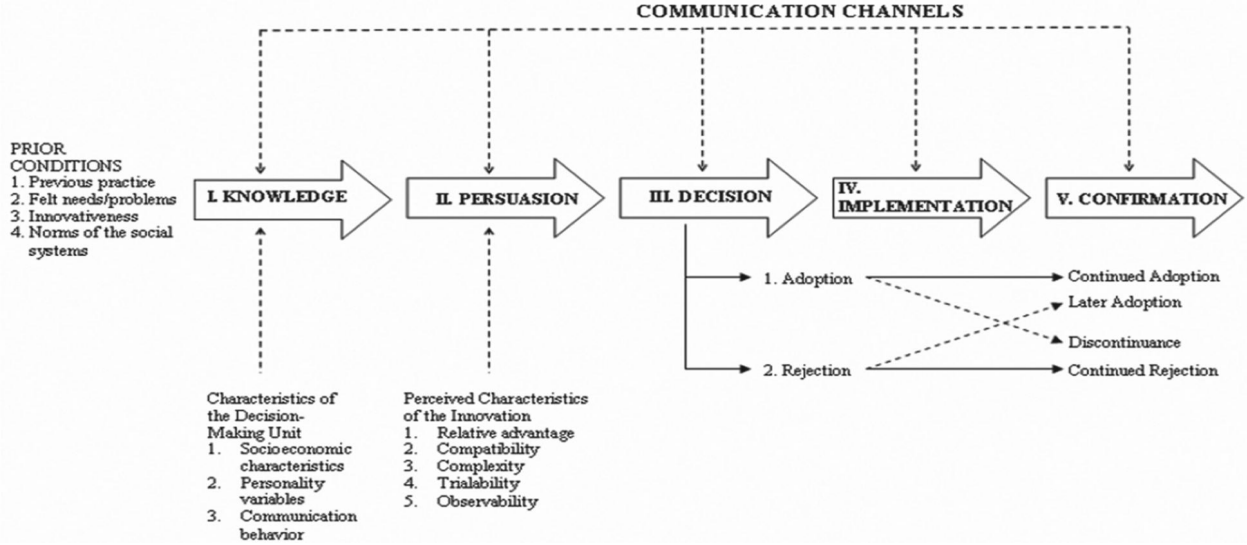

Figure 4. A model of five stages in the innovation-decision process. Adapted from "Diffusion of Innovations" by E. M., Rogers, 1995; © 1995. Reprinted with the permission of The Free Press, a Division of Simon & Schuster.

Rogers explains these stages as follows:

1. Knowledge: Knowledge "occurs when an individual (or another decision-making unit) is exposed to the innovation's existence and gains some understanding of how it functions."
2. Persuasion: Persuasion "occurs when a person (or another decision-making unit) forms a favorable or unfavorable attitude toward the innovation."
3. Decision: Decision "occurs when a person (or another decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation."
4. Implementation: Implementation "occurs when a person (or another decision-making unit) puts an innovation into use."
5. Confirmation: Confirmation "occurs when a person (or another decision-making unit) seeks reinforcement of an innovation-decision. An individual may reverse

this previous decision if exposed to conflicting messages about the innovation" (p. 20-21).

Rogers (1995) elucidates that the knowledge phase of the decision-making process is when an individual mainly seeks to know the innovation. In the case of technological innovation, an adopter may obtain the knowledge of both hardware and software that would enable him or her to get familiar with how technological innovation is and how it functions. Koehler and Mishra (2009) explain that in the classroom practice, teachers need to have technological and pedagogical knowledge to adopt and utilize technology for instructional practice effectively. Subsequently, in the persuasion phase of the decision-making process, an individual seeks evaluative information on the innovation. This information will enable the "individual to reduce uncertainty about expected innovation consequences" (Rogers, 1995, p. 21). An individual at this stage will acquire information about the perceived benefits of using that innovation, or its disadvantage. Koehler and Mishra (2009) developed Technological Pedagogical Content Knowledge (TPACK) model. They emphasize the importance of technological knowledge-knowledge of how to use innovation (technology) for instructional purposes. According to Koehler and Mishra (2009) technological knowledge is not enough in terms of usage in teaching. The teacher must have pedagogical knowledge. Technological and pedagogical knowledge (TPK) together enable the efficient use of technologies for instructional purposes (Koehler and Mishra, 2009).

In the innovation-decision process, an individual could decide to adopt the innovation as a result of the knowledge or information he/she acquired. Rogers (1995) clarifies this point by explaining that "a decision to make full use of an innovation as the best course of action available or to reject, a decision not to adopt an innovation can be reversible at a later time" (p.

21). Rogers names this process of receding the decision to use innovation: discontinuance. Rogers defines "discontinuation" as "a decision to reject an innovation after it had previously been adopted" (p. 21). He gave justification for the discontinuation by stating that an individual might become dissatisfied with the way he or she uses the innovation, or, he or she is not satisfied with the outcomes of using that innovation and eventually may decide to discontinue the utilization of that innovation. However, discontinuation may be because of an upgrade or improvement in some ways that the user may need additional knowledge or information on how to keep on track on that innovation. These processes of "later adoption and discontinuance occur during the confirmation stage of the innovation process" (p. 21).

Rogers further explains and categorizes adopters into different categories based on some set parameters. The categories were derived from the process of conceptualization. According to Rogers, conceptualization is "based on observations of reality and designed to make comparisons possible" (p. 248). Before this categorization, Rogers explains that the categories share certain characteristics. These include "1) exhaustive, or include all the units of study, 2) mutually exclusive, or include from any other category a unit of study that appears in one category, and 3) derived from one classificatory principle" (p. 246).

The categories contained some unique features that separated each set from one another, which assisted in the formulation of attitude for adoption or rejection of an innovation. Rogers identifies and explains five adopter categories. They include "Innovators," "Early Adopters," "Early Majority," "Late Majority," and "Laggards."

Innovators. Rogers explains that "this group of adopters is enthusiastic about trying new ideas. Their curiosity led them out of a local circle of peers' networks and into more cosmopolite social relationships" (p. 248). They possess a common desire for information sharing and

communication, even when they are separated by distance, which may be regional or geographical. They are easily able to "cope with the high degree of uncertainty about an innovation at the time that the innovator adopts" (p. 248). Largely, innovators possess a significant value of venturesomeness. For this reason, he or she "must be willing to accept an occasional setback when one of the new ideas he or she adopt proves unsuccessful, as inevitably happens" (p. 248). Robinson (2009) points out that no change process could succeed without that energy of adopters. Robinson suggests that in any change situation that involved the introduction of innovation, the first challenge would be to focus and try to identify the innovators, partners with them by providing an appropriate support system in place, and to achieve the desired level of adoption.

Early adopters. Early Adopters are a group of individuals that are more involved in the social system than the innovators. According to Rogers (1995), early adopters are localites. They possess the "highest degree of opinion leadership" (p. 249). Due to their high involvement with the social system, potential adopters turned to them to acquire information about the innovation. Rogers indicated that an early adopter is,

> Seen by many individuals in the social system as an individual to refer to for information acquisition before embracing innovation. An early adopter plays an important role in serving to decrease uncertainty about a new idea by adopting it and then conveying a subjective evaluation of the innovation to near-peers using interpersonal networks. (p.249)

Robinson (2009) maintains that early adopters might serve the role of an independent test led by reinventing the innovation to fit the needs of the social system. In addition, Robinson emphasizes that early adopters need support from the social system. Therefore, an early adopter should be

given the opportunity to try the innovation and maintain a good relationship with him/her through regular and constructive feedback.

Early majority. This group adopts innovation much earlier than the majority of members in a social system. They value lots of interaction with peers, but they rarely hold positions of leadership. Rogers (1995) explains that the early majority serve as a vital link in the diffusion process by being an intermediary between the very early and relatively late adopters. They provide interconnectedness in the system. In terms of adopting new ideas, this group contemplates for some time before they become an integral part of the adoption process. Rogers (1995) explains that "their innovation-decision period is relatively longer than that of innovator and the early adopter" (p. 249).

Late majority. This category of adopter only accepts innovation after a clear majority of members in the social system have adopted the innovation. They did so as a result of economic necessity or increased pressure in the social system. They adopted innovation with a high degree of skepticism and caution. They based their decision to adopt the innovation by considering the level by which they agree that the innovation would fit into the social system.

Rogers (1995) points out that a late majority adopter "can be persuaded of the utility of a new idea, but the pressure of peers is necessary to motivate adoption" (p. 250). Robinsons (2009) explains that to get this category to adopt the innovation, leaders in the social system should emphasize social norms as compared to the product. Individuals in this category possess some unique characteristics. They want to see people holding an opinion similar to themselves and adopt the innovation for the purpose as described in the social system.

Laggards. This group are the last category to adopt innovation in the social system. Laggards make their decision to adopt an innovation after an innovation had become obsolete,

and they replace the innovation with the latest one. They are skeptical of innovation and change agents in the social system (Rogers, 1995). Their traditional approach to innovation slows the innovation-decision process and their awareness-knowledge of new ideas. Rogers (1995) clarifies that laggards' resistance to innovation is an attribute to the viewpoint that "resources are limited, and so they must be relatively certain that a new idea will not fail before they can afford to adopt" (p. 250).

Technology Acceptance Model (TAM)

According to Surendran (2012) information system theorists have explored and developed theories to explain users' acceptance and use of technology. Especially, the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975) describes an individual's behavior regarding the acceptance of technology. The Theory of Planned Behavior (TPB) by Ajzen (1985) describes individual's change in behavior about the acceptance of technology. The Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh, Morris, Davis, and Davis (2003) describe a unified view of a user's intentions to use technology and subsequently the usage behavior. Davis, Bagozzi, and Warshaw (1989) develop the Technology Acceptance Model (TAM). TAM is an information system theory that describes how users accept and use technology. Davis, Bagozzi, and Warshaw (1989) point out that several factors may come into play to influence users' decision to reject or accept innovation and would largely determine its usage. TAM stands out as an influential model that predicts users' acceptance and use of information technology (Surendran, 2012). The researcher selected TAM because it was closely related to the purpose of this study.

TAM was developed from the Theory of Reasoned Action (TRA) (Chang, Chou & Yang, 2010; Holden & Karsh, 2010, Chen, Shing-Han, & Chien-Yi, 2011; Surendran, 2012). Chen,

Shing-Han, and Chien-Yi (2011) elaborate that TAM is a powerful model that describes factors that predict an individual's intention toward acceptance and use of information technology. Chen, Shing-Han, and Chien-Yi explain that TRA put more emphasis on the study and examination of the system use about subjective norms and perceived behavioral controls and attitudes toward technology integration.

TAM, on the other hand, emphasizes on the system usage by focusing on perceived ease of use and perceived usefulness. Davis, Bagozzi, and Warshaw (1989), explain that, an individual's behavioral intentions to accept the system (technology) is determined by his or her perceived usefulness, which eventually translates individual's attitudes. Attitude formation is an outcome of perceived usefulness and perceived ease of use of the system (Davis, Bagozzi & Warshaw, 1989). Figure 5 shows elements of TAM as identified and explained by Davis, Bagozzi, and Warshaw (1989).

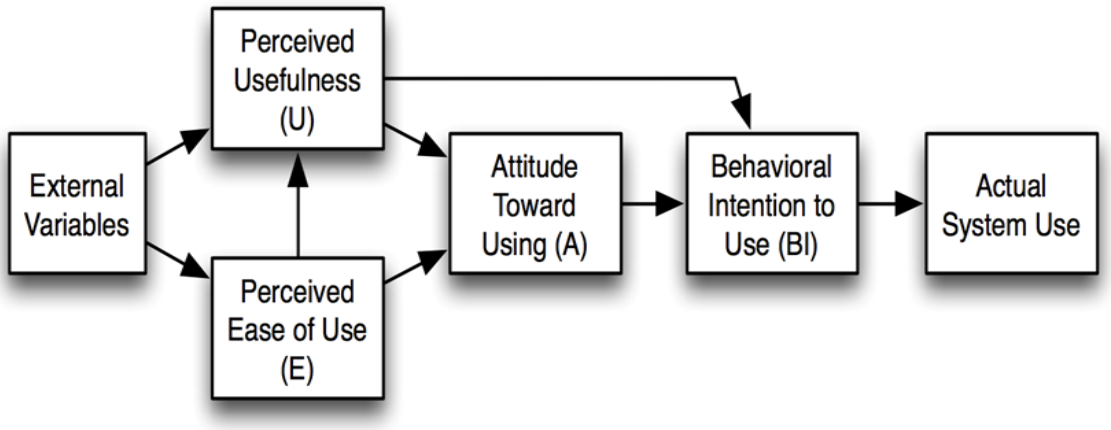

Figure 5. Technology acceptance model. First Modified Version Adapted from "User Acceptance of computer Technology: A Comparison of Two Theoretical Models," by F. Davis, R. P. Bagozzi and P. R. Warshaw, 1989, *Management Science, 35*(8), p. 985. Used with permission.

Davis, Bagozzi, and Warshaw, (1989) arrive at these elements in the first modified version of TAM and provide the following explanations.

External variables. These factors tend to influence an individual's action toward a system (Chuttur, 2009). Venkatesh and Davis (1996) state that external variables are specific system (technology) features that are comprised of individual user training, participation in design, and the implementation process. Surendran (2012) explains that external variables might be apparent as political and social. Political in the sense that they have an impact on the organization's decision to adopt an innovation, and social when they have to do with an individual's language, skill set, and facilitation conditions as identified by Venkatesh and Davis (1996).

Perceived usefulness (PU). Perceived usefulness is an individual's personal belief as to work effectiveness of the system. Davis, Bagozzi, and Warshaw (1989) define perceived usefulness as "the degree to which the person believes that using the particular system will increase her/his job performance" (p. 985).

Perceived ease of use (PEU). Davis, Bagozzi, and Warshaw (1989) state that the perceived ease of use is "the degree to which the person believes that using the particular system would be free of effort" (p. 985). Holden and Karsh (2010) describe that "perceived ease of use was either defined as the lack of (physical or mental) effort or simply as ease of use" (p. 6).

Attitudes toward using (A). Surendran (2012) explaind that "attitudes toward using" a system (technology) is when individuals are concerned with the assessment of the interest to adopt a system (technology).

Behavioral intention to use (A). Surendran (2012) maintain that an individual's behavioral intentions to use technology "is the measure of the likelihood of a person employing

the application" (p. 2). Davis, Bagozzi, and Warshaw (1989) explain that an individual's attitude influenced his or her behavioral intentions to use a system (technology).

Actual System Use. Davis, Bagozzi, and Warshaw (1989) explain "actual system use" as a stage by which an individual would arrive in system use for the purpose by which he/she defined it. For example, in a classroom situation, this is the level by which a teacher would make use of the desired technologies for instructional purposes. At this level, the teacher would be satisfied with the technology in place and make the necessary alignment of technology and contents for effective instructional delivery and achievement of the stated objectives. The actual system use stage is similar to Roger's DOI theory confirmation stage. Rogers (1995) states that "at the confirmation stage the individual (or another decision-making unit) seeks reinforcement of the innovation-decision already made or reverses a previous decision to adopt or reject athe innovation of exposed to conflicting messages about the innovation" (p. 181).

Researchers in various disciplines have used TAM and described factors that influenced the overall acceptance of the information system. Holden and Karsh (2010) report that TAM enables the understanding of factors that influenced one's acceptance of the technology. Therefore, it helped organizations to utilize an individual's full potential, aligned their goals to those factors toward promoting acceptance, and ultimately, increased technology usage. Fathema, Shannon, and Ross (2015) conducted a quantitative study that investigated faculty use of the Learning Management System (LMS) in higher education institutions in the United States. The researchers used the TAM and studied faculty attitudes, behavioral intentions, and actual system use. The researchers indicated that all participants shared a characteristic where the use of LMS was non-mandatory. They found that system quality, perceived self-efficacy, and facilitating conditions in the TAM had a significant effect on the predictive ability of faculty

attitudes towards LMSs. Similarly, Alharbi and Drew (2014) report that there was a strong relationship between attitudes, perceived ease of use, and perceived usefulness of LMS as they determine educators' behavioral intention to use LMS. Park (2009) studied 628 college students' behavioral intentions to use eLearning across all majors. Park (2009) found that TAM was a "useful theoretical model that helped to understand and explain behavioral intention to use e-learning" (p. 158).

In Nigeria, researchers across disciplines and levels of education have also used TAM as a theoretical framework for their studies. Olumide (2016) conducted a conceptual study that examined TAM as a predictor of accepting information systems to acquire information literacy skills. The researcher used qualitative content analysis and analyzed journal articles and conference papers that studied technology acceptance and used TAM as a theoretical framework for studying users' attitudes toward information literacy. Olumide (2016) found that TAM had a high prediction ability of users' acceptance of technology in achieving information literacy. Akinde (2016) conducted a conceptual study and examined a theoretical model that explained, "Lecturers' use of educational support systems for teaching in university-based library school" (p. 2). The researcher made a comparison of some information system theories that included Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), and Technology Acceptance Model (TAM). The researcher found that TAM was more appropriate to be used in examining the predictive ability of individuals' acceptance and use of information systems.

Echeng, Usoro, Majewski, and Mesto (2013) conducted a quantitative study of students' acceptance of web 2.0 for learning in five colleges in Nigeria. They used random sampling methods and selected 500 participants for the study. They found that there was a strong correlation in all variables in TAM, except motivation. The researchers conclude that TAM was

a reliable model that had the potential to predict an individual's attitudes and behavioral intention to accept and use social systems.

DOI and TAM were found to be excellent theoretical models when combined. Lee, Hsieh, and Hsu, (2011) describe TAM as a great model that explains the process of accepting technology. They explain that TAM and DOI look similar in constructs and could complement each other while examining the adoption of technology. Furthermore, they elucidate that "the constructs employed in TAM are fundamentally a subset of perceived innovation characteristics; thus, the integration of these two theories could provide an even stronger model than standing alone" (p. 125).

In this study, the researcher uses three constructs from DOI in the innovation-decision process (Knowledge, Persuasion, and Implementation), and two constructs from TAM-perceived ease of use and perceived usefulness. These constructs have enabled the researcher to study faculty attitudes toward integration and utilization of instructional and web-based technologies for teaching. The researcher aligned constructs from these theories with the purpose and research questions for this study. Table 3 shows how the researcher used different elements of both theories to answer research questions.

Table 3

Alignment of Theoretical Constructs to Research Questions

Research Question	Technology Acceptance Model (TAM)	Diffusion of Innovation Theory
RQ1. Which instructional and web-based technologies do faculty have access to and to what extent do they use them for teaching?		
RQ2. What are faculty attitudes toward the utilization of instructional and web-based technologies for teaching?	Attitude	Decision
RQ3. What relationships exist between faculty access to technology, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization for teaching?	Perceived Usefulness of (A), Perceived Ease of Use of (A)	Knowledge
RQ4. Are there group differences in technology utilization among faculty across gender, age, teaching experience, years of teaching with technology, and level of education?	Behavioral Intentions to Use (A)	Persuasion
RQ5. Does access to technology, technology attitudes, perceived usefulness, and perceived ease of use impact faculty technology utilization for teaching?	Actual System Use	Implementation Confirmation

Summary

This chapter presented the literature that served as the theoretical basis of this study. It presented the history of education in Nigeria in general and teacher preparation in particular. It then outlined literature related to technology integration. While there was an abundance of literature related to technology integration around the world, there were very few empirical studies in Nigeria's context. This chapter includes a review of literature related to Diffusion of Innovation and Technology Acceptance Model which were chosen to describe Nigeria's teacher education faculty access, attitudes, and use of instructional and web-based technologies for teaching. Chapter three presents the design and methodology of the study.

CHAPTER THREE

METHODOLOGY

This chapter describes how the study was conducted. The chapter begins with a succinct restatement of the problem, purpose of the study, and research questions. This is followed by a detailed description of the research design, the population of the study, the sample, and the sampling procedures. The next section presents a description of data collection process. The chapter concludes with a description of the process of data analysis and procedures for meeting the Institutional Review Board's requirements for the study.

Restatement of the Problem and Purpose of the Study

Many of Nigeria's faculty were trained before technology became an integral component of education and learning process, except for some educators trained overseas. Therefore, faculty are uncomfortable or unskilled in using instructional technologies (Onyia & Onyia, 2011). As a result, many faculty tend to use traditional didactic methods. This may have the potential to affect pre-service teachers' ability to learn how to integrate technologies for teaching and eventually may lead to the production of unskilled and unprofessional teachers at various levels of education in the country where services of these teachers are required (Onyia & Onyia, 2011). Understanding faculty access, attitudes, and use of instructional and web-based technologies will facilitate the government's, administrators', and stakeholders' ability to predict faculty use of technology as they become available.

The purpose of his study is to use Rogers's Diffusion of Innovation Theory (1995) and Davis, Bagozzi, and Warshaw's (1989) Technology Acceptance Model (TAM) to describe faculty access, attitudes, and use of instructional and web-based technology for teaching at Nigeria's Teacher Preparation Colleges.

Research Questions

The study was guided by the following research questions:

1. Which instructional and web-based technologies do faculty have access to and to what extent do they use them for teaching?
2. What are faculty attitudes toward the utilization of instructional and web-based technologies for teaching?
3. What relationships exist between faculty access to technology, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization for teaching?
4. Are there group differences in technology utilization among faculty across gender, age, teaching experience, years of teaching with technology, and level of education?
5. Does access to technology, technology attitudes, perceived usefulness, and perceived ease of use impact faculty technology utilization for teaching?

Research Design

This study has a mixed method approach with an explanatory sequential design. The researcher collected and analyzed quantitative data first; following this, qualitative data were collected and analyzed (Creswell, 2013; Sauro, 2015). Ivankova, Creswell, and Stick (2006) explain that the major advantage of the explanatory sequential design is straightforwardness, thereby giving the researcher many opportunities to explore quantitative data in more detail. The researcher chose this design because quantitative data provide general findings from the statistical analysis, while qualitative data provide an in-depth interpretation of findings by exploring participants' viewpoints about the research problem (Creswell, 2013).

The Study Context

There are six geopolitical zones in Nigeria. Within these zones, there are 85 Teacher Preparation Colleges. The Federal Government owns 22 (Federal Colleges of Education), State Governments own 47, and private individuals own 16. To conduct this study, the researcher obtained site approval permission (see Appendix A) from the Executive Secretary of the National Commission for the Colleges of Education (NCCE). Figure 6 shows the color-coded location of states in six geopolitical zones in Nigeria.

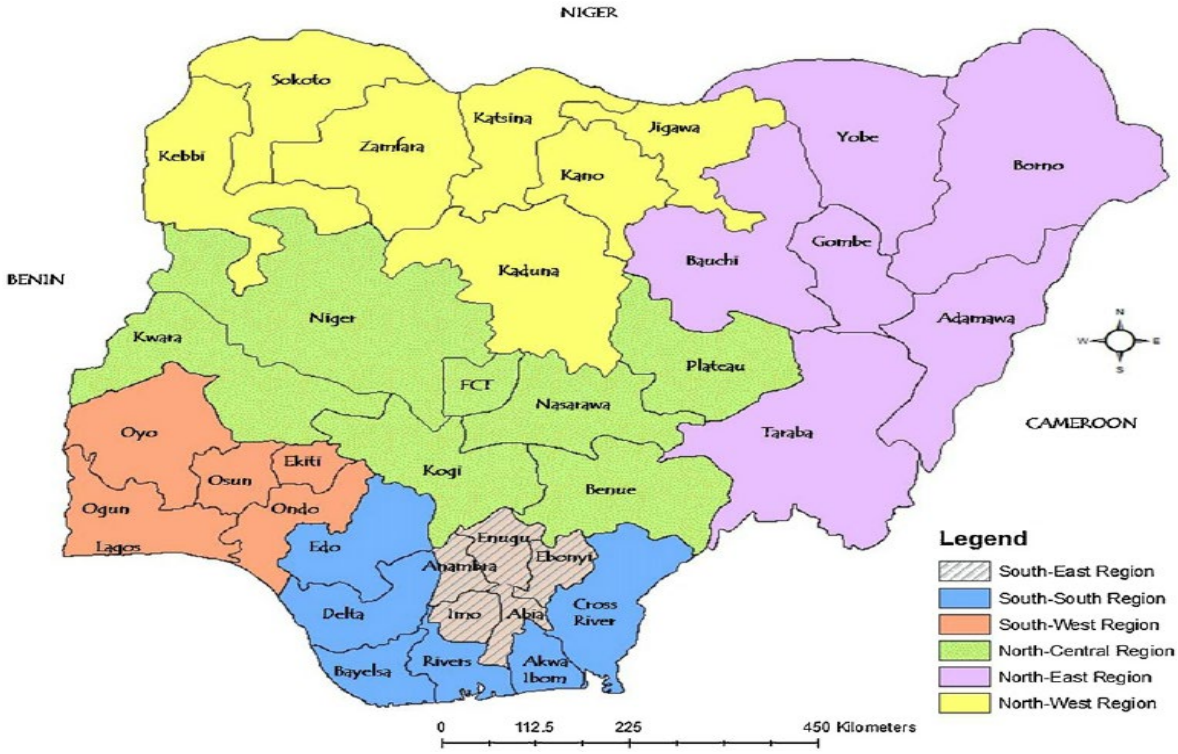

Figure 6. Map of Nigeria. Showing the six geopolitical regions and states comprised in each. Nigeria is a federation state and has 36 states with Abuja as the federal capital territory. These states are spread within six geopolitical regions, which aids federal government in distributing resources to different parts of the country. Adopted with permission from "Spatio-Temporal Epidemiology of Highly Pathogenic Avian Influenza (H5N1) Outbreaks in Nigeria, 2006–2008," by P. S., Ekong, E., Ducheyne, T. E., Carpenter, O. A., Owolodun, A. T., Oladokun, L. H., Lombin and D. Berkvens, 2012, *Preventive Veterinary Medicine*, *103,* p. 171. Used with permission.

Overall, every state in Nigeria owns a state college of education, and some states have more than one. Table 4 shows the distribution of Teacher Preparation Colleges in Nigeria within the six geopolitical zones.

Table 4

Distribution of Teacher Preparation Colleges in Nigeria

Geopolitical Region	Colleges Ownership			Total
	Federal	State	Private	
North-West	5	9	-	14
North-East	3	7	1	11
North-Central	4	9	3	16
South-West	4	8	6	18
South-South	3	9	-	12
South-East	3	5	6	14
Total	22	47	16	85

Population of the Study

The population of this study includes faculty from five Federal Teacher Preparation Colleges (Federal Colleges of Education) in the north-west zone. The north-west zone is made up of seven states, namely, Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara. The researcher chose to conduct this study only in the north-west zone due to lack of time and resources to cover all colleges in six geopolitical zones. Table 5 shows the number of faculty (lecturers) in each college used for this study.

Table 5

Number of Faculty (Lecturers) From Selected Colleges

S/No.	Colleges	Number of Faculty (Lecturers) (N)
1.	Federal College of Education, Bichi	292
2.	Federal College of Education, Kano	430
3.	Federal College of Education, Katsina	280
4.	Federal College of Education (Technical), Gusau	252
5.	Federal College of Education, Zaria	845
	Total	2099

Sampling Methods

The researcher used two sampling approaches and obtained the target population. First, for quantitative data collection, the researcher used a proportional sampling method and obtained a finite population, then followed with a random sampling method and selected respondents from the subpopulation (Salkind, 2010). Next, for qualitative data, the researcher used a non-probability sampling method (volunteer sampling) and selected interviewees (Creswell, 2012; Gay, Mills & Airasian, 2009; Roulston, 2014). The researcher describes these sampling methods in detail in the following sections.

Quantitative Sample

According to Punch (1998), "the logic of quantitative sample is that the researcher analyzes data collected from the sample but wishes in the end to make statements about the whole target population, from which the sample is drawn" (p. 105). The researcher used Salkind's (2010) procedure and obtained the percentage proportion, target sampling, and a minimum number of respondents from each school. The researcher used the proportional sampling method described and divided a finite population into subpopulation then applied a random sampling technique to each subpopulation and obtained the target population by Salkind (2010). According to Krejcie and Morgan's (1970) table for determining sampling size for a finite population, the representative sample for 2,099 population is 327. Table 6 shows the spread of the sample by proportion across five colleges used in this study.

Table 6

Spread of the Sample by Proportion Across Colleges

Colleges	Approximate number of Faculty	Proportion (%)	Target Sample	Minimum Number of Respondents
Federal College of Education, Bichi	292	14.0	41	46
Federal College of Education, Kano	430	20.4	88	67
Federal College of Education, Katsina	280	13.4	38	44
Federal College of Education (Technical), Gusau	252	12.0	30	39
Federal College of Education, Zaria	845	40.2	340	131
	2099	100	537	327

Qualitative Sample

Qualitative data does not form the basis for generalization to the population in this study. It was collected and analyzed only to develop an in-depth explanation of a central phenomenon from quantitative findings (Creswell, 2012). Punch (1998) explains that the "Decision about the sampling direction should be coherent and consistent with the study's logic rather than arbitrary or *ad hoc"* (p. 194). As such, the researcher used a non-probability sampling method with an emphasis on volunteer sampling technique and selected interviewees. The researcher built-in an item in the survey that asked survey respondents to indicate their willingness to be contacted for further interviewing by providing their phone numbers. The researcher only contacted interviewees based on their willingness and availability to be studied (Creswell, 2012; Gay, Mills & Airasian, 2009; Roulston, 2014).

The study was designed to include a qualitative sample of 10 interviewees. The researcher created a pool of four interviewees from each school and randomly selected and contacted two from each school (total of 10 across all schools). Before the interviews, the researcher emailed the consent form (see Appendix H: Informed Consent II) and interview questions (see Appendix I: Interview Protocol) to each potential interviewee. Faculty in Nigeria may not have access to a scanner; as such, oral consent was audio recorded with faculty's permission before interviews. The researcher stated explicitly the request to audio record the interview in the consent form II (see Appendix H: Informed Consent II) to which all interviewees had agreed. Additionally, at the beginning of the interviews, the researcher read the informed consent and the purpose of the study to each interviewee, in case if he or she changed his or her mind to withdraw from the interview. The researcher conducted all interviews via phone, and all responses were recorded using this format: Interviewee pseudonym_interview_number (for example Abu_Asma_interview_006).

Instrumentation

The researcher used two instruments for data collection based on the research design-survey (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey) and two versions of interview protocols (see Appendices I & J: Interview Protocol for Interviewees and Researcher). Table 7 shows the alignment of surveys and interview protocol items with research questions. The researcher used a self-developed survey and generated quantitative data and interview protocol for qualitative data.

Table 7

Alignment of Survey and Interview Items With Research Questions

Research Question	Survey Items	Interview	References (Surveys)
RQ1. Which instructional and web-based technologies do faculty have access to and to what extent do they use them for teaching?	1,2,5,6	Please, which technologies and web-based tools listed did you have access to and use for teaching in your school? (When do you use them? How do you use them? How often do you use them? How do you model appropriate use of technology? Who provide these tools (school or personal)? Are there any technology or web-based tool you used and is not mentioned on the list?)	Machado and Ibrahim (2018); Ithaca (2011 & 2013); Nkwenti, (2014)
RQ2. What are faculty attitudes toward the utilization of instructional and web-based technologies for teaching?	3,4,7,8	How would you describe your attitude towards the use of computer and web-based tools for teaching? (What experiences did you have while using technologies for teaching? How comfortable are you in using technologies for teaching? What are some issues/problems you have encountered using technologies for teaching?)	Hurt, Joseph, and Cook, (1977); Nkwenti (2014); Tozer (2017)
RQ3. What relationships exist between faculty access to technology, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization for teaching?	1,2,3,4, 5,6, 7,8,9,10 ,11,12	Please describe the importance of using technology for teaching. (How do you see yourself in terms of using technology for teaching? In what ways does the use of technology impact your teaching? How has technology use influenced your instructional method? How important is technology to students' learning?)	
RQ4. Are there group differences in technology utilization among faculty across gender, age, teaching experience, years of teaching with technology, and level of education?	2,4,14,1 5,16, 17,18	Please describe how you make decisions regarding what technology to use in your classroom. (Who decide on the technology to be used in class? What hinders you from using technology for teaching? How do you overcome the barriers that stop you from using technology for teaching?)	
RQ5. Does access to technology, technology attitudes, perceived usefulness, and perceived ease of use impact faculty technology utilization for teaching?	1,3,4,5, 7, 8,11,12	What professional development experiences you have had over the last two years? (How many times are such professional development workshops/seminars/conferences were conducted in a year? Who organized them? What topics were covered? Why did you choose to attend?) What competencies did you develop? What additional training do you feel you would need to use technology for teaching efficiently?	

Survey Development

The researcher developed a survey instrument entitled Educators' Technology Access, Attitudes and Use (ETAAU) Survey (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey) and generated quantitative data for the study. The instrument consisted of 19 items (1-13 have multiple sub-items), and the researcher arranged them based on the sequence from research questions. Four items (1, 2, 5, & 6) elicited information on faculty access to and frequency of usage of both instructional and web-based technologies. Items three, four, seven, and eight elicited responses on faculty attitudes to both instructional and web-based technologies. Items nine and 10 collected information about the Diffusion of Innovation Theory. Items 11 and 12 explicitly addressed faculty's perceived usefulness and ease of use as related to the Technology Acceptance Model. Item 13 elicited information about barriers to faculty use of instructional and web-based technologies for teaching. Lastly, items 14-18 elicited demographic information (gender, age, teaching experience, years of teaching with technology, and level of education) that the researcher used to categorize data for inferential analysis. The researcher drew items from the following instruments with permission (see Appendix B: Permission to Adapt Research Instruments):

1. Ithaca College Faculty Survey on Instructional Technology (Dispensa, 2009, 2011 & 2013).
2. International Students' Technology Survey (Machado & Ibrahim, 2018).
3. Scales for the Measurement of Innovativeness (Hurt, Joseph, & Cook, 1977).
4. Teachers' Use of Social Media Communication in the Teaching Practices Survey (Tozer, 2017).
5. TPACK Instruments (Nkwenti, 2014).

Survey validation. The researcher conducted content and face validity testing of the instrument. For content validity testing, the researcher contacted ten faculty in the United States teacher preparation program. Six faculty responded, and the researcher used their independent feedback and modified items 1 and 2. For example, they recommended changing the wording for stem items from – "from the list of technologies provided below, which and which technology (ies) do you have access to and use in your teaching" to "which of the following technologies did you use last year in your teaching?" These same wordings were recommended for item two. Also, they recommended reorganizing items by type of technologies (instructional and web-based technologies). On the other hand, face (surface) validity testing was conducted using five doctoral students from four African countries (2 Egyptians, 1 Kenyan, 1 Togolese, and 1 Congolese) who were teachers in their countries before coming to the United States for doctoral studies. They all indicated that the instrument appeared to be a valid measure of all constructs identified for the study.

After obtaining Institutional Review Board (IRB) approval, the researcher conducted reliability (consistency) testing through piloting of the survey. Table 8 shows the reliability coefficients for scaled items used for this study. The researcher administered the survey to 20 faculty in two colleges (Federal College of Education, Kontagora, and Zuba) in Nigeria that were not part of the study. Their responses were run and tested in the Statistical Package for the Social Sciences (SPSS, v.25) and obtained the coefficient of reliability (Cronbach's alpha) scores (Heale & Twycross, 2015). The researcher used the final version of the instrument for the collection of quantitative data.

Table 8

Scales, Corresponding Survey Items and Alpha Values

Items	Scaled Items	Number of Items	Reliability (α) Score
3,4, 7, and 8	Faculty Attitudes	26	.80
9 and 10	Diffusion of Innovation	20	.73
11 and 12	Technology Acceptance Model	14	.71
13	Barriers to Technology Use	13	.71

To measure the reliability of the scale items used on the survey, the researcher used Cronbach's alpha (Tavakol & Dennick, 2011). There are four categories of scale item in this survey. They included items that measure faculty attitudes, Diffusion of Innovation, technology acceptance model, and barriers to technology use. From the results of the piloting of the instrument obtained, 26 items measure faculty attitude and received an alpha value of $\alpha = .80$. Tavakol and Dennick (2011) suggest that an alpha value of $\alpha = .80$ fall within the excellent range of internal consistency. Therefore, all items are worthy of retention because they are positively related to the scale. Twenty items assessed the diffusion of innovation. An alpha value of $\alpha = .73$ was obtained for these items. The researcher retained all 20 items because they were adopted from an inventory with permission. Removing any item would not yield a valid result from the inventory. In this case, an alpha value of $\alpha = .73$ falls within the accepted value (Tavakol & Dennick, 2001), and the researcher retained all items measuring the Diffusion of Innovation. Tavakol and Dennick (2011) explain that a high alpha value indicates the presence of redundant items in the research instrument. They recommend that the length of the instrument should be shortened.

Fourteen items focus on perceived usefulness and perceived ease of instructional and web-based technologies as they related to the Technology Acceptance Model. For this items' category, an alpha value of α = .71. Tavakol and Dennick (2011) suggest that an alpha score of α = .71 is within an acceptable range of internal consistency. Finally, 13 items assessed barriers to faculty use technology for teaching. An alpha score of α = .71 was obtained for this scale. The researcher found all 13 items positively related to the scale and worthy of retention.

Interview Protocol Development

The researcher, with the help of his dissertation committee chair, developed two versions of interview protocols. One for interviewees (see Appendix I: Interview Protocol_Interviewees' Version) and the other for the researcher (see Appendix J: Interview Protocol_Researcher's Version). Both versions of the Interview Protocols were the same, except that the researcher's version contained some warm-up and follow-up questions. The researcher used the interview protocol and generated qualitative data from volunteered interviewees. Responses from interviews were audio recorded with the permission of interviewees. The researcher transcribed the generated responses (Annum, 2015; McMillan, 2004) and transferred them to Nvivo (v.12) software for analysis.

Validation of the interview protocol. The interview protocol was face validated by representative of Applied Research Lab (ARL) and a panel of six faculty (two with extensive experience, two with moderate experience, and two with limited experience in technology use) at Indiana University of Pennsylvania. The researcher used the feedback provided by the six faculty and came up with the final version of the two interview protocols. For example, two faculty recommended to include the list of all technologies in question one and modify follow-up questions. And another faculty member recommended to only ask for faculty experiences with

technology not split them into positive or negative in question two. Another professor with moderate technology experience recommended to include a question and ask who decides on technologies to be used in class (administrators or faculty) on question four. This feedback immensely helped the researcher to come up with the final version of the interview protocol.

Data Collection and Analysis

A Mixed method study requires the use of multiple ways to generate data. As such, the researcher employed an Explanatory Sequential Design method. Data collection took place in two phases. In phase one, the researcher collected and analyzed quantitative data from surveys; following this in phase two, the researcher collected and analyzed qualitative data from the interview protocol. The researcher obtained site approval permission from the Executive Secretary, National Commission for Colleges of Education (NCCE) (see Appendix A: Site Approval Letter from NCCE Nigeria) to conduct the study in five federal teacher preparation colleges in the north-west geopolitical zone.

Phase I: Collection of Survey Data

The researcher administered the survey online via Qualtrics and obtained quantitative data. The researcher sent a brief email (see Appendices C & D: Email for Survey Distribution) to five administrators in selected colleges containing a unique survey link that directed potential respondents to informed consent form I (see Appendix F: Informed Consent Form I)) and survey (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The use of different survey links across each college enabled the researcher to keep track of responses and allowed data distinction. The administrators sent out 100 emails containing the survey link to randomly selected faculty at their respective colleges. Except for the Federal College of Education- Zaria, which is twice as large as the other colleges, the administrator sent out 200

emails to randomly selected faculty from the college's faculty list-serve. After two weeks, the researcher requested administrators to send out a reminder email to non-respondents. The researcher included an item in the surveys and invited survey respondents to indicate their willingness to participate in the interview by providing their cell phone numbers for further contact. Within a month of qualitative data collection, over 200 faculty responded to the survey. This enabled the researcher to close the survey after five weeks and continue with data analysis.

Analysis of survey data. Quantitative data analysis followed the sequence adopted from the research design. The collection and analysis of quantitative data were conducted first, followed by the collection and analysis of qualitative data. Figure 7 shows the explanatory sequential design by Creswell (2012).

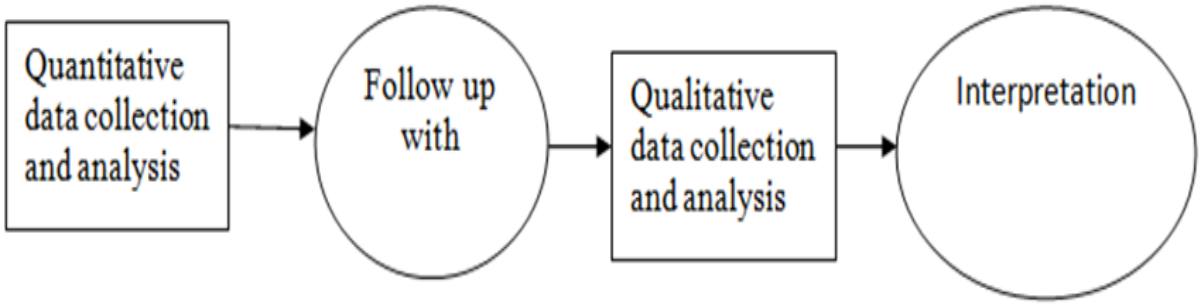

Figure 7. Explanatory sequential design. Adopted from "Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research," 4th, by J. W. Creswell; ©2012. Reprinted by permission of Pearson Education, Inc., New York, New York.

The researcher exported quantitative data generated via Qualtrics to Statistical Package for the Social Sciences (SPSS) for analysis. The pattern of analysis followed a sequence based on the research question type. Before the analysis, the researcher conducted data clean-up for a set of quantitative data generated. Table 9 shows the summary of data analysis procedures by research question type and statistical tests in correspondence to survey items. The researcher used descriptive statistics and analyzed descriptive questions (research questions one & two). Research question three was analyzed using the Pearson correlation coefficient. This enabled the

researcher to investigate if a relationship exists between faculty access to technology, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization in teaching. Research question three also aimed to identify the pattern and strength of the relationship between these variables. Research question four was analyzed using Analysis of Variance (ANOVA) and independent-samples t-test. This enabled the researcher to analyze the variability in the utilization of technology within groups among faculty gender, age, teaching experience, years of teaching with technology, and level of education.

Table 9

Data Analysis Procedures by Research Questions Types and Statistical Tests

Research Questions	Question Type	Statistical Tests	Survey Items
RQ1. Which instructional and web-based technologies do faculty have access to and to what extent do they use them for teaching?	Descriptive	Mean, Median, Mode, Std. Dev.	1, 2, 5, 6
RQ2. What are faculty attitudes toward the utilization of instructional and web-based technologies for teaching?	Descriptive	Mean, Median, Mode, Std. Dev.	3, 4, 7, 8
RQ3. What relationships exist between faculty access to technology, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization for teaching?	Inferential	Pearson correlation coefficient	1 - 12
RQ4. Are there group differences in technology utilization among faculty across gender, age, teaching experience, years of teaching with technology, and level of education?	Inferential	Analysis of Variance (ANOVA), Independent-Samples t-test	2,4,14, 15, 16, 17, 18
RQ5. Does access to technology, technology attitudes, perceived usefulness, and perceived ease of use impact faculty technology utilization for teaching?	Inferential **(Dropped)**	Regression Analysis **(Dropped)**	All items in 1 and 2 **(Dropped)**

Phase II: Collection of Qualitative Data

For qualitative data collection, the researcher used a volunteer sampling method (Creswell, 2012; Gay, Mills & Airasian, 2009; Roulston, 2014). The researcher developed a

participation pool from 20 volunteered potential interviewees and randomly selected 10 interviewees (two) from each college. The researcher began by contacting potential interviewees by sending a text message using the phone number they provided. In this text message, the researcher briefly introduced himself and thanked them for their willingness to participate in the study. Next, the researcher made an initial phone call to all potential interviewees that expressed willingness for participation in the interview. During the phone call, the researcher explained the purpose of the study and the interview and made a request for participant's email and a date and time for the phone/Skype interviews. Also, the researcher requested permission to send informed consent form II (see Appendix H: Informed Consent Form II) and the interview protocol (interviewees' version) (see Appendix I: Interview Protocol). The researcher also confirmed the date and time for the interview after the participant has read the informed consent form II. All potential interviewees agreed to voluntarily participate in the interview after reading the informed consent II.

After this initial contact, the researcher emailed all potential interviewees (see Appendix L: Email Sent to Potential Interviewees after the Initial Contact), the informed consent form II (see Appendix H: Informed Consent Form II), and interview protocol (interviewees' version) (see Appendix I: Interview Protocol). To maintain a high level of confidentiality, interviewees were not required to return the signed informed consent form ahead of time. Instead, the researcher asked interviewees to confirm the scheduled date and time for the telephone interview. On the day of the interview, the researcher asked for the interviewee's permission to audio record the interview. Following this, the researcher orally read the informed consent II to interviewee using a pseudonym while recording the interview. The use of pseudonym concealed the identity of the interviewee during transcription and data analysis phase of the study. The

researcher collected interview data until information redundancy or data saturation was attained (Patton, 2001).

Analysis of qualitative data. Punch (1998) explains that qualitative data analysis is more rigorous than quantitative analysis. Punch (1998) maintains that qualitative data analysis is "required to be systematic, disciplined, and able to be seen (and to be seen through, as in transparent), and described" (p. 200). For this study, qualitative data analysis was based on the process outlined by Miles and Huberman (1994), described in Punch (1998, p. 201). Miles and Huberman (1994) formulate this process based on regularities and sequences that link the phenomena under investigation. They include data collection, data display and data reduction (data display and data reduction were conducted several times in reversible process), then followed by drawing conclusions.

The researcher used interpretive analysis for qualitative data. Hatch (2002) explains that interpretation "is about giving meaning to data. It is about making inferences, developing insights, attaching significance, refining understandings, drawing conclusions and extrapolating lessons" (p. 180). Also, Hatch (2002) clarifies that researchers construct interpretations and later link those interpretations to data. By following this sequence, the researcher carried out the following steps of interpretive analysis outlined by Hatch (2002) for analysis of qualitative data generated which involve reading the data for a sense of the whole, reviewing impressions previously recorded in research journals and bracketing in protocols and recording these in memos, reading the data, identifying and recording impressions in memos, studying memos for salient interpretations, rereading the data, coding places where interpretations are supporting or challenging, writing a draft summary, reviewing interpretations with participants, and finally writing a revised summary and identifying excerpts that support interpretations (Hatch, 2002).

The researcher used Nvivo software to store transcribed interview responses, generated codes, visual representation, quantification, and categorization of data generated.

Data Quality

In the first phase of ensuring data quality, the survey underwent face and content validation by six faculty with different expertise. The researcher used their feedback and modified items one and two of the survey. Also, the researcher conducted reliability (consistency) testing through piloting by administering the survey instrument to 20 faculty at two teacher preparation colleges in Nigeria that were not part of the study. Their responses were tested and obtained the coefficient of reliability (Cronbach's alpha) score for the scale-items in the survey.

For the second phase, the researcher transcribed all recorded interviews. The transcripts include interviewees' pseudonyms, rather than their names, to ensure confidentiality. The researcher replaced any references made by interviewees to the college name with a preselected pseudonym to ensure a high level of confidentiality. The researcher securely stored both audio files and transcribed interviews.

To establish the trustworthiness of data, the researcher then conducted member checking by sending the transcribed data to interviewees. Hatch (2002) suggests that "Participants should have the chance to consider and give their reactions to the interpretations included in the summary written. This minimal level of member checking might be used when participants are distant from the researcher or scattered in many places" (p. 188). In addition, Creswell (2012) claims that member checking is conducted to ensure the credibility of the interview data. Therefore, the researcher requested interviewees to review and verify transcribed responses. Upon interviewees' acceptance of transcribed responses, the researcher placed all transcribed

data into Nvivo (v.25) for coding. Here, the researcher employed generic (values) coding method for data generated. Saldana (2016) recommends the use of values coding for interview transcripts because it allows the researcher to acclimatize to interviewee's language, perspectives, and worldviews.

During these stages, the researcher has been taking notes (memoing). Klenke (2016) explains that memoing helps to ensure the high-level credibility of data because the researcher cannot memorize all emerging trends in the process of data collection and analysis. The researcher conducted memoing by keeping track of changes, categories, and emergent relationships between categories. The researcher used analytical memo because it enables the researcher to think critically about what he/she is doing and why and also allows the researcher to challenge his/her assumptions by recognizing the extent to which his/her thoughts, actions, and decisions shape coding (Saldana, 2016).

Summary

This mixed method study examined faculty access, attitudes, and use of instructional and web-based technologies for teaching in Nigeria's teacher preparation program. This study was conducted in seven states (Jigawa, Kano, Katsina, Kaduna, Kebbi, Sokoto, and Zamfara) of Nigeria's north-western geopolitical zone. Within these states, there are five teacher preparation colleges. The researcher used proportional sampling and selected the survey respondents and volunteer sampling for the interviewees. There were two phases of data collection in this study. Phase one involved the collection of quantitative data using a survey, and phase two involved conducting interviews with 10 volunteered interviewees. In line with this, the researcher analyzed data in two phases. First, the researcher analyzed quantitative data using the Statistical Package for the Social Sciences (SPSS, v.25). Second, the researcher transcribed, and coded data

generated from interviews and finally exported all responses into Nvivo (v.12) for analysis. Trustworthiness was established through member checking, values coding, and analytical memoing.

CHAPTER FOUR

DATA AND ANALYSIS

Currently, Nigerian faculty has greater access to technology than ever before. A mixed method approach was used to explore faculty access, attitudes, and use of instructional and web-based technologies in teacher preparation program in Nigeria's north-west geopolitical zone. This chapter begins with an explanation of the study context, followed by a detailed description of faculty who participated in the quantitative and qualitative phases. The data analysis section presents details on how data were collected and analyzed. Results are organized by research questions and the chapter concludes with a summary.

The Study Context

The purpose of this study is to describe faculty access, attitudes, and use of instructional and web-based technology for teaching in Nigeria's Teacher Preparation Colleges. This study was conducted in Nigeria's north-west geopolitical zone. The north-west zone is comprised of seven states (Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara). There are five federal teacher preparation colleges located in four states (Kaduna, Kano, Katsina and Zamfara states). They are comprised of "Federal College of Education, Zaria-Kaduna State; Federal College of Education, Kano and Federal College of Education (Technical), Bichi- Kano State; Federal College of Education, Katsina- Katsina State; and Federal College of Education (Technical) Gusau-Zamfara State" (NCCE, n.d.).

The researcher obtained site approval from the Executive Secretary (ES) of the National Commission for the Colleges of Education (NCCE) (see Appendix A: Site Approval Letter). The ES oversee the affairs of all teacher preparation colleges (colleges of education) in Nigeria. After

a thorough review, the ES granted permission to conduct this study at these colleges. He assured support and assistance that the researcher might require.

Description of Samples

Explanatory sequential design requires the sequential collection of both quantitative and qualitative data (Creswell, 2013; Sauro, 2015). For this reason, the researcher used a proportional random sampling technique for the collection of quantitative data, and a volunteer sampling method for qualitative data collection. Details are presented in the section that follows.

Quantitative Sample

In phase one, first, the researcher used a proportional random sampling technique to select respondents from the subpopulation (Salkind, 2010). Table 10 presents a summary of the survey respondents' demographic characteristics. Many survey respondents were males (n = 139, 73.2%); a little over a fourth were female respondents (n = 50, 26.3%). This was not deemed problematic because this gender difference is common in Nigerian context in the field of education. Many survey respondents were between the ages of 31 and 40, which summed up to 117 respondents (n = 171, 61.6%). The majority taught between one and five years (n = 112, 58.9%). A little over one-third of survey respondents taught between six and 10 years (n = 70, 36.8%). While the majority of survey respondents have been using technology for teaching for one to three years (n = 170, 90.5%), only a small number reported that they have been using technology for four to six years (n = 6, 3.2%); seven – nine years (n = 5, 2.6%); and over 10 years (n = 5, 2.6%).

Table 10

Survey Respondents' Demographic Characteristics

Characteristics	N	%
Gender		
Male	139	73.2
Female	50	26.3
Other	-	-
Missing data	1	.5
Age		
21 – 40	121	64
Over 40	67	35.8
Missing data	1	.5
Years of college teaching		
1 – 5	112	58.9
6 – 10	70	36.8
11 – and above	7	3.7
Missing data	1	.5
Years of college teaching with technology		
1 – 3	170	90.5
4 – 6	6	3.2
7 – 9	5	2.6
10 and over	5	2.6
Missing data	2	1.1
Highest degree obtained		
Bachelors	129	67.9
Masters	56	29.5
Doctorate	3	1.6
Other	1	.5
Missing data	1	.5

Note. Variation arises because of two missing cases in the respondents' demographic data. And there is unequal distribution of survey respondents. Male respondents (n = 139) outnumbered female (50) respondents.

The target sample for a population of 2,099 is 327 respondents (Krejcie & Morgan, 1970). Recognizing that the response rate for online surveys is low (Saleh & Bista, 2017) the researcher distributed 600 electronic surveys across five colleges within four states of the north-west geopolitical zone. Of the 600-sampled faculty, 234 (71.5%) responded to the survey. From 234 responses, only 190 (58.1%) surveys were complete enough to be considered valid for data analysis. A response rate of 58.1% of the target sample of 327 was deemed acceptable.

Qualitative Sample

The researcher used volunteer sampling method for qualitative data collection (Creswell, 2012; Gay, Mills & Airasian, 2009; Roulston, 2014). He created a pool of 20 potential interviewees based on their willingness to participate after reading the Informed Consent II (see Appendix H: Informed Consent for Interview Protocol). The researcher selected ten participants (two from each colleges) and conducted the interview. Table 11 presents the demographic characteristics of the interviewees.

Table 11

Demographic Characteristics of Interviewees

Characteristics	N	%
Gender		
Male	7	70
Female	3	30
Age		
33 – 40	6	60
41 – 50	4	40
Years of college teaching		
5 – 10	7	70
11 – 15	3	30
Years of college teaching with technology		
1 – 3	9	90
4 – 6	1	10
Highest degree obtained		
Bachelors	2	20
Masters	7	70
Doctorate	1	10

Table 11 shows the demographic characteristics of the interviewees. The qualitative sample included both male (n = 7) and female (n = 3) faculty. The majority were between the ages of 33 and 40 (n = 6) and had 5 to 10 years of college teaching experience. Also, the sample included some older faculty who had been teaching for more than 11 years (n = 3). Of the 10 interviewees, only one had a doctorate degree.

Presentation of Results

In this section, the researcher describes the statistical procedures used to analyze the two data streams. In this study, data analysis was carried out in two phases. In phase one, the researcher analyzed quantitative data, followed by an analysis of qualitative data. The researcher has organized the quantitative results by research questions; qualitative data is presented where necessary to explain the numeric findings.

Research Question One: Access and Extent of Use of Instructional and Web-Based Technologies

Research question one was designed to examine faculty access and use of instructional and web-based technologies (survey items 1, 2, 5 & 6; Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The researcher ran frequencies for all categorical variables and descriptive (mean, median, mode and standard deviation) for all continuous variables (Pallant, 2016). Results are presented in the section that follows.

Faculty access and use of instructional technologies. Survey item one elicited information regarding faculty access to and use of instructional technologies (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). Data were collected using a three-point scale (used, not used, and not available). Table 12 presents the descriptive statistical findings for faculty access to and use of instructional technologies.

Table 12

Faculty Access and Use of Instructional Technologies

Technology	Used n (%)	Not Used n (%)	Not Available n (%)
Cell Phone	182 (95.8)	6 (3.2)	2 (1.1)
Clickers	5 (2.6)	179 (94.2)	6 (3.2)
Desktop Computer in Classrooms	6 (3.2)	177 (93.7)	6 (3.2)
Laptop in Classrooms	179 (94.2)	6 (3.2)	5 (2.6)
Tablet (iPad, Android, Surface Pro etc.)	177 (93.2)	7 (3.7)	6 (3.2)
Interactive Whiteboards	12 (6.30	7 (3.7)	171 (90.0)
VCR/DVD Player	172 (90.5)	10 (5.3)	8 (4.2)
Instructor Run Computer Stations	1 (0.50	179 (94.2)	10 (5.3)
LCD Projector/Computer Projection Systems	6 (3.2)	179 (94.2)	5 (2.6)
Overhead Projector/Document Camera	7 (3.7)	179 (94.2)	4 (2.1)
Assistive Technology Tools (voice recognition programs, screen reader, screen enlargement application, auto-page turner, etc.)	2 (1.1)	10 (5.3)	178 (93.7)
Internet connection in classrooms	171(90%)	7(3.7)	12(6.3)

As evident from Table 12, the majority of survey respondents have access to and have used Cell Phones (n = 182, 95.8%), Laptops in Classrooms (n = 179, 94%), Tablets (n = 177, 93.2%), VCR/DVD Player (n = 172, 90.5%), and Internet Connection in Classrooms (n = 171, 90.0%). While survey respondents have access to Clickers (n = 179, 94.2%), Instructor Run Computer Stations (n = 179, 94.2%), LCD Projector/Computer Projection Systems (n = 179, 94.2%), Overhead Projector/Document Cameras (n = 179, 94.2%), and Desktop Computers in Classrooms (n = 177, 93.7%), they do not use them for teaching. A large proportion of survey respondents indicated lack of access to Assistive Technology Tools (n = 178, 93.7%) and Interactive Whiteboards (n = 171, 90.0%).

The extent to which faculty use instructional technologies. Survey item two examined the extent to which faculty use instructional technology for teaching (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). For this item, data were collected using a six-point Likert scale (never, rarely, seldom, occasionally, frequently, and regularly). Table 13 presents the descriptive statistics.

Table 13

The Extent to Which Faculty Use Instructional Technologies for Teaching

Instructional Technologies	Never n (%)	Rarely n (%)	Seldom n (%)	Occasionally n (%)	Frequently n (%)	Regularly n (%)
Cell Phone	6 (3.2)	4 (2.1)	--	4 (2.1)	1 (.5)	175 (92.1)
Clickers	186 (97.9)	1 (.5)	--	2 (1.1)	1 (.5)	--
Desktop Computer in Classrooms	183 (96.3)	2 (1.1)	1 (.5)	--	4 (2.1)	--
Laptop in Classrooms	11 (5.8)	1 9.5)	2 (1.1)	4 (2.1)	168 (88.4)	4 (2.1)
Tablet (iPad, Android, Surface Pro Etc.)	13 (6.8)	1 (.5)	--	5 (2.6)	1 (.5)	170 (89.5)
Interactive Whiteboards	178 (93.7)	2 (1.1)	--	1 (.5)	1 (.5)	8 (4.2)
VCR/DVD Player	20 (10.5)	2 (1.1)	--	--	--	167 (87.9)
Instructor Run Computer Stations	187 (98.4)	--	1 (.5)	--	--	2 (1.1)
LCD Projector/Computer Projection Systems	183 (96.3)	2 (1.1)	2 (1.1)	1 (.5)	2 (1.1)	--
Overhead Projector/Document Camera	181 (95.3)	2 (1.1)	1 (.5)	4 (2.1)	2 (1.1)	--
Assistive Technology Tools (voice recognition programs, screen reader, screen enlargement application, auto-page turner etc.)	188 (98.9)	--	1 (.5)	--	1 (.5)	--
Internet Connection in the Classroom	15 (7.9)	3 (1.6)	--	--	--	172 (90.5)

Note. Rarely = 2 – 4 times a semester; Seldom = once a month; Occasionally = once every two weeks; Frequently = 1 – 2 times a week; Regularly = Daily.

Table 13 shows that many survey respondents used several technologies on daily basis. These include Cell Phones (n = 176, 92.6%) and Tablets (n = 171, 90%). Several used Laptops (n = 168, 88.4%) and VCR/DVD Players (n = 167, 87.9%) frequently. The majority indicated that they have never used Assistive Technology Tools (n = 188, 98.9%), Instructor Run Computer Stations (n = 187, 98.4%), Clickers (n = 186, 97.9%), LCD

Projector/Computer/Projection Systems (n = 183, 96.3%), Desktop Computer in Classrooms (n = 183, 96.3%), Overhead Projector/Document Cameras (n = 181, 95.3%), and Interactive Whiteboards (n = 178, 93.7%).

Faculty access and use of web-based technologies. Survey items five and six examined faculty access and use of web-based technologies (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). Data were collected using a three-point scale (used, not used, and not available). Table 14 presents a summary of the results.

Table 14

Faculty Access and Use of Web-Based Technologies

Web-Bases Technology	Used n (%)	Not Used n (%)	Not Available n (%)
Content on Internet Sites	184 (96.8)	3 (1.6)	3 (1.6)
Video/Vodcast (YouTube, Vimeo etc.)	10 (5.3)	175 (92.1)	5 (2.6)
Audio/Podcast	174 (91.6)	10 (5.3)	6 (3.2)
Multimedia Presentation (PowerPoint, Slideshare etc.)	181 (95.3)	6 (3.2)	3 (1.6)
Sound System in the Lecture Room	177 (93.2)	7 (3.7)	6 (3.2)
Email (Yahoo Mail, Gmail etc.)	181 (95.3)	8 (4.2)	1 (.5)
Interactive Content Delivery and Assessment (Nearpod, Zaption, Mentimeter, etc.)	1 (.5)	14 (7.4)	175 (92.1)
Social Media/Tools (Facebook, Twitter etc.)	64 (33.7)	126 (66.3)	--
Photo/Video Sharing (Instagram, Flickr, Snapchat, Pinterest etc.)	5 (2.6)	183 (96.3)	2 (1.1)
Video Conferencing/Chatting Systems (Skype, FaceTime, Zoom, Yahoo Messenger, Google+, Google Hangouts, etc.)	6 (3.2)	180 (94.7)	4 (2.1)
Classroom Management/LMS (D2L, Moodle, WebQuest)	2 (1.1)	13 (6.8)	175 (92.1)
Blogs (WordPress, Wikis etc.)	4 (2.1)	179 (94.2)	7 (3.7)
Interactive Quizzes (Kahoot, Quizbox, Quizlet, Poll Everywhere)	--	13 (6.8)	177 (93.2)
Google Tools (Docs, Slides, Sheets)	179 (94.2)	7 (3.7)	4 (2.1)
Virtual World (Second Life)	2 (1.1)	12 (6.3)	176 (92.6)
Plagiarism Detection Software/Sites (Turnitin)	4 (2.1)	10 (5.3)	176 (92.6)

Of the 16 web-based technologies listed in survey item six, the majority of survey respondents do not have access to Interactive Content Delivery and Assessment (n = 175, 92.1), Classroom Management/LMS (n = 175, 92.1%), Interactive Quizzes (n = 177, 93.2%), Virtual World (n = 176, 92.6%, and Plagiarism Detection Software/Sites (n = 176, 92.6%). The majority

indicated that they have used Content on Internet Sites (n = 184, 96.8%), Multimedia Presentations (n = 181, 95.3%), Emails (n = 181, 95.3%), Google Tools (n = 179, 94.2%) and Sound Systems in the Lecture Room (n = 177, 93.2%). A good number of survey respondents indicated that they have access to several technologies but did not use them. They include Photo/Video Sharing Tools- Instagram, Flickr, Snapchat, and Pinterest (n = 183, 96.3%), Video Conferencing/Chatting Systems (n = 180, 94.7%), Blogs, (n = 179, 94.2%), Video/Vodcast (n = 175, 92.1%) and Social Media/Tools (n = 126, 66.3%).

The extent to which faculty use web-based technologies. Survey item six examined the extent to which faculty used web-based technologies for teaching (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). Data were collected using a six-point Likert scale (never, rarely, seldom, occasionally, frequently, and regularly). Table 15 shows that survey respondents' use of web-based technologies for teaching varies.

Table 15

The Extent to Which Faculty Use Web-Based Technologies for Teaching

Web-Based Technology	Never n (%)	Rarely n (%)	Seldom n (%)	Occasionally n (%)	Frequently n (%)	Regularly n (%)
Content on Internet Sites	4 (2.1)	5 (2.6)	1 (.5)	3 (1.6)	4 (2.1)	172 (91.0)
Video/Vodcast (YouTube, Vimeo etc.)	177(93.2)	1 (.5)	4 (2.1)	4 (2.1)	2 (1.1)	2 (2.1)
Audio/Podcast	16 (8.4)	3 (1.6)	--	--	169 (88.9)	2 (1.1)
Multimedia Presentation (PowerPoint, Slideshare etc.)	9 (4.7)	--	2 (1.1)	5 (2.6)	173 (91.1)	1 (.5)
Sound system in the Lecture Room	12 (6.3)	5 (2.6)	--	2 (1.1)	170 (89.5)	1 (.5)
Email (Yahoo Mail, Gmail etc.)	8 (4.2)	3 (1.6)	2 (1.1)	5 (2.6)	3 (1.6)	169 (88.9)
Interactive Content Delivery and Assessment (Nearpod, Zaption, Mentimeter, etc.)	189 (99.5)	--	--	1 (.5)	--	--
Social Media/Tools (Facebook, Twitter etc.)	14 (7.4)	1 (.5)	1 (.5)	169 (88.9)	3 (1.6)	2 (1.1)
Photo/Video Sharing (Instagram, Flickr, Snapchat, Pinterest etc.)	186 (97.9)	1 (.5)	1 (.5)	1 (.5)	--	1 (.5)
Video Conferencing/Chatting Systems (Skype, FaceTime, Zoom, Yahoo Messenger, Google+, Google Hangouts etc.)	188 (98.9)	1 (.5)	--	1 (.5)	--	--
Classroom Management/LMS (D2L, Moodle, WebQuest)	187 (98.4)	1 (.5)	1 (.5)	--	--	--
Blogs (Wordpress, wikis etc.)	187 (98.4)	--	--	1 (.5)	--	1 (.5)
Interactive Quizzes (Kahoot, Quizbox, Quizlet, Poll Everywhere)	20 (10.5)	1 (.5)	--	--	--	169 (88.9)
Google Tools (Docs, Slides, Sheets)	12 (6.3)	3 (1.6)	--	2 (1.1)	1 (.5)	171 (90.0)
Virtual World (Second Life)	188 (98.9)	--	--	--	--	--
Plagiarism Detection Software/Sites (Turnitin)	184 (96.8)	1 (.5)	1 (.5)	2 (1.1)	--	--

Note. Rarely = 2 – 4 times a semester; Seldom = once a month; Occasionally = once every two weeks; Frequently = 1 – 2 times a week; Regularly = Daily.

The majority of survey respondents indicated that they regularly used Content on Internet Sites (n = 176, 93.3%), Email (n = 172, 90.5%), Google Tools (n = 171, 90%), and Interactive Quizzes (n = 169, 88.9%). While a vast majority of survey respondent used Multimedia Presentations (n = 174, 91.6%), Audio/Podcasts (n = 171, 90%), Sound Systems in the Lecture Room (n = 171, 90%) frequently, the majority (n = 169, 88.9%) of survey respondents indicated

they have used Social Media Tools for teaching occasionally (once every two weeks). Almost all survey respondents indicated that they have never used Interactive Content Delivery and Assessments (n = 189, 99.5%), Video Conferencing/Chatting Systems (n = 188, 98.9%), Virtual World/Second Life (n = 188, 98.9%), Classroom Management/LMS (n = 187, 98.4%), Blogs (n = 187, 98.4%), Photo/Video Sharing (n = 186, 97.9%), Plagiarism Detection Software/Sites (n = 184, 96.8%), and Video/Vodcasts (n = 177, 93.2%).

The qualitative data generated through 10 interviews help to explain the pattern described above. Item one of the interview protocol elicited information on faculty access to and use of instructional and web-based technologies (see Appendix J: Interview Protocol). The researcher used the following codes to code the data: Have access to instructional and web-based technologies; Inadequate/low access to instructional and web-based technologies; and No access to instructional and web-based technologies (see Appendix K: List of Codes). Under each code, the researcher generated meaning units (references by sources), the frequency of mentions, and illustrative quotes. Table 16 presents the codes, frequency count based on the number of times the meaning unit was referred by different interviewees and some illustrative quotes.

The qualitative data presented in Table 16 support the numeric findings presented. Access to instructional and web-based technologies varies across colleges. Some colleges have more technology access than others. In colleges where there was substantial access to technology, eight interviewees made 20 comments and indicated that they have access to very basic technologies, mostly Cell Phones, Laptops, Projectors, Sound Systems, and Social Media/Tools. Ten interviewees made 17 comments about inadequate/low access, and four made six comments about lack of access to instructional and web-based technologies.

Table 16

Faculty Access and Use of Instructional and Web-Based Technologies

Codes	References by Sources	f	Illustrative Quotes from the Interview
Have access to instructional and web-based technologies	8	20	Instructional technologies: I have access to a computer, desktop computer, and actually, we are using the smartboard, and rest of technologies (Interviewee 3) Laptop and cell phones are readily available, and I used them frequently (Interviewee 5)
Inadequate/low access to instructional and web-based technologies	10	17	Instructional technologies: Access to technology is at the lowest low (Interviewee 4) We have a projector, but it is not in all lecture halls. We have very limited access to projectors to use in our teaching (Interviewee 7) Web-based technologies: A school-wide network connection is very slow. The network is very weak that is why I have my personal modem (Interviewee 7)
No access to instructional and web-based technologies	4	6	Actually, we don't have these web-based technologies or tools in your list. Or I can say we do not know them. Personally, I don't know about 90% of them. I can tell you; I don't know any of my colleague that I know of who use them (Interviewee 7) We don't have access to most of what you have on the list. We only use something like google docs to share materials with students, and not in the class. In the class, no. I used the traditional way of teaching (Interviewee 4)

Research Question Two: Faculty Attitudes Toward the Use of Instructional and Web-Based Technologies

Research question two explored faculty attitudes toward utilization of instructional and web-based technologies for teaching. Survey items 3, 4, 7, 8, 9 and 10 elicited data that helped to answer this question (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey).

Faculty attitudes toward the use of instructional and web-based technologies. Survey items three and seven explored faculty attitudes toward instructional and web-based technologies (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). Results are presented in Table 17. There was very little difference in terms of survey respondents' attitudes toward the use of instructional and web-based technologies.

Table 17

Faculty Attitudes Toward Use of Instructional and Web-Based Technologies

Attitude	Strongly disagreed n (%)	Disagree n (%)	Somewhat disagree n (%)	Neither agree nor disagree n (%)	Somewhat agree n (%)	Agree n (%)	Strongly Agree n (%)
Instructional Technologies							
Good	103 (54.2)	69 (36.0)	--	--	--	2 (1.1)	16 (8.4)
Unimportant	96 (50.5)	93 (48.9)	--	--	--	--	1 (.5)
Hard	58 (30.5)	130 (68.4)	--	--	--	1 (.5)	1 (.5)
Engaging	--	2 (1.1)	--	155 (81.6)	--	22 (11.6)	11 (5.8)
Inefficient	184 (96.8)	4 (2.1)	--	--	--	1 (.5)	1 (.5)
Useless	20 (10.5)	170 (89.5)	--	--	--	--	--
Web-Based Technologies							
Good	1 (.5)	--	--	--	--	170 (89.5)	17 (8.9)
Unimportant	22 (11.6)	166 (87.5)	--	--	--	--	1 (.5)
Hard	10 (5.3)	10 (5.3)	--	3 (1.6)	--	128 (67.4)	37 (5.8)
Engaging	--	--	--	169 (88.9)	--	9 (4.7)	11 (5.8)
Inefficient	183 (96.3)	5 (2.6)	--	--	--	--	--
Useless	184 (96.8)	5 (2.6)	--	--	--	--	--

Table 17 shows that survey respondents shared similar attitudes on the use of technologies for most items. While the majority of survey respondents disagree/strongly disagree that use of instructional technology is good (n = 172, 90.2%), they agree/strongly agree that use of web-based technologies is good (n = 187, 98.4%). Almost all survey respondents strongly disagree/disagree that use of instructional (n = 189, 99.4%) and web-based (n = 188, 99.1%)

technologies is unimportant. Almost all survey respondents agree/strongly agree that use of instructional technology is not hard (n = 188, 99.1%), while many respondents agree/strongly agree that use of web-based technologies is hard (n = 165, 73.2%). However, there is some variability as few respondents neither agree nor disagree that use of web-based technologies is hard (n = 3, 1.6%).

A large majority of survey respondents were ambivalent about instructional (n = 155, 81.6%) and web-based (n = 169, 88.9%) technologies' potential to be engaging. Almost all respondents disagree/strongly disagree that use of instructional (n = 188, 99.1%) and web-based (n = 188, 99.1%) technologies is inefficient. Moreover, all respondents disagree/strongly disagree that use of instructional (n = 190, 100%) and web-based (n = 189, 99.4) technologies is useless.

Item two of the interview protocol elicited information related to faculty attitudes toward the use of instructional and web-based technologies (see Appendix J: Interview Protocol). The researcher used the following to code data: Administrators' positive attitudes to technology, Administrators' negative attitudes to technology, Faculty's positive attitudes to technology, and Faculty's negative attitudes to technology (see Appendix K: List of Codes). A total of 23 meaning units. Figure 8 shows the faculty's perception of their attitudes and administrators attitudes organized by the number of meaning units.

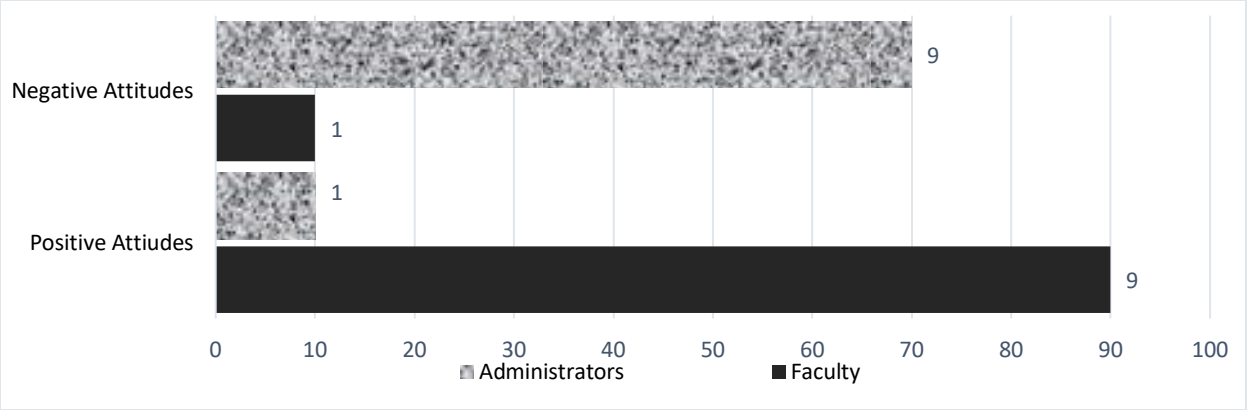

Figure 8. Faculty and administrators' attitudes toward the use of technology.

As evident from figure 8, on average, all interviewees described faculty's attitudes toward technology as positive (n = 9). They indicated that they were ready, passionate, and willing to learn how to use technology in the absence of administrators' support. They describe personal benefits to technology use. For example, some interviewees indicated that it provides them with opportunities to expand their creativity. Interviewee 6 explained that "I have a very positive attitude towards technology. There are certain things that you likely get from technology use, which ordinarily you cannot get. I am very positive about using technology in my teaching, and I am enjoying it." Another indicated that he took advantage of personal, professional development related to technology use. He said,

> I have a very positive attitude towards technology. I go to extra length to learn more ways of integrating technologies for teaching. I learned about technologies that we don't even have available in our college. And also encourage my colleagues to learn as well. (Interviewee 10).

Only one interviewee described administrators' attitudes as positive. The interviewee said, "There are a lot of improvements in this regard. Administrators are doing a little better due

to government dedication and plan to equip our education sector with technology" (Interviewee 5).

Figure 8 shows that seven interviewees made nine comments related to administrators' negative attitudes and failure to provide enough access, support, and encouragement. One interviewee said, "Lecturers have positive attitudes, but administrators have negative attitudes. They just provide some of these technologies, and they don't care" (Interviewee 9). Similarly, another interviewee said,

> Administrators do not even provide us with technology support. Even if you write or forward a request, they hardly get back to you. Their words are always; school is running out of the budget. But they will make a provision for it when forwarding another budget. This is where politics come in. I better not go into this. (Interviewee 1)

Only one interviewee commented on faculty's negative attitudes. He said, "They (faculty) don't want to because it requires a lot of preparation to be able to use, teach using technologies" (Interviewee 1).

Faculty technology comfort levels. Survey items four and eight explored faculty comfort level for both instructional and web-based technologies (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). Data were collected using a seven-point Likert scale. Survey respondents reported a high degree of comfort in terms of using both instructional ($M = 5.99$, $SD = .568$) and web-based technologies for teaching ($M = 5.77$, $SD = .624$). The majority of survey respondents fall within the moderate comfort level for both instructional

(90%) and web-based (68.4%) technologies. Figure 9 shows the survey respondents' comfort level with technology.

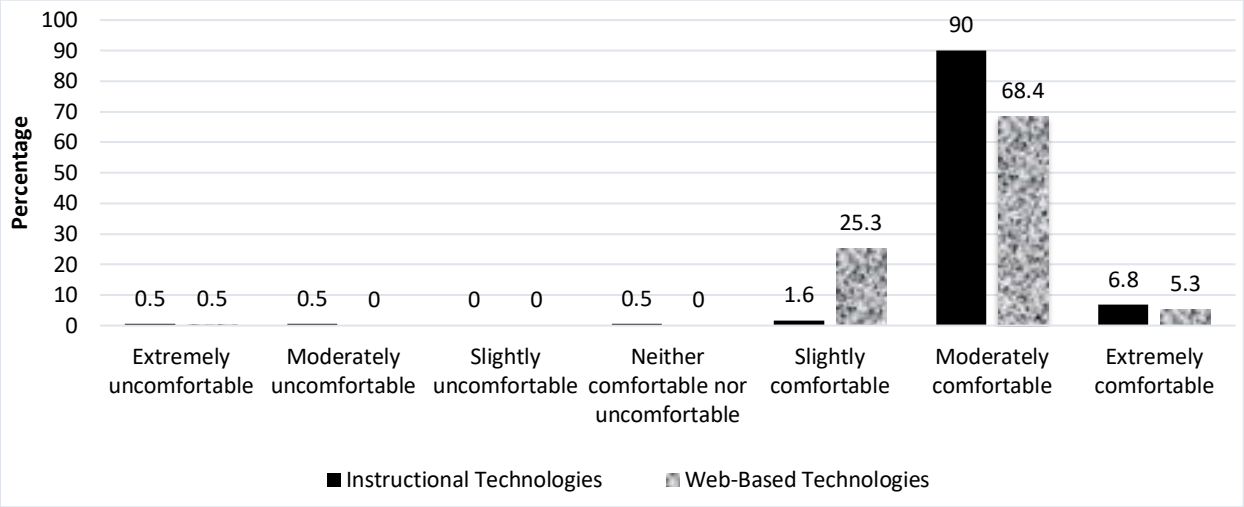

Figure 9. Faculty technology comfort levels.

Interview protocol 2b elicited data related to faculty comfort levels while using technology for teaching (see Appendix J: Interview Protocol). Based on the overall interview, the researcher created four codes: very comfortable, comfortable, averagely comfortable, and not comfortable (see Appendix K: List of Codes). Based on these codes, a total of 23 meaning units related to these codes (references by sources) were generated. Table 18 presents illustrative quotes for each code along with the number of times each was references across interviews.

Table 18

Faculty Technology Comfort Levels

Comfort Level	References by Sources	f	Illustrative Quotes
Very Comfortable	5	5	I can say I am very comfortable. I like it, and I enjoy using it. From that scare, I can say 9. I really enjoy it, and I feel yes, I am very comfortable (Interviewee 7)
Comfortable	4	4	For example, internet connection, you browse the internet to get information; that way, I am very comfortable. Even with the use of laptops, and projectors in the lab, from 1-10, I can say 7 (Interviewee 6)
Not Comfortable	1	1	Something that you may not have access to, you may not be comfortable with (Interviewee 6)
Averagely Comfortable			

Qualitative data presented aligned with the quantitative findings. While the quantitative data show that the majority of survey respondents were moderately/extremely comfortable in using both instructional (96.8%) and web-based (73.7%). Five interviewees made five comments and indicated that they are very comfortable in the use of technology for teaching. And four interviewees indicated that they are comfortable. Of the ten interviewees, only one interviewee indicated a lack of comfort in using technology for teaching.

Faculty technology attitudes: Rogers's DOI theory. As mentioned earlier, research question two also explored faculty attitudes in terms of two theories used for this study. Items nine and 10 elicited responses about Rogers's Diffusion of Innovation (DOI) Theory (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The two items were based on Hurt, Joseph, and Cooks' (1977) Individual Innovativeness (II) Instrument. The Individual Innovativeness Instrument is 20 items inventory that measures and categorizes individuals into different stages of innovativeness as identified by Rogers. The Individual

Innovativeness Instrument has been shown to be valid and reliable and has high predictive value (Hurt, Joseph, & Cook, 1977).

The researcher used the instructions provided by Hurt, Joseph, and Cook (1977) to score the instrument in three simple steps. In step one, all scores for items 4, 6, 7, 10, 13, 15, and 20 are added. Step two involves adding all scores for items 1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18, and 19. Step three involves using a simple formula to compute all scores (II = 42 + (total scores for step 2 minus total scores for step 1). Table 19 presents the required scores for each category of DOI.

Table 19

Measurement of Individual Innovativeness (II) Instrument

Individual Innovativeness	Scores
Innovators	Above 80
Early adopters	69 – 79
Early majority	57 – 68
Late majority	46 – 56
Laggards/Traditionalist	Below 46

Table 20 presents the result from survey items nine and 10 based on Individual Innovativeness Instrument in descending order of means (See Appendix G: Educators' Technology Access, Attitudes, and Use Survey). Results show that the majority of survey respondents indicated that they "enjoy trying new ideas (n = 183; M = 4.96, SD = .189), and they "frequently improvise methods for solving a problem when an answer is apparent" (n = 175; M = 4.92, SD = .315). However, only three-fourths of the survey respondents described themselves as "an inventive kind of person" (n = 146; M = 4.76, SD = .453). Also, about three-fourths of the survey respondents described themselves as skeptical of new ideas (n = 144; M = 3.56, SD = .715). They indicated that they "must see other people using innovations before they will

consider them," and some are apprehensive of new ways of thinking (n = 161; M = 2.93, SD = .442). They indicated that they are "reluctant about adopting new ways of doing things until I see them working for people around me."

Table 20

Measuring Faculty Innovativeness Inventory

Statements	M	SD
I enjoy trying new ideas	4.96	.189
I frequently improvise methods for solving a problem when an answer is not apparent	4.92	.315
I am inventive kind of person	4.76	.453
I enjoy taking part in the leadership responsibilities of the group I belong to	4.08	.331
I find it stimulating to be original in my thinking and behavior	4.07	.357
I am challenged by unanswered questions	4.07	.326
I seek out new ways to do things	4.04	.369
My peers often ask me for advice or information	4.03	.228
I am receptive to new ideas	4.02	.504
I consider myself to be creative and original in my thinking and behavior	4.01	.272
I am challenged by ambiguities and unsolved problems	4.01	.372
I am generally cautious about accepting new ideas	3.95	.408
I am aware that I usually one of the last people in my group to accept something new	3.80	.722
I tend to feel that the old way of living and doing things is the best way	3.78	.797
I often find myself skeptical of new ideas	3.56	.715
I feel that I am an influential member of my peer group	3.12	.445
I am suspicious of new inventions and new ways of thinking	2.93	.442
I rarely trust new ideas until I can see whether the vast majority of people around me accept them	2.45	.604
I must see other people using new innovations before I will consider them	2.37	.886
I am reluctant about adopting new ways of doing things until I see them working for people around me	2.29	.780

Note. The results of the individual innovativeness. There is variability in survey respondents' level of innovativeness. Adopted instrument from "Scales for the Measurement of Innovativeness," by H. T. Hurt, K. Joseph, & C. D. Cook, 1977, *Human Communication Research, 4*(1), 58-65. Used with permission

Findings from the Individual Innovativeness Instrument revealed a greater variability in the innovativeness of survey respondents. Table 21 shows that the majority of survey respondents could be classified as the Early Majority (n = 176, 92.6%). Only a few survey respondents could be classified as Innovators (n = 6, 3.2%) and Early Adopters (n = 8, 4.2%). None of the survey respondents were classified as the Late Majority and Laggards/Traditionalists.

Table 21

Survey Respondents' Innovativeness

Faculty Innovativeness	F	%
Innovators	6	3.2
Early adopters	8	4.2
Early majority	176	92.6
Late majority	-	-
Laggards/Traditionalist	-	-

Note. Faculty who score above 68 are considered highly innovative, and Faculty who score below 64 are considered low in innovativeness.

Faculty technology attitudes: TAM. Survey items 11 and 12 elicited responses about the Technology Acceptance Model (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The researcher used a five points Likert-scale (Strongly disagree, disagree, neither agree nor disagree, agree and strongly agree) to measure these items. Item 11 assessed faculty's perceived usefulness of technology. Table 22 presents results for survey respondents' perceived usefulness of technology in descending order of means. Overall, faculty expressed positive attitudes on the perceived usefulness of technology. While scores clustered around the mean for the majority of the survey items, variability was observed with, "It enables me to model student-centered strategies." It had the lowest mean score and highest standard deviation (M = 3.38, SD = .631). Also, there was a strong argument on "It is useful to my students," (M = 4.69, SD = .473).

Table 22

Faculty Perceived Usefulness of Technology

Statement	M	SD
It is useful to my students	4.69	.473
It enhances my ability to deliver content effectively	4.20	.411
It improves students' computer skills	4.15	.475
It improves students' ability to engage in research	4.11	.471
It improves students' ability to develop their collaboration skills	4.05	.337
It improves my productivity and efficiency in general	4.01	.424
It enables me to model student-centered strategies	3.38	.631

Survey item 12 elicited responses about faculty's perceived ease of use of technology (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The researcher used a five points Likert-scale (Strongly disagree, disagree, neither agree nor disagree, agree and strongly agree) to elicit data. Table 23 presents results for survey respondents' perceived ease of use of technology in descending order of means. Overall, faculty exhibited positive attitudes for perceived ease of use. While scores for six items had a high mean score, the mean score was lower for, "It requires fewest steps possible to accomplish what I want to with it in my teaching" (M = 3.31, SD = .522).

Of the seven items in this construct, survey respondents appreciate that technology allowed them to recover from their mistake quickly (M = 4.77, SD = .522) as well as, "It is user-friendly" (M = 4.74, SD = .547). There was a strong argument that respondents had the skills and competence to use technology (M = 4.06, SD = .352) and that it was easy for their students to use (M = 4.02, SD = .358).

Table 23

Faculty Perceived Ease of Use of Technology

Statement	M	SD
I can recover from my mistakes quickly	4.77	.522
It is user-friendly	4.74	.547
I can use it successfully every time	4.18	.505
It is easy/simple to use	4.10	.541
I have the skills and competency to use it	4.06	.352
It is easy for my students to use	4.02	.358
It requires fewest steps possible to accomplish what I want to do with it in my teaching	3.31	.522

Faculty Technology Experiences. Item 2c of the interview protocol elicited qualitative data related to faculty experiences in using technology for teaching (see Appendix J: Interview Protocol). A total of nine meaning related to the two codes: positive experience and negative experience (see Appendix K: List of Codes). Six interviewees described positive experiences. For example, one interviewee said, "I have had many positive experiences. My students comment that they like and enjoy what and how I am experimenting and pushing them to learn and use technology" (Interviewee 5). Another interviewee said,

> I am using technology to teach and give assignments to my students. I give them assignments to be submitted online. I have web pages and blogs that I get my grading scale for grading my students. It is a very good experience. I also create a class page that I post grades on Google Documents, share documents. I love it. (Interviewee 9)

Three interviewees described some negative experiences while teaching with technology. One said, "Sometimes I feel, I am doing more than required because you don't have positive support from administrators" (Interviewee 5). Likewise, another interviewee said,

> Some of my students don't have access to these technologies. They don't even have a good cell phone that they can use to access the internet. This made me get bored sometimes. Also, I do double work. Teach students how to learn and use these technologies and teach content at the same time. (Interviewee 1)

Barriers to Faculty Use of Technology for Teaching. Survey item 13 explored barriers to faculty use of technology for teaching (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The researcher used a five points Likert-scale to elicit data (Strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). Barriers to faculty use of technology for teaching are multifaceted. These barriers relate to access, infrastructure vision, and training. Table 24 presents barriers to faculty use of technology in descending order of means.

Table 24

Barriers to Faculty Use of Technology for Teaching

Barriers	M	SD
Lack of access to computers in the classroom (Access)	4.60	.657
Faculty lack input in technology decisions (Involvement)	4.43	.731
No idea how my school want us to use technology (Vision)	4.30	.810
Lack of technology leadership in my school	4.28	.677
Lack of freedom to decide how to use technology in courses	4.10	.769
Too much course materials to cover	4.09	.750
Too many students in my class	3.98	.658
Internet is too slow	3.22	.535
Inadequate software	3.12	.542
Not sure how to make technology relevant to my course	3.05	.672
Technology is unpredictable	3.02	.582
I don't have enough competence	2.98	.582
Outdated computer/program/software available in the school	1.67	.932

As evident from Table 24, scores were clustered around the means for six items. A variability was observed in the way some barriers affect faculty use of technology for teaching. While scores of the six items clustered around the mean for barriers to use of technology, it was

observed that the biggest barriers were related to access (M = 4.60, SD = .657), lack of involvement (M = 4.43, SD = .731), lack of technology vision (M = 4.30, SD = .810), and lack of technology leadership (M = 4.28, SD = .677). Interestingly, they were less concerned about speed of Internet connection (M = 3.22, SD = .535), inadequate software (M = 3.12, SD = .542), how to make technology relevant in their courses (M = 3.05, SD = .672), technology is unpredictable (M = 3.02, SD = .582), lack of technology competence (M = 2.98, SD = .582) and outdated computer/program/software available in the school (M = 1.67, SD = .932).

Interview protocol 4c elicited responses on barriers to faculty use of technology for teaching (see Appendix J: Interview Protocol). From this item, the researcher obtained a total of forty-eight meaning units related to the five codes (lack of technology competence, lack of access to technology, overcrowded classrooms, lack of stable electricity, and poor internet connectivity). The qualitative data were quantized to create figure 10. It presents the barriers to faculty use of technology for teaching organized by percentages. These data confirm that qualitative data support the statistical findings. During the interview, many more interviewees described that they have had challenges with electricity/power supply, access to technology, more than poor Internet connectivity, overcrowded classrooms, and lack of technology competence.

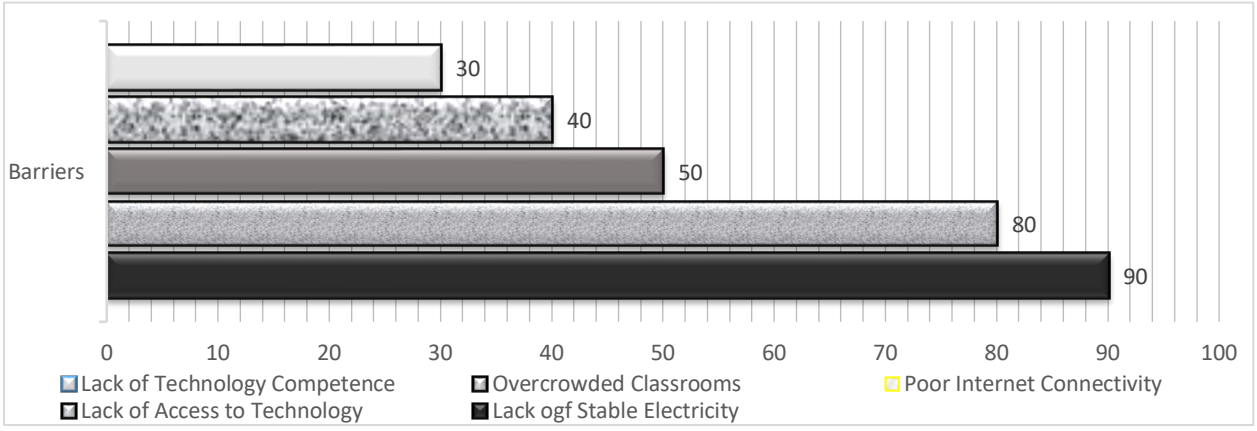

Figure 10. Barriers to faculty use of technology for teaching.

Table 25 presents barriers identified by interviewees into the two categories: institutional based and faculty-based barriers and the number of times each barrier was referenced by interviewees.

Table 25

Barriers to Faculty Use of Technology for Teaching (Qualitative)

Categories	Barriers	Reference by Sources	f
1. Institutional Based	Lack of stable electricity/power supply	9	20
	Lack of access to technology	8	12
	Poor Internet connectivity	5	7
	Overcrowded classrooms	4	4
2. Faculty-Based	Lack of technology competence	3	5

As evident from Table 25, almost all interviewees (n = 9, f = 20) indicated that "lack of stable electric/power supply" was a major barrier to their technology use. For example, one interviewee said, "the big issue is electricity is not available at any time. So even if you plan to use any technology, this issue will cripple your efforts. You know our problem with electricity, it is still there" (Interviewee 9). Other interviewees expressed similar concerns. One indicated that "it made the use of web-based technologies more difficult" (Interviewee 2). Likewise, another interviewee pointed out that the problem was one in Nigerian schools in general and explained that attempts are being made to change this. An interviewee said, "some of our new lecture halls, actually they are equipped with a standby generator as an alternative power supply" (Interviewee 8).

Interview data helped to explain why survey respondents indicated a lack of or inadequate access to technology across Nigerian teacher preparation colleges. Eight of the ten interviewees made 12 comments related to "lack of access to technology." They explained that technology access to technology varies across colleges and that there is inadequate access to

instructional and web-based technologies needed to facilitate instruction. For example, one interviewee said, “Absence of most of the tools. I mean technologies. We don’t have enough access to the majority of technologies” (Interviewee 6).

Poor internet connectivity is another barrier that was identified by five interviewees. In five comments, some interviewees described the depth of the problem. One interviewee explained, “We also have internet connection in the IT centers and library, here it is a strong connection. But around the college, in the classroom areas, we have it, but it is very weak or too poor” (Interviewee 2). However, Interviewee 4 said, “We don’t have a reliable Internet connection.”

Survey data highlighted students’ overpopulation as one of the barriers that prevented faculty from using technology for teaching. Four interviewees made four comments about how this high number impeded their efforts to integrate technology for teaching. For example, one interviewee explained,

> Sometimes also, the student population is an obstacle. We have classes that have over 300 students, for example, everyone in the School of Education know this, also in the School of Languages. So, with this large number of students, this is a big obstacle. (Interviewee 8)

Faculty have developed some strategies to address the problem of overcrowded classrooms. One interviewee said, “Roughly we have about 250 or more students in a class. So, you have to divide them into sections to be able to teach. Too much work on lecturer’s side” (Interview 2). Nevertheless, the large number of students in the classroom remains a barrier for faculty use of technology for teaching.

Technology competency plays an important role in determining faculty use of technology for teaching. Three interviewees made five comments about, "lack of technology competence" as a barrier to technology utilization. They explained that a lack of technology competence had prevented them from utilizing instructional and web-based technologies for teaching. One interviewee said, "Knowledge (competence) is another factor that prevents the use of technology. It is not everyone who is good at it" (Interviewee 2). Another interviewee elaborated on his colleagues' competence by saying, "I will tell you not all lecturers are using technology because they do not have knowledge. They don't have the competence that is required" (Interviewee 5).

Research Question Three: Relationships Between Faculty Technology Access, Attitudes, Perceived Usefulness, Perceived Ease of Use, and Technology Utilization

Research question three was designed to examine relationships between the following variables: faculty access to both instructional and web-based technologies, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization. Survey items one and five elicited responses related to faculty access to and use of both instructional and web-based technologies. Survey items three and four elicited data related to faculty attitudes toward instructional technologies, and survey items seven and eight are related to faculty attitudes toward web-based technologies. Survey items 11 and 12 elicited data related to the Technology Acceptance Model (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey).

The researcher computed and created scales for faculty technology attitudes, perceived usefulness, and perceived ease of use. Data for survey item three were collected using a five-point Likert-scale (strongly disagree, disagree, neither agree nor disagree, agree and strongly agree). During data analysis, survey items three and four were merged to create an instructional

technology attitudes scale (Attitude_Tech_Scale). This procedure was repeated for survey items seven and eight to create the web-based technologies attitudes scale (Attitude_Web_Scale). Data for survey item seven were collected using a five-point Likert-scale (strongly disagree, disagree, neither agree nor disagree, agree and strongly agree). Data for survey items 11and 12 were collected using a five-point Likert-scale as identified above. The researcher used the procedure described above to create the perceived usefulness of technology scale (Perceived_Usefulness scale), and faculty's perceived ease of use of technology scale (Perceived_Ease_Use scale). The researcher used these to run statistical tests for variables identified in research question three.

Relationships among faculty technology attitudes, perceived usefulness and perceived ease of use. The researcher ran Pearson's product-moment correlation coefficient to examine the strength of the relationships among faculty attitudes toward instructional and web-based technologies (as measured by the Attitude_Tech_Scale and Att_Web_Scale), perceived usefulness scale, and perceived ease of use of technology. Table 26 presents means, standard deviations and correlations for faculty attitudes, perceived usefulness, and perceived ease of use of instructional and web-based technologies.

Table 26

Means, Standard Deviation and Correlations for Faculty Attitudes, Perceived Usefulness, and Perceived Ease of Use of Technologies

	Variables	M	SD	1	2	3	4
1	Attitude_Tech_Scale	11.14	1.86	1.0	-.207**	-.175*	-.008
2	Attitude_Web_Scale	15.10	.630		1.0	.204**	.002
3	Perceived_Ease_Use	29.2	1.75			1.0	.624**
4	Perceived_Usefulness	28.6	1.77				1.0

***. $p < .01$ two-tailed. * $p < .05$ two-tailed*

Table 26 shows that the strength of relationships varies across variables. Findings revealed that there was a strong positive correlation between survey respondents' perceived ease of use of technology and perceived usefulness of technology ($r = .624$, $n = 185$, $p < .01$). Also, there was a small positive correlation between survey respondents' perceived ease of use and their attitude toward web-based technologies ($r = .204$, $n = 184$, $p < .05$). There was a small negative correlation between survey respondents' attitudes toward instructional and web-based technologies ($r = -.207$, $n = 186$, $p < .01$). Likewise, there was a small negative correlation between survey respondents' perceived ease of use and attitude towards instructional technology ($r = -.175$, $n = 188$, $p < .01$).

Impact of faculty access to instructional technologies on attitudes and technology utilization. Faculty attitudes scales for both instructional and web-based technologies are independent variables with multiple levels. The researcher ran a one-way ANOVA to examine the impact of faculty access to instructional and web-based technologies on technology attitudes and utilization. The assumption of homogeneity of variance was tested and satisfied based on Levene's test (Pallant, 2016). Table 27 presents the results of one-way between-groups ANOVA for the variables identified.

Table 27

One-Way ANOVA for Faculty Access, Attitudes, and Utilization of Instructional Technologies

Instructional Technologies	Sum of Squares	df	Mean Square	F	Sig
Cell Phones					
Between Groups	52.845	2	26.423	8.268	.000
Within Groups	597.597	187	3.196		
Total	650.442	189			
Clickers					
Between Groups	122.701	2	61.350	21.739	.000
Within Groups	527.741	187	2.822		
Total	650.442	189			
Desktop Computer in Classroom					
Between Groups	85.992	2	42.996	14.378	.000
Within Groups	556.209	186	2.990		
Total	642.201	188			
Laptop in Classrooms					
Between Groups	140.753	2	70.376	25.820	.000
Within Groups	509.689	189	2.726		
Total	650.442	189			
Tablet (iPad, Android, Surface Pro etc.)					
Between Groups	111.709	2	55.855	19.388	.000
Within Groups	538.733	187	2.881		
Total	650.442	189			
Interactive Whiteboards					
Between Groups	227.956	2	113.987	50.449	.000
Within Groups	422.486	187	2.259		
Total	650.442	189			
VCR/DVD Player					
Between Groups	120.768	2	60.384	21.318	.000
Within Groups	529.674	187	2.832		
Total	650.442	189			
Instructor Run Computer Stations					
Between Groups	63.048	2	31.524	10.036	.000
Within Groups	587.394	187	3.141		
Total	650.442	189			
LCD Projector/ Computer Projection System					
Between Groups	67.931	2	33.966		
Within Groups	582.511	187	3.115	10.904	.000
Total	650.442	189			
Overhead Projector/Document Camera					
Between Groups	69.607	2	34.804	11.205	.000
Within Groups	580.835	187	3.106		
Total	650.442	189			
Assistive Technology Tools					
Between Groups	159.880	2	79.940	30.473	.000
Within Groups	490.562	187	2.623		
Total	650.442	189			
Internet connection in the classroom					
Between Groups	196.107	2	98.054	40.358	.000
Within Groups	454.335	187	2.430		
Total	650.442	189			

*. $p < .05$

Findings from the independent one-way between-groups ANOVA revealed that there was a statistically significant difference for survey respondents' access to instructional technologies on technology attitudes and utilization at the $p < .05$. The effect size was calculated. Cohen (1988) indicates that an effect size, *d,* ranges between small (.1), medium (.25) and large (.4). Some technologies had large effect sizes: Clickers, F (2, 187) = 21.8, $p = .000$, $d = .19$; Laptop in Classrooms, F(2, 189) = 25.8, $p = .000$, $d = .21$; Tablet, F (2, 187) = 19.4 = .000, $d = .17$; Interactive Whiteboards, F(2, 187) = 50.4, $p = .000$, $d = .30$; Assistive Technology Tools, F (2, 187) = 30.5, $p = .000$, $d = .25$; and Internet Connection in the Classroom, F (2, 187) = 40.4, $p = .000$, $d = .30$. Others had medium effect sizes - Cell Phones, F (2, 187) = 8.27, $p = .000$, $d = .08$; Desktop in Classrooms, F (2, 186) = 14.4, $p = .000$, $d = .13$; VCR/DVD Player, F (2, 187) = 21.3, $p = .000$, $d = .12$; LCD Projector/Computer Projection Systems, F (2, 187) = 10.9, $p = .000$, $d = .11$; and Overhead Projector/Document Camera, F (2, 187) = 11.2, $p = .000$, $d = .11$. Only the Instructor Run Computer Stations, F (2, 187) = 10.03, $p = .000$, $d = .01$ had a small effect size.

The researcher ran a Post-hoc comparison using the Tukey HSD test to identify the actual mean differences (I – J*) between groups for each instructional technology. Results revealed that the actual differences in mean scores between groups (Not Used, Used and Not Available) varies significantly across various instructional technologies. Table 28 presents the result of Post-hoc (Tukey HSD) to show the actual mean difference.

Table 28

Tukey HSD Comparison for Faculty Access, Attitudes, and Utilization of Instructional Technologies

Instructional Technologies	I	J	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Cell Phones	Not Used	Used	2.58425*	.74174	.002	.8319	4.3366
		Not Available	5.16667*	1.45961	.001	1.7183	8.6150
	Used	Not Used	-2.58425*	.74174	.002	-4.3366	-.8319
		Not Available	2.58242	1.27099	.107	-.4203	5.5852
	Not Available	Not Used	-5.16667*	1.45961	.001	-8.6150	-1.7183
		Used	-2.58242	1.27099	.107	-5.5852	.4203
Clickers	Not Used	Used	-4.25587*	.76171	.000	-6.0554	-2.4563
		Not Available	-2.55587*	.69723	.001	-4.2031	-.9087
	Used	Not Used	4.25587*	.76171	.000	2.4563	6.0554
		Not Available	1.70000	1.01724	.219	-.7033	4.1033
	Not Available	Not Used	2.55587*	.69723	.001	.9087	4.2031
		Used	-1.70000	1.01724	.219	-4.1033	.7033
Desktop Computers	Not Used	Used	-3.21751*	.71784	.000	-4.9135	-1.5215
		Not Available	-2.21751*	.71784	.007	-3.9135	-.5215
	Used	Not Used	3.21751*	.71784	.000	1.5215	4.9135
		Not Available	1.00000	.99839	.577	-1.3588	3.3588
	Not Available	Not Used	2.21751*	.71784	.007	.5215	3.9135
		Used	-1.00000	.99839	.577	-3.3588	1.3588
Laptop	Not Used	Used	4.23929*	.68520	.000	2.6205	5.8581
		Not Available	1.36667	.99970	.360	-.9951	3.7285
	Used	Not Used	-4.23929*	.68520	.000	-5.8581	-2.6205
		Not Available	-2.87263*	.74856	.000	-4.6411	-1.1041
	Not Available	Not Used	-1.36667	.99970	.360	-3.7285	.9951
		Used	2.87263*	.74856	.000	1.1041	4.6411
Tablet	Not Used	Used	3.90799*	.65409	.000	2.3627	5.4533
		Not Available	2.52381*	.94431	.022	.2929	4.7548
	Used	Not Used	-3.90799*	.65409	.000	-5.4533	-2.3627
		Not Available	-1.38418	.70458	.124	-3.0488	.2804
	Not Available	Not Used	-2.52381*	.94431	.022	-4.7548	-.2929
		Used	1.38418	.70458	.124	-.2804	3.0488
Interactive Whiteboards	Not Used	Used	.23810	.71486	.941	-1.4508	1.9270
		Not Available	3.79950*	.57963	.000	2.4301	5.1689

	Used	Not Used	-.23810	.71486	.941	-1.9270	1.4508
		Not Available	3.56140*	.44887	.000	2.5009	4.6219
	Not Available	Not Used	-3.79950*	.57963	.000	-5.1689	-2.5009
		Used	-3.56140*	.44887	.000	-4.6219	-2.4301
VCR/DVD Player	Not Used	Used	3.11628*	.54746	.000	1.8229	4.4097
		Not Available	1.00000	.79832	.424	-.8860	2.8860
	Used	Not Used	-3.11628*	.54746	.000	-4.4097	-1.8229
		Not Available	-2.11628*	.60871	.002	-3.5544	-.6782
	Not Available	Not Used	-1.00000	.79832	.424	-2.8860	.8860
		Used	2.11628*	.60871	.002	.6782	3.5544
LCD Projector	Not Used	Used	-2.67784*	.73251	.001	-4.4084	-.9473
		Not Available	-2.41117*	.80026	.008	-4.3018	-.5205
	Used	Not Used	2.67784*	.73251	.001	.9473	4.4084
		Not Available	.26667	1.06873	.966	-2.2582	2.7916
	Not Available	Not Used	2.41117*	.80026	.008	.5205	4.3018
		Used	-.26667	1.06873	.966	-2.7916	2.2582
Overhead Projector	Not Used	Used	-2.86832*	.67903	.000	-4.4725	-1.2641
		Not Available	-2.01117	.89099	.065	-4.1162	.0938
	Used	Not Used	2.86832*	.67903	.000	1.2641	4.4725
		Not Available	.85714	1.10465	.718	-1.7526	3.4669
	Not Available	Not Used	2.01117	.89099	.065	-.0938	4.1162
		Used	-.85714	1.10465	.718	-3.4669	1.7526
Assistive Technology Tools	Not Used	Used	3.00000*	1.25459	.047	.0360	5.9640
		Not Available	4.08989*	.52637	.000	2.8463	5.3335
	Used	Not Used	3.00000*	1.25459	.047	.0360	5.9640
		Not Available	1.08989	1.15169	.612	-1.6310	3.8108
	Not Available	Not Used	-4.08989*	.52637	.000	-5.3335	-2.8463
		Used	-1.08989	1.15169	.612	-3.8108	1.6310
Internet Connection	Not Used	Used	3.91312*	.60108	.000	2.4931	5.3332
		Not Available	.88095	.74132	.462	-.8704	2.6323
	Used	Not Used	-3.91312*	.60108	.000	-5.3332	-2.4931
		Not Available	-3.03216*	.46548	.000	-4.1319	-1.9324
	Not Available	Not Used	-.88095	.74132	.462	-2.6323	.8704
		Used	3.03216*	.46548	.000	1.9324	4.1319

*. *The mean difference is significant at the 0.05 level*

However, post-hoc tests were not performed for Attitude_Tech_Scale by Instructor Run Computer Stations because at least one group had fewer than two groups. Table 29 shows the location of variables that have less than or equal to one group, which prevents Post-hoc tests. Also, Robust Test of Equality of Means (Welch and Brown-Forsythe) were not performed for the same reason.

Table 29

Showing Descriptive Results that Prevented Post-hoc Tests

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Not Used	179	10.9944	1.72065	.12861	10.7406	11.2482	9.00	21.00
Used	1	14.0000	.	.	.	.	14.00	14.00
Not Available	10	13.4000	2.59058	.81921	11.5468	15.2532	8.00	17.00
Total	190	11.1368	1.85513	.13458	10.8714	11.4023	8.00	21.00

Impact of faculty access to web-based technologies on attitude and technology utilization. Faculty technology attitudes and technology utilization are independent variables with multiple levels. A one-way ANOVA was run to explore the impact of faculty access to web-based on attitudes and utilization. Findings from the independent one-way between-groups ANOVA revealed that there was a statistically significant difference in survey respondents' access to web-based technologies on technology attitudes and utilization at the $p < .05$. The effect size was calculated. Table 30 presents the results.

Table 30

One-Way ANOVA for Faculty Access, Attitudes, and Utilization of Web-Based Technologies

Web-Based Technologies	Sum of Squares	df	Mean Square	F	Sig
Content on Internet Sites					
Between Groups	1.774	2	.887	2.265	.107
Within Groups	71.672	183	.392		
Total	73.446	185			
Video/Vodcast (like YouTube, Vimeo, etc.)					
Between Groups	8.080	2	4.04	11.310	.000
Within Groups	65.366	183	.357		
Total	73.446	185			
Audio/Podcast					
Between Groups	17.677	2	8.839	29.003	.000
Within Groups	55.769	183	.305		
Total	73.446	185			
Multimedia Presentation (PowerPoint, Slideshare, etc.)					
Between Groups	6.257	2	3.129	8.521	.000
Within Groups	67.189	183	.367		
Total	73.446	185			
Sound System in the Lecture Room					
Between Groups	7.705	2	3.852	10.724	.000
Within Groups	65.741	183	.359		
Total	73.446	185			
Email (Yahoo Mail, Gmail, etc.)					
Between Groups	2.611	2	1.305	3.372	.036
Within Groups	70.835	183	.387		
Total	73.446	185			
Interactive Content Delivery and Assessment (Nearpod, Zaption, Mentimeter, etc.)					
Between Groups	10.377	2	5.188	15.055	.000
Within Groups	63.069	183	.345		
Total	73.446	185			
Social Media/Tools (Facebook, Twitter, etc.)					
Between Groups	.074	2	.074	.186	.667
Within Groups	73.372	183	.399		
Total	73.446	185			
Photo/Video Sharing (Instagram, Flickr, Snapchat, Pinterest, etc.)					
Between Groups	.456	2	.228	.572	.565
Within Groups	72.990	183	.399		
Total	73.446	185			
Video Conferencing/Chatting System (Skype, FaceTime, Zoom, Yahoo Messenger, Google+, Google Hangouts, etc.)					
Between Groups	4.631	2	2.315	6.157	.003
Within Groups	68.816	183	.376		
Total	73.446	185			
Classroom Management/LMS (D2L, Moodle, WebQuest)					
Between Groups	8.210	2	4.105	11.515	.000
Within Groups	65.236	183	.356		
Total	73.446	185			

Blogs (Wordpress, Wikis, etc.)					
Between Groups	3.252	2	1.626		
Within Groups	70.194	183	.384	4.239	.016
Total	73.446	185			
Interactive Quizzes (Kahoot, Quizbox, Quizlet, Poll Everywhere)					
Between Groups	7.372	2	7.372	20.528	.000
Within Groups	66.075	183	.359		
Total	73.446	185			
Google Tools (Docs, Slides, Sheets)					
Between Groups	8.414	2	4.207	11.839	.000
Within Groups	65.032	183	.355		
Total	73.446	185			
Virtual World (Second Life)					
Between Groups	8.808	2	4.404	12.469	.000
Within Groups	64.638	183	.353		
Total	73.446	185			
Plagiarism Detection Software/Sites (Turnitin)					
Between Groups	9.137	2	4.568	13.000	.000
Within Groups	64.309	183	.351		
Total	73.446	185			

*. $p < .05$

Results revealed a statistically significant difference between groups for Video/Vodcast, F (2, 183) = 11.3, p = .000, d = .11; Audio/Podcast, F (2, 183) = 29.00, p = .000, d = .20; Multimedia Presentation, F (2, 183) = 8.52, p = .000, d = .09; Sound System in the Lecture Room, F (2, 183) = 10.7, p = .000, d = .11; Email, F (2, 183) = 3.37, p = .036, d = .036; Interactive Content Delivery and Assessment, F (2, 183) = 15.1, p = .000, d = .14; Video Conferencing/Chatting System, F (2, 183) = 6.16, p = .003, d = .06; Classroom Management/LMS, F (2, 183) = 11.5, p = .000, d = .11; Blogs, F (2, 183) = 4.24, p = .016, d = .04; Interactive Quizzes, F (2, 183) = 20.5, p = .000, d = .10; Google Tools, F (2, 183) = 11.9, p = .000, d = .11; Virtual World, F (2, 183) = 12.5, p = .000, d = .12; and Plagiarism Detection Software/Sites, F (2, 183) = 13.00, p = .000, d = .12. However, the results for survey respondents' access to web-based technologies on attitudes and utilization of Contents on Internet Sites F (2, 183) = 2.27, p = .107; Social Media/Tools F (2, 183) = .186, p = .667; and Photo/Video Sharing F (2, 183) = .572, p = .565, were not statistically significant at the $p > .05$.

Robust tests for equality of means was reported due to the violation of the homogeneity of variance for Contents on Internet Sites, Social Media/Tools and Photo/Video Sharing Tools. Table 31 shows results for Robust tests for equality of means for Social Media/Tools and Photo/Video Sharing. Robust tests were not performed for content on Internet Sites because at least one group has zero variance.

Table 31

A Robust Test for Equality of Means

Att_Web_Scale		Statistic[a]	df1	df2	Sig.
Social Media/Tools					
	Welch	.158	1	100.902	.692
	Brown-Forsythe	.158	1	100.902	.692
Photo/Video Sharing					
	Welch	.104	2	2.145	.905
	Brown-Forsythe	.125	2	2.891	.887

A Post-hoc comparison using the Tukey HSD test was run to identify the actual mean differences (I – J*) between groups for each instructional technology. Results revealed that the actual differences in mean scores between groups (Not Used, Used and Not Available) varies significantly across various web-based technologies. Table 32 presents the result of Post-hoc (Tukey HSD) to show the actual mean difference.

Table 32

Tukey HSD Comparison for Faculty Access, Attitudes, and Utilization of Web-Based Technologies

Web-Based Technologies	I	J	Mean Difference (I-J)	Std. Error	Sig.	95%Confidence Interval	
						Upper Bound	Lower Bound
Video/Vodcast	Not Used	Used	.47868	.20436	.053	-.0042	.9616
		Not Available	1.14535*	.27114	.000	.5047	1.7860
	Used	Not Used	-.47868	.20436	.053	-.9616	.0042
		Not Available	.66667	.33336	.115	-.1210	1.4544
	Not Available	Not Used	-1.14535*	.27114	.000	-1.7860	-.5047
		Used	-.66667	.33336	.115	-1.4544	.1210
Audio/Podcast	Not Used	Used	-.95906*	.18879	.000	-1.4052	-.5130
		Not Available	.38889	.29095	.377	-.2986	1.0764
	Used	Not Used	.95906*	.18879	.000	.5130	1.4052
		Not Available	1.34795*	.22929	.000	.8062	1.8898
	Not Available	Not Used	-.38889	.29095	.377	-1.0764	.2986
		Used	-1.34795*	.22929	.000	-1.8898	-.8062
Multimedia Presentation	Not Used	Used	-.11798	.27476	.903	-.7672	.5313
		Not Available	1.33333*	.44251	.008	.2877	2.3790
	Used	Not Used	.11798	.27476	.903	-.5313	.7672
		Not Available	1.45131*	.35277	.000	.6177	2.2849
	Not Available	Not Used	-1.33333*	.44251	.008	-2.3790	-.2877
		Used	-1.45131*	.35277	.000	-2.2849	-.6177
Sound System in the Lecture Room	Not Used	Used	-.64368*	.24887	.028	-1.2318	-.0556
		Not Available	.33333	.34605	.601	-.4844	1.1510
	Used	Not Used	.64368*	.24887	.028	.0556	1.2318
		Not Available	.97701*	.24887	.000	.3889	1.5651
	Not Available	Not Used	-.33333	.34605	.601	-1.1510	.4844
		Used	-.97701*	.24887	.000	-1.5651	-.3889
Video Conferencing/Chatting System	Not Used	Used	.92429*	.27809	.003	.2672	1.5814
		Not Available	.37429	.31006	.450	-.3584	1.1069
	Used	Not Used	-.92429*	.27809	.003	-1.5814	-.2672
		Not Available	-.55000	.41136	.377	1.5220	.4220
	Not Available	Not Used	-.37429	.31006	.450	-1.1069	.3584
		Used	.55000	.41136	.377	-.4220	1.5220
Classroom Management/LMS	Not Used	Used	-.16667	.45601	.929	-1.2442	.9109
		Not Available	-.81783*	.17827	.000	-1.2391	-.3966
	Used	Not Used	.16667	.45601	.929	-.9109	1.2442
		Not Available	-.65116	.42463	.278	-1.6545	.3522

	Not Available	Not Used	.81783*	.17827	.000	.3966	1.2391
		Used	.65116	.42463	.278	-.3522	1.6545
Blogs	Not Used	Used	.12000	.31319	.922	-.6200	.8600
		Not Available	.69143*	.23872	.012	.1273	1.2555
	Used	Not Used	-.12000	.31319	.922	-.8600	.6200
		Not Available	.57143	.38819	.307	-.3458	1.4887
	Not Available	Not Used	-.69143*	.23872	.012	-1.2555	-.1273
		Used	-.57143	.38819	.307	-1.4887	.3458
Google Tools	Not Used	Used	.12000	.31319	.922	-.6200	.8600
		Not Available	.69143*	.23872	.012	.1273	1.2555
	Used	Not Used	-.12000	.31319	.922	-.8600	.6200
		Not Available	.57143	.38819	.307	-.3458	1.4887
	Not Available	Not Used	-.69143*	.23872	.012	-1.2555	-.1273
		Used	-.57143	.38819	.307	-1.4887	.3458
Virtual World	Not Used	Used	.36364	.45686	.706	-.7159	1.4432
		Not Available	-.78665*	.18480	.000	-1.2233	-.3500
	Used	Not Used	-.36364	.45686	.706	-1.4432	.7159
		Not Available	-1.15029	.42267	.019	-2.1490	-.1515
	Not Available	Not Used	.78665*	.18480	.000	.3500	1.2233
		Used	1.15029*	.42267	.019	.1515	2.1490
Plagiarism Detection Software/Sites	Not Used	Used	-1.13889*	.35623	.005	-1.9806	-.2971
		Not Available	-1.02762*	.20268	.000	-1.5065	-.5487
	Used	Not Used	1.13889*	.35623	.005	.2971	1.9806
		Not Available	.11127	.29981	.927	-.5972	.8197
	Not Available	Not Used	1.02762*	.20268	.000	.5487	1.5065
		Used	-.11127	.29981	.927	-.8197	.5972

*Note. * The mean difference is significant at the 0.05 level*

Conversely, post-hoc tests were not performed for Email, Interactive Content Delivery, and Assessment, and Interactive Quizzes because at least one group had fewer than two groups. Also, Robust Test of Equality of Means (Welch and Brown-Forsythe) were not performed for the same reason.

Research Question Four: Differences in Technology Utilization Among Faculty Across Gender, Age, Years of Service, Years of Teaching With Technology and Levels of Education

Research question four was designed to examine group differences in technology utilization among faculty across gender, age, teaching experience (in years), years of teaching with technology, and level of education. Survey items 2, 6, and 14-18 elicited data to answer this question (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). Given the variability in demographic characteristics of survey respondents, the researcher collapsed some of the groups for each of the independent variables listed in Table 33. This made it possible for the researcher to run independent-samples t-test for variables that had two categories and a one-way between groups ANOVAs for variables that had three categories. Table 33 shows a description of survey items in relation to information they explored and consolidated categories created by collapsing of figures.

Table 33

Variables, Survey Items, and Consolidated Groups

Variables	Survey Items	Consolidated Groups	Modified Groups
Gender	14	2	Male and Female
Age	15	2	21-40, and Over 40
Years of Service	16	3	1-5, 6-10, and 11-100
College Teaching with Technology	17	4	1-3, 4-6, 7-9, and Over 10 years
Level of Education	18	2	Undergraduate and Graduate Degree (Master, Doctorate, & PGD)

Survey items 14, 15, and 18 assessed faculty's technology utilization across gender, age, and level of education (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). A series of independent-samples t-tests were run to compare faculty utilization of instructional and web-based technologies by gender (male and female), age (21-40 and 41-100)

and level of education (undergraduate and graduate degree). Survey items 16 and 17 explored faculty college teaching experiences and years of college teaching with technology. A series of one-way ANOVAs were run to compare faculty utilization of instructional and web-based technologies by college teaching experience and college teaching with technology. Details about each test and related findings are presented in the following sections, organized by the independent variables listed in Table 33.

Group differences in faculty technology utilization across gender. Survey items 2, 6, and 14 explored faculty technology utilization across gender (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The researcher ran an independent samples t-test to compare the mean scores for survey respondents' utilization of instructional and web-based technologies across gender. Table 34 presents the results independent-samples t-test for faculty utilization of instructional and web-based technologies across gender.

Table 34 shows the mean scores between male (M = 34.5, SD = 5.24) and female (M = 35.4, SD = 3.00), t (150.5) = -1.48, p = .142 (two-tailed) for utilization of instructional technologies were not statistically significant. The magnitude of the difference in the means (mean difference = -.907, 95% CI: -2.12 to .308) was very small (eta squared = .01). Similarly, the mean scores for male (M = 48.7, SD = 7.96) and female (M = 49.8, SD = 5.10), t = (136.4) = -.1.14, p = .259 (two-tailed) for utilization of web-based technologies were not statistically significant. The magnitude of the difference in the means (mean difference = -1.13, 95% CI: -3.09 to .838) was very small (eta squared = .01).

Table 34

Results of t-tests and Descriptive Statistics for Faculty Technology Utilization by Gender

Outcome	Levene's Test	Groups						95% CI for Mean Difference			
		Male			Female						
		M	SD	N	M	SD	N		t	df	*p*
Instructional Technologies	.012	34.5	5.24	139	35.4	3.00	50	-2.12, .308	-1.48	150.5	.142
Web-Based Technologies	.036	48.7	7.96	136	49.8	5.10	50	-3.09, .838	-1.14	136.4	.259

Group differences in faculty technology utilization across age. Survey items 2, 6, and 15 explored faculty technology utilization across age (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The researcher used an independent samples t-test to compare the mean scores of survey respondents' utilization of instructional and web-based technologies across age categories. The results of the two independent samples t-test presented in Table 35 shows that the mean scores for survey respondents between the age, 21-40 (M = 34.7, SD = 4.62) and those of over 40 (M = 34.7, SD = 5.04), t (187) = .004, p = .997 (two-tailed) for utilization of instructional technology use were not statistically significant. The magnitude of the difference in the means (mean difference = .003, 95% CI: -1.42 to 1.43) was very small (eta squared = .01). A similar pattern was observed for survey respondents' utilization of web-based technologies. There was not a statistically significant difference in the mean scores of survey respondents between the age of 21-40 (M = 48.7, SD = 7.56) and those of over 40 (M = 49.4, SD = 6.86), t = (184) = -.624, p = .523 (two-tailed) for utilization of web-based technologies. The magnitude of the difference in the means (mean difference = -.697, 95% CI: -2.90 to 1.50) was very small (eta squared = .01).

Table 35

Results of t-tests and Descriptive Statistics for Faculty Technology Utilization by Age

Outcome	Levene's Test	Groups						95% CI for Mean Difference			
		21 - 40			Over 40						
		M	SD	N	M	SD	N		T	df	*p*
Instructional Technologies	.872	34.7	4.62	121	34.7	5.04	68	-1.42, 1.43	.004	187	.997
Web-Based Technologies	.360	48.7	7.56	119	49.4	6.86	67	-2.90, 1.50	-.624	184	.534

Group differences in faculty technology utilization across levels of education. Survey items 2, 6, and 18 explored faculty technology utilization across levels of education (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The researcher ran an independent-samples t-test to compare the mean scores of survey respondents' utilization of instructional and web-based technologies.

Table 36 shows a statistically significant difference in the mean scores for survey respondents' utilization of instructional technologies by level of education. Survey respondents with an undergraduate degree had a higher mean score (M = 35.6, SD = 2.85) than those with a graduate degree (M = 32.8, SD = 7.03), t (68.2) = 2.90, p = .005 (two-tailed). The magnitude of the difference in the means (mean difference = 2.73, 95% CI: .847 to 4.60) was moderate (eta squared = .10). Similarly, in terms of web-based technologies, there was a statistically significant difference in the mean scores. Survey respondents with an undergraduate degree had a higher mean score (M = 50.6, SD = 3.67) than those with a graduate degree (M = 45.4, SD = 11.1) t = (64.0) = 3.52, p = .001 (two-tailed) for utilization of web-based technologies. The magnitude of the difference in the means (mean difference = 5.20, 95% CI: 2.25 to 8.15) was moderate (eta squared = .10).

Table 36

Results of t-tests and Descriptive Statistics for Faculty Technology Utilization by Levels of Education

Outcome	Levene's Test	Groups						95% CI for Mean Difference			
		Undergraduate Degree			Graduate (MS, Ph.D./D.Ed., PGD)						
		M	SD	N	M	SD	N		t	df	*p*
Instructional Technologies	.000	35.6	2.85	129	32.8	7.03	60	.847, 4.60	2.90	68.2	.005
Web-Based Technologies	.000	50.6	3.67	127	45.4	11.1	59	2.25, 8.15	3.52	64.0	.001

Group differences in faculty technology utilization across years of service. Survey item 17 explored faculty's utilization of instructional and web-based technology across college teaching experiences (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The independent variable, years of service was regrouped to three groups (1-5, 6-10, & 11-100 years). A consolidated mean score was calculated for the item related to each construct: instructional and web-based technologies. A one-way ANOVA was run to compare faculty utilization of instructional and web-based technologies by college teaching experiences. Table 37 shows the results of the two one-way between-groups ANOVA tests.

Table 37

One-Way ANOVA for Faculty Technology Utilization by Years of Service

Variables	Sum of Squares	df	Mean Square	F	Sig
Instructional Technologies					
Between Groups	737.951	2	368.976	19.507	.000
Within Groups	3518.250	186	18.915		
Total	4256.201	188			
Web-Based Technologies					
Between Groups	2383.373	2	1191.687	29.115	.000
Within Groups	7490.283	183	40.931		
Total	9873.656	185			

p < .05

Findings from one-way between-groups ANOVA revealed a statistically significant difference at $p < .01$ across years of service for survey respondents' utilization of instructional technologies, F (2, 186) = 19.5, $p < .01$, $d = .17$, as well as their utilization of web-based technologies, F (2, 183), = 29.1, $p < .01$, $d = .17$. The researcher ran a Post-hoc comparison using the Tukey HSD test to compare all possible pairs of mean and describe how they are different. Table 38 shows a variation in the mean scores between and within the groups for both instructional and web-based technologies.

Table 38 shows that those survey respondents who had 1-5 years' experience (M = 35.6, SD = 2.44) had higher mean scores than those with over 11 years' experience (M = 34.2, SD = 10.1) for utilization of instructional technology. The mean score for survey respondents who had 6-10 years' experience (M = 34.2, SD = 5.71) is higher than mean scores for those with over 11 years' experience (M = 25.3, SD = 10.1). However, the mean scores for respondents who had 1-5 years' experiences (M = 35.6, SD = 2.44) and those with 6-10 years' experience (M = 34.2, SD = 5.371) did not differ significantly.

For utilization of web-based technologies, the mean scores for survey respondents who had 1 – 5 years' experience (M = 50.1, SD = 5.00) was higher than those with over 11 years' experience (M = 29.7, SD = 6.60). The mean scores for survey respondents who had 6-10 years' experience (M = 48.8, SD = 8.20) is higher than mean scores for those with over 11 years experiences (M = 29.7, SD = 6.60). However, the mean scores for survey respondents with 1-5 years' experience (M = 50.1, SD = 5.0) slightly differs from those with 6 – 10 years' experience (M = 48.8, SD = 8.20).

Table 38

Tukey HSD Comparisons for Faculty Instructional and Web-Based Technologies Utilization by Years of Service

Variables	I	J	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Instructional technologies Use	1-5	6-10	1.48214	.66265	.068	-.0835	3.0477
		Over 11	10.33929*	1.69442	.000	6.3360	14.3426
	6-10	1-5	-1.48214	.66256	.068	-3.0447	.0835
		Over 11	8.85714*	1.72407	.000	4.7838	12.9305
	Over 11	1-5	-10.33929*	1.69442	.000	-14.3426	-6.3360
		6-10	-8.85714*	1.72407	.000	-12.9305	-4.7838
Web-based technologies Use	1-5	6-10	1.34244	.98355	.362	-.9816	3.6665
		Over 11	20.44048*	2.68090	.000	14.1057	26.7753
	6-10	1-5	-1.34244	.98355	.362	-3.6665	.9816
		Over 11	19.09804*	2.72464	.000	12.6599	25.5362
	Over 11	1-5	-20.44048*	2.68090	.000	-26.7753	-14.1057
		6-10	-19.09804*	2.72464	.000	-25.5362	-12.6599

**. The mean difference is significant at the 0.05 level*

Group differences in faculty utilization of instructional and web-based technologies across years of teaching with technology. Survey item 18 explored faculty's utilization of instructional and web-based technology across college teaching experiences (see Appendix G: Educators' Technology Access, Attitudes, and Use Survey). The independent variable, Years of Teaching with Technology was regrouped from six to four groups (1-3, 4-6, 7-9, & over 10 years). The researcher calculated a consolidated mean score for items related to each construct: instructional and web-based technologies then ran a one-way between-groups ANOVAs to compare faculty utilization of instructional and web-based technologies by Years of College Teaching with technology. Table 39 shows the results of the two one-way ANOVA tests.

Table 39

One-Way ANOVA for Faculty Technology Utilization by Years of College Teaching With Technology

	Sum of Squares	df	Mean Square	F	Sig.
Instructional Technologies					
Between Groups	1888.679	3	629.560	62.622	.000
Within Groups	1849.805	184	10.053		
Total	3738.484	187			
Web-Based Technologies					
Between Groups	4837.911	3	1612.637	66.195	.000
Within Groups	4409.527	181	24.362		
Total	9247.438	184			

$p < 0.05$

Findings from the first one-way between-groups ANOVA revealed that there was a statistically significant difference at $p < .01$ in the mean scores for survey respondents' utilization of instructional technologies, F (3, 184) = 62.6, $p < .01$, $d = .5$ by Years of Teaching with Technology. Also, there was a statistically significant difference in survey respondents' mean score for utilization of web-based technologies, F (3, 181), = 66.2, $p < .01$, $d = .5$ by Years of Teaching with Technology. The researcher ran a Post-hoc comparison using the Tukey HSD test to compare all possible pairs of mean and describe how they are different. Table 40 shows a variation in the mean scores between and within the groups for both instructional and web-based technologies.

Table 40 shows that that survey respondents who had 1-3 years of experience teaching with technology (M = 35.7, SD = 2.21) had higher mean scores than those with 4-6 years (M = 23.0, SD = 8.40), 7-9 years (M = 22.0, SD = 11.4), and over 10 years (M = 30.6, SD = 6.20) for instructional technology use. The mean score for survey respondents who had 4-6 years of teaching experience with technology (M = 23.0, SD = 8.40) and 7-9 years category (M = 22.0, SD = 11.4) did not differ significantly.

Table 40

Tukey HSD Comparisons for Faculty Technology Utilization by Years of Teaching With Technology

	I	J	Mean Difference (I – J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Instructional technologies	1	2	12.72093*	1.31681	.000	9.3069	16.1350
		3	13.72093*	1.43844	.000	9.9915	17.4503
		4	5.12093*	1.43844	.003	1.3915	8.8503
	2	1	-12.72093*	1.31681	.000	-16.1350	-9.3069
		3	1.00000	1.91995	.954	-3.9778	5.9778
		4	-7.60000*	1.91995	.001	-12.5778	-2.6222
	3	1	-13.72093*	1.43844	.000	-17.4503	-9.9915
		2	-1.00000	1.91995	.954	-5.9778	3.9778
		4	-8.60000*	2.00532	.000	-13.7991	-3.4009
	4	1	-5.12093*	1.43844	.003	-8.8503	-1.3915
		2	7.60000*	1.91995	.001	2.6222	12.5778
		3	8.60000*	2.00532	.000	3.4009	13.7991
Web-based technologies	1	2	22.68837*	2.23921	.000	16.8820	28.4948
		3	18.23837*	2.49643	.000	11.7650	24.7118
		4	17.98837*	2.49643	.000	11.5150	24.4618
	2	1	-22.68837*	2.23921	.000	-28.4948	-16.8820
		3	-4.45000	3.31103	.536	-13.0357	4.1357
		4	-4.70000	3.31103	.489	-13.2857	3.8857
	3	1	-18.23837*	2.49643	.000	-24.7118	-11.7650
		2	4.45000	3.31103	.536	-4.1357	13.0357
		4	-.25000	3.49013	1.000	-9.3001	8.8001
	4	1	-17.98837*	2.49643	.000	-24.4618	-11.5150
		2	4.70000	3.31103	.489	-3.8857	13.2857
		3	.25000	3.49013	1.000	-8.8001	9.3001

*. *The mean difference is significant at the 0.05 level*

For utilization of web-based technologies, Table 40 shows that the mean scores for survey respondents who had 1-3 years of teaching experience with technology (M = 50.1, SD = 5.00) was higher than those with 4-6 years (M = 27.8, SD = 8.70), 7-9 years (M = 32.3, SD = 20.3), and over 10 years (M = 32.5, SD = 6.40) for web-based technologies. Likewise, the mean

scored for survey respondents who had over 10 years (M = 30.6, SD = 6.20) is higher than those with 4-6 years (M = 23.0, SD = 8.40), and 7-9 years (M = 22.0, SD = 11.4).

Faculty access to professional development. Question five of the interview protocol was designed to explore faculty access to professional development conferences, workshops, and seminars that enhance technology use for teaching (see Appendix J: Interview Protocol). Interview protocol 5a asked some follow-up questions and explored the number of times PD were organized in a year. The interpretive analysis was used to analyze interviewees' professional development access (Hatch, 2002). The researcher classified interviewees into two categories based on access to professional development. Some had access, and others do not. This is reflected in Table 41, which shows the number of times faculty who had access attended professional development over the last two years.

Table 41

Faculty Access to Professional Development

Categories	Codes	Reference by Sources	f
1. PD Available	PD Once a Year	3	4
	PD Twice a Year	2	4
	PD Three or More Times a Year	1	1
2. PD Absent	PD Absent	4	6

Six of the ten interviewees made nine comments related to PD access over the last two years. Table 41 shows that only one interviewee had access to multiple PD events, two interviewees had access to access to two events twice per year, and three interviewees had access to only one event per year. There was evidence to show that there was a technology PD partnership between some stakeholders and some colleges. For example, Interviewee 5 explained, "There was a workshop organized by the Center for Information and Communication

Technology in partnership with our college. This is a three-day workshop on instructional technologies." Some institutions are strategic with attempts to include everyone, while at others, only some faculty are included. One interviewee explained,

> CPDP that I have mentioned earlier is organized to provide teachers with basic knowledge of technology use in classrooms. Participants were selected by administrators. It is not an open program to all. This is organized by the Teacher Development Program and NCCE in collaboration with other colleges' management (administrators). Yes, there was about three of them so far, I can remember. (Interviewee 8)

Four interviewees made six comments about the absence of technology-related professional development. The comment below illustrates a presence for discipline-specific professional development and the lack of knowledge about professional development in other departments. One interviewee explained,

> As far as I know, there was never a time that I was sponsored to attend any conference on technology. Even in school here, I only go for conferences on my own in my subject are-Chemistry. But for technology, no. Or maybe in the school of education, they may have them organized for their staffs. I don't know because in my college we have different schools. So, you may not know what is happening in other schools. (Interviewee 6)

Faculty's decision to attend professional development. Interview protocol 5e explored that factors that shaped interviewees willingness to participate in PD (see Appendix J: Interview Protocol). A total of 11 meaning units relate to two codes: Faculty Encouraged to attend PD and Faculty Autonomy (see Appendix K: List of Codes). Of the ten interviewees, six interviewees indicated that they were not required to attend a PD event. However, they decided to attend for their benefit.

Interviewees explained that faculty were autonomous in their decision to attend any PD event. They mentioned several reasons for their attendance. One interviewee explained, "It is for my own good. I want to learn more in terms of technology integration. To better my knowledge and develop competence regarding technology integration in education" (Interviewee 7). Also, interviewee 3 explained, "No....attending conference I think each and every academic staff have [uhh] passion for attending workshops. Because attending workshops would improve you personally. So, it is not by force, or by pursuing, no we have a passion for attending conferences."

Administrators encourage faculty to attend PD by providing some incentives. Four interviewees indicated that administrators supported and encouraged them to attend PD in their respective colleges. In some colleges, administrators strategically select some faculty to attend PD whenever they are organized. One interviewee said, "Yes, it is not compulsory. They just select some names of lecturers for each batch. In addition, they even give us attendance allowances" (Interviewee 7). Another interviewee also explained that

> Some names were drafted for each workshop from each department. It is not that we were forced to attend, but you are very much encouraged to attend. Also, we get paid for attending. In one of them actually, all participants were provided with a Tablet. NO one is penalized for not attending. (Interviewee 5)

Faculty's suggestions for future research. Interview protocol item 5g explored interviewees suggestions for further research. Four interviewees expressed the need for technology professional development workshops, seminars, or conferences that would provide opportunities for learning about emerging technologies and web 2.0 technology. One interviewee

identified not just the content areas but also the duration and frequency of sessions that would be beneficial. This is reflected in the illustrative quotes below.

> We need to learn how to use programs or technologies that are accessible through cell phones, because, of our students. We need to learn more about presentation programs — also, a training that will only focused on developing lecturers' technology competence. There should be enough time for each conference, not just for three days. Maybe a week long. Because we hear that in other colleges, they use to have a weeklong long workshop. (Interviewee 5)

Another interviewee emphasized the important role that administrators and various stakeholders in education can play to help faculty to see the value and benefits of using technology for teaching. The interviewee said,

> They could help lecturers see the value of using technologies for teaching. A lot of us don't see that to be very important. Also, how to use assistive technologies. I am a special education major, so I think generally lecturers need to have enough knowledge on how to use them so that they can at the same time teach students how to use them. (Interviewee 8)

Summary

This mixed methods study was designed to explore faculty access, attitudes, and use of instructional and web-based technologies in five of Nigeria's Teacher preparation colleges. Quantitative and qualitative data were collected in two sequential phases. In phase one, out of 234 total survey responses, a total of 190 responses were statistically analyzed to answer the four research questions. Descriptive statistics were used to explore research questions one and two. Inferential statistics, specifically the Pearson product-moment correlation coefficient, a series of

One-way ANOVAs and independent-samples t-tests were used to explore research questions three and four. The researcher presents a detailed analysis of quantitative and qualitative data organized by research questions. In phase two, qualitative data obtained from 10 interviews were presented were necessary to explain the numeric findings. Chapter five presents a discussion of findings and recommendations for administrators, practitioners, policymakers, and researchers.

CHAPTER FIVE

DISCUSSION OF FINDINGS

This study used a mixed method approach with a sequential explanatory design to explore Nigeria's faculty access, attitudes, and use of instructional and web-based technologies in teacher preparation program. It describes the degree of access and use of instructional technologies and web-based technologies as reported by faculty. It examines faculty attitudes toward technology utilization and the relationships between faculty access to technology, perceived usefulness, perceived ease of use, and technology utilization. Finally, it explores group differences in faculty technology utilization across gender, age, teaching experience, years of teaching with technology, and level of education. Chapter four presented the results based on the analysis of quantitative and qualitative data. This chapter lists the findings. It also presents a discussion of these findings organized by four research questions. It then presents recommendations for administrators, practitioners, policymakers, and researchers.

Overview of the Study

The researcher reviewed the literature in the following major areas (see Chapter Two): (a) historical development of teacher preparation in Nigeria, (b) information and communication technology and web-based technologies in education, (c) International Society for Technology in Education (ISTE) and development of standards, (d) information communication technology and web-based technologies in Nigeria's teacher preparation program, (e) faculty attitudes toward technology integration in Nigeria's teacher preparation program, and (f) theoretical framework: Rogers's DOI and Davis, Bagozzi, and Warshaw's TAM. The review of the literature revealed that there was extensive literature related to technology integration around the world. However,

there were very few empirical studies in Nigeria's context. This formed the basis for generating the following research questions:

1. Which instructional and web-based technologies do faculty have access to and to what extent do they use them for teaching?
2. What are faculty attitudes toward the utilization of instructional and web-based technologies for teaching?
3. What relationships exist between faculty access to technology, technology attitudes, perceived usefulness, perceived ease of use, and technology utilization for teaching?
4. Are there group differences in technology utilization among faculty across gender, age, teaching experience, years of teaching with technology, and level of education?
5. Does access to technology, technology attitudes, perceived usefulness, and perceived ease of use impact faculty technology utilization for teaching?

The researcher created two instruments: Educators' Technology Access, Attitudes, and Use (ETAAU) Survey and Interview Protocol to collect both quantitative and qualitative data from five faculty in five teacher preparation colleges in Nigeria's northwest geopolitical zone. The researcher conducted content and face validity testing of instruments prior to the study, as well as reliability (consistency) testing of the survey through piloting. The researcher analyzed responses and obtained the coefficient of reliability (Cronbach's alpha). All items were deemed worthy of retention because they positively relate to the scale. Following data collection, research question five was discarded from further analysis because it violated the assumptions of linear and multiple regression (linear relationship, multicollinearity, and homoscedasticity).

SPSS (v.25) and Nvivo (v.12) were used to analyze the quantitative and qualitative data respectively. The next section will present a list of findings that emerged.

Summary of Findings

A total of 190 respondents from five teacher preparation colleges were included in the quantitative phase of this study, and 10 faculty volunteered and participated in the interview. The majority of survey respondents were between the ages of 31 and 40 years. More than half have taught between one and five years and taught using technology between one and three years. Data analysis presented in Chapter Four led to the following findings organized in six constructs. A summary of the key research findings is presented below:

Construct One: Faculty Access and Use of Instructional and Web-Based Technologies

1. The majority of surveyed Nigerian faculty have greater access to Cell Phones, Laptops in Classrooms, Tablet, VCR/DVD Player, and Internet Connection in Classrooms. They reported that they use Cell Phones and Tablets daily, and several used Laptops and VCR/DVD Players frequently.
2. While the majority of survey respondents have access to Clickers, Instructor Run Computer Stations, LCD Projector/Document Camera, and Desktop Computers in Classrooms, they do not use them for teaching.
3. A large proportion of survey respondents indicated a lack of access to Assistive Technology Tools and Interactive Whiteboards.
4. The majority of survey respondents indicated that they had not used the following technologies for teaching: Assistive Technology Tools, Instructor Run Computer Stations, Clickers, Projector/Computer Projection System, Desktop Computer in Classroom, Overhead Projector/Document Camera, and Interactive Whiteboards.

5. Survey respondents reported a lack of access to the majority of web-based technologies listed in the survey item six. These include Interactive Quizzes, Virtual World, Plagiarism Detection Software/Sites, Classroom Management/LMS, and Interactive Content Delivery and Assessments.
6. The majority of survey respondents had access to some web-based technologies but did not use them for teaching. They include Photo/Video Sharing Tools, Video Conferencing/Chatting Systems (Blogs, and Social Media/Tools.
7. A vast majority of survey respondents have used Social Media Tools for teaching occasionally.

Construct Two: Faculty Attitudes Toward Utilization of Instructional and Web-Based Technologies

8. The majority of respondents disagree/strongly disagree that the use of instructional technology is good and agree/strongly agree that the use of web-based technologies is good.
9. The majority of respondents indicated that the use of instructional and web-based technologies as important. Almost all survey respondents disagree/strongly disagree that the use of instructional and web-based technologies is inefficient and useless.
10. While a vast majority of respondents agree/strongly agree that the use of instructional technology is not hard, they agree/strongly agree that the use of web-based technologies is hard.
11. A large majority of respondents were ambivalent about instructional and web-based technologies' potential to be engaging.

12. Overall interviewees have positive attitudes toward the use of technology for teaching. The majority of interviewees spoke highly about faculty's positive attitudes and administrators' negative attitudes. Several interviewees described their positive experience with technology. These were attributed primarily to their intrinsic motivation.
13. Only one of the interviewees indicated that administrators have positive attitudes toward technology and provide college-wide support for technology use initiatives. Conversely, only one interviewee described the negative attitude faculty showed toward technology use.
14. Survey respondents reported a high degree of comfort regarding the use of instructional and web-based technologies for teaching.
15. Based on the survey data, four-fifths of survey respondents classified themselves as the "Early Majority" in terms of Roger's Diffusion of Innovation Theory. The rest were evenly classified as the "Early Adopters" and "Innovators." None of the respondents classified themselves as the "Late Majority" or "Laggards/Traditionalist."

Construct Three: Barriers to Faculty Utilization of Instructional and Web-Based Technologies

16. The majority of survey respondents reported a lack of technology access, lack of involvement, lack of stable electricity/power supply, lack of technology vision, and leadership as significant barriers to technology use for teaching.
17. The majority of survey respondents were less concerned about the speed of Internet connection, inadequate software, how to make technology relevant,

unpredictable nature of technology, and outdated computer/program/software. Some interviewees reported poor internet, overcrowded classrooms, and lack of technology competence among the barriers that prevented the use of technology for teaching.

Construct Four: Relationships Between Faculty's Access to Technology, Technology Attitudes, Perceived Usefulness, Perceived Ease of Use, and Technology Utilization

18. Results of a one-way ANOVA showed that there was a statistically significant difference at the .05 level ($p = .000$) for survey respondents' access to instructional technologies on technology attitudes and utilization. Post hoc comparison using the Tukey HSD test revealed that the actual difference in the mean scores between groups (Not Used, Used and Not Available) varies significantly across various instructional technologies.
19. Results of a one-way ANOVA showed that there was a statistically significant difference at the .05 level ($p = .000$) for survey respondents' access to web-based technologies on technology attitudes and utilization. Post hoc comparison using the Tukey HSD test revealed that the actual difference in the mean scores between groups (Not Used, Used and Not Available) varies significantly across various web-based technologies.

Construct Five: Group Differences in Faculty Technology Utilization Across Gender, Age, Years of Service, Years of Teaching With Technology, and Level of Education

20. Results of an independent-samples *t*-test showed that mean scores between male and female for utilization of instructional and web-based technologies were not statistically significant.

21. Results of an independent-sample t-test show that mean score for survey respondents' instructional and web-based technologies use between the ages of 21 to 40 and those over 40 were not statistically significant.
22. Results of an independent-sample t-test show that there was a statistically significant difference in the mean scores for survey respondents' utilization of instructional and web-based technologies by levels of education. Survey respondents with an undergraduate degree had a higher mean score than those with a graduate degree. The magnitude of the difference in the means (mean difference = 2.73, 95% CI: .847 to 4.60) for respondents' utilization of instructional (eta squared = .10) and web-based (eta squared = .10) was moderate.
23. A one-way ANOVA showed that there was a statistically significant difference at the .05 level (p = .000) across years of service for survey respondents' utilization of instructional and web-based technologies. Post hoc comparison using the Tukey HSD revealed that the mean score for respondents who had 1-5 years' experience and those with 6-10 years' experience did not differ significantly for instructional technology, and for respondents' utilization of web-based technologies, the mean scores for survey respondents with 1-5 years' experience is slightly higher than those with 6-10 years' experience.
24. A one-way ANOVA showed a statistically significant difference at the .05 level (p = .000) for survey respondents' utilization of instructional and web-based technologies by Years of Teaching with Technology. Post hoc comparison using the Tukey HSD revealed that the mean scores for survey respondents who had had 4-6 years and 7-9 years of service with technology did not differ significantly

for instructional technologies. Post hoc comparison also revealed that the mean scores for survey respondents who had over 10 years of teaching with technology are higher than those with 4-6 years, and 7-9 years' experience of teaching with technology for web-based technologies.

Construct Six: Faculty Access and Decision to Attend Professional Development

25. Interviewees revealed that access to technology professional development was varied and limited. Several interviewees described their positive experience with technology. They attributed this primarily to their intrinsic motivation. Also, some interviewees explained that administrators encourage faculty to attend Professional Development by providing some incentives.
26. Interviewees acknowledge the government's increased efforts toward improving technology access. They expressed the need for access to more technology professional development conferences. They explained that administrators and various stakeholders in education should work with faculty to understand the benefits that technology offers in education.
27. Interviewees expressed the lack of college-wide technology professional development in some colleges. There was evidence to show that some institutions are more inclusive than others; at some institutions, some faculty were given preference over others.
28. Some interviewees expressed dissatisfaction with ways administrators handled technology activities in their institutions. They explained that they do not have a voice in technology decisions.

Discussion of Findings

In the twenty-first century, we are witnessing many more changes that have ever been experienced by any civilization. The information age is challenging educators to embrace a new paradigm that includes the use of technology tools. Education systems are shifting into a new paradigm by embracing technology as an essential tool to address this change (Henson, 2010). According to Prensky (2006) children born in the digital age (digital natives) are significantly affected by the rapid growth in technology. Technology integration in education has become imperative due to the nature of students in our classroom.

Over the last few decades, technology integration has been widely accepted across all levels of education. Scholars have identified several factors that influence technology integration in both K-12 and college classrooms. Access to technology has a profound impact on faculty use of technology for teaching (Howard & Mozejko, 2015). Technology access and faculty attitudes toward technology utilization are vital factors that determine faculty use of technology (Ajoku, 2014). As access to technology increases, faculty's attitudes toward technology determines technology use for instructional purposes (Blackwell, Lauricella, & Wartella 2014; Marzilli, Delello, Marmion, McWhorter, Roberts & Marzilli, 2014). In Nigeria, there was a lack of empirical studies related to faculty access, attitudes, and use of instructional technologies. Finding in this study will serve as a contribution to the literature.

Faculty Access and Extent of Use of Instructional and Web-Based Technologies

In the United States, researchers have conducted studies on teachers and faculty access to and use of instructional technologies in both K-12 and higher education classrooms (Blackwell, Lauricella, & Wartella 2014; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sandurur, 2012; Howley, Wood, & Hough 2011; Pittman & Gaines 2015). These studies explored the relationship

between technology access and its utilization for teaching. Pittman and Gaines (2015) report that technology access had a significant correlation with technology utilization, especially when students have direct access to computers. Sexena (2017) argues that technology access and teachers technological knowledge are strong impediments to technology integration in the classroom and they may have a prolonged impact on teacher's attitudes and use of technologies for teaching. These findings mirror those conducted in UK schools (Morley, 2011).

In Nigeria, government and several stakeholders have put forward some efforts to increase technology access in the country's education sector (Intel, 2012; Onwuagboke, Ranjit-Singh & Soon-Fook, 2015; SchoolNet, 2003; TETFund, 2016). Ajoku (2014) critically examines Nigeria's colleges' access to technology. Ajoku (2014) found that access to technology is the primary determinant of technology utilization in classrooms. Other scholars (Ajayi & Ekundayo, 2009; Jude & Dankaro, 2012; Onwuagboke, Ranjit-Singh, & Soon Fook, 2015) have documented that there is limited access to instructional and web-based technologies in Nigeria's colleges. Garba, Ranjit-Singh, Yusuf, and Ziden (2013) express concerns because the majority of Nigeria's teacher preparation colleges are not up to date regarding access and use of technology. Consistent with the sparse literature, this study confirms that participating faculty in Nigeria's teacher preparation colleges have low access to technology. Low access to technology may be due to the fact that Nigeria is in the infancy stage with technology integration across all levels of education (Garba, Ranjit-Singh, Yusuf, & Ziden, 2013). Additionally, low access to technology may be due to the way the education budget is utilized; equipping colleges with technology resources may not be a high priority. Colleges may be using their annual budget for some projects and give less attention to providing technology resources in the classrooms and lecture

rooms. An analysis of the federal budget would shed light on how federal money is spent in this regard.

Researchers around the world have described a high level of technology utilization in different classrooms (Buchanan, Sainter, & Saunders, 2013; Marzilli, Delello, Marmion, McWhorter, Roberts and Marzilli, 2014; Strayhorn, 2007). Strayhorn (2007) and Jaschik and Ledeman (2018) found a high level of technology utilization among higher education faculty in the United States. According to Pew Research (2014), "in developing countries, there has been an increase in the number of social media users from 33% in 2013 to 42% in 2017" (p. 6). The researcher was unable to find studies that describe Nigeria's faculty use of web-based technologies for teaching. This study shows that web-based technology continues to be underutilized in Nigeria's teacher preparation program. The extent to which faculty use web-based technologies and instructional technologies varies. As discussed in the findings, this could be due to inadequate access to instructional and web-based technologies across Nigeria's teacher preparation colleges.

Faculty Access and Decision to Attend Professional Development

Faculty in the United States have numerous avenues for professional development. In the United States, colleges and universities provide funding for faculty to attend professional development conferences both nationally and internationally (Baldwin & Chang, 2007; Henard & Roseveare, 2012; Miles, Odden, Fermanich & Archibald, 2004). Additionally, universities in the United States provide professional development opportunities to their local community through professional development centers (Jacob, Xiong, & Ye, 2015). Similar technology-related initiatives have been spearheaded by the Nigerian government and various stakeholders in education. They include DigitNet project by ETF, TETFund act initiatives, School Access

Program by Intel, School Net project, NOUN project, PolyNet, NUC-Virtual Digital Library, NEARNet, and Teachers Network-Teach Net project (Idowu & Esere, 2013; Intel, 2012; Onwuagboke, Ranjit-Singh & Soon-Fook, 2015; SchoolNet, 2003; TETFund, 2016). This study confirms that faculty have access to technology-related PD initiatives in Nigeria's education systems. The factors that influence faculty's decision to attend or not to attend professional development merits additional study.

There was a lack of literature that describes how universities and colleges' support faculty professional development. Ajoku (2014) and Owolabi, Oyewole, and Oke (2013) recommend college-wide professional development. They suggest that administrators and policymakers should address and find out ways to conduct technology professional development for faculty in terms of instructional and web-based technologies used for teaching. This study confirms that some college administrators support and encourage faculty to attend technology professional development. While professional development is being offered in a systematic way at some institutions, it is not a priority at others. Some interviewees noted the lack of college-wide technology professional development; others indicated that they had access to some professional development. They expressed the need for additional technology professional development conferences. The lack of support in some colleges could be attributed to administrators' negative attitudes toward technology or the lack of sufficient funds to be used for professional development initiatives. Colleges may have a tight annual budget from the federal government that the money may not be enough to support extra programs for faculty professional development.

Faculty Attitudes Toward Utilization of Instructional and Web-Based Technologies

Globally, researchers have conducted several studies to explore teachers' attitudes toward technology integration at different levels of education (Banas, 2010; Bauer & Kenton, 2005; Strayhorn, 2007). Hassad (2013) report that faculty technology attitudes and use were positively related and indicated a high tendency of technology use in constructivist teaching. Loague, Caldwell, and Balam (2018) found that faculty have a positive attitude toward technology and agree that the use of technology enhances practice and support learning. Also, in a study of technology integration at a public regional university in the United States, Marzilli, Delello, Marmion, McWhorter, Roberts, and Marzilli, (2014) found that, overall faculty exhibit positive attitudes towards the use of technology in classrooms, and they are highly motivated and use an average of six technology tools in each of their courses.

Existing literature confirms that technology integration is in its infancy in Nigeria (Garba, Singh, Yusuf, & Ziden, 2013; Owolabi, Oyewole, & Oke, 2013). Faculty technology attitudes and self-efficacy determine to a large extent technology use for teaching (Aremu &Adediran, 2011). The findings in this study mirror findings of many scholars. For example, Hassad (2013) found that faculty attitude toward technology is moderate, and there is a statistically significant correlation with technology use for teaching. Similarly, Marzilli, Delello, Marmion, McWhorter, Roberts, and Marzilli (2014) found that faculty's positive attitudes toward technology have influenced their technology adoption. This study revealed that faculty in Nigeria's teacher preparation program had favorable attitudes toward technology. The majority agreed that the use of instructional and web-based technologies for teaching is important. The qualitative findings corroborate the quantitative findings across the five colleges. Faculty's limited access to technology has not had a negative impact on their attitudes toward technology. Their positive

attitudes could be attributed to their participation in professional development where they learned about the benefits that technology offers in twenty-first century classrooms.

Studies have shown that administrators also have some negative attitudes toward technology. Loague, Caldwell, and Balam (2018) found that administrators showed negative attitudes due to lack of enough tech support services in their colleges. Ledeman (2018) reports a lack of institutional support in terms of training to use technology for teaching. This area is under-researched in Nigeria. This study mirrors Loague, Caldwel, and Balam's (2018) and Ledeman's (2018) works. Faculty perceived college administrators' attitudes toward technology as negative due to the lack of administrators' technology support in terms of providing up to date technology (hardware and software) for use in teaching and learning. The majority of interviewees explained that administrators in their colleges made little to no effort toward procurement of technology or providing technology-related services like professional development workshops or conferences. Also, interviewees expressed that they were left alone to carry out all technology initiative with little support from the administrators. Of the ten interviewees, only one interviewee indicated administrators' positive attitudes toward technology integration in Nigeria's teacher preparation program.

The literature showed the interplay of several factors that determine faculty technology comfort level. These include technology skills and expertise, technology competence and training, self-efficacy, and confidence. In their study, Marzilli, Delello, Marmion, WcWhorter, Roberts, and Marzilli (2014) found that faculty technology skills have a significant correlation with technology use in the classroom. Buchanan, Sainter, and Saunder (2013) found a positive relationship between faculty's internet self-efficacy and use of technology for teaching. They found that faculty's self-efficacy determines their comfort levels in using technologies for

teaching. Owolabi, Oyewole, and Oke (2013) argue that faculty technology comfort levels influenced their technology attitude formation. Buabeng-Andoh (2012) also maintains this view and explains that teachers' computer self-efficacy had greatly influenced their attitudes toward technology.

This study is consistent with the literature and findings revealed that the majority of survey respondents were moderately/extremely comfortable regarding the use of instructional and web-based technologies for teaching. In this regard, qualitative findings supported the quantitative findings. Interviewees expressed that they were very comfortable while using technology for teaching. Of the ten interviewees, only one interviewee indicated a lack of comfort in using technology for teaching. The interviewee explained that faculty might not be comfortable with what he or she does not have access to by explaining that access to technology may have a tremendous impact on the degree of comfort that faculty would develop, which eventually determines faculty technology attitude formation. Faculty were comfortable with the technology they had access to. This could be attributed to their positive attitudes and the fact that they have minimal access. Also, they volunteered to participate in the interviews, and their responses may not reflect those who chose not to participate.

Around the world, several researchers in higher education have used Rogers's DOI in many different ways (Aizstrauta, Ginters, & Eroles, 2015; Doyle, Garrett, & Currie, 2014; Jwaifell & Gasaymeh, 2013; Moran, Hawkes, & Gayar, 2010). Jaschik and Lederman (2018) found that 33% of faculty were "Early Adopter," 55% were "Late Majority," and 12% were "Laggards." The results demonstrated two things. First, findings in this study are consistent with Rogers's (1995) categorization of individuals within the social system for two categories "Early Adopters" and "Early Majority" categories. Four-fifths of teacher educators were described as

"Early Majority," "Early Adopters," and "Innovators" in the innovativeness categories. Second, for the remaining categories, findings were not consistent with Rogers's (1995) innovator categorization because none of the survey respondents classified themselves as the "Late Majority" and "Laggards or Traditionalist". The absence of literature makes it difficult to explain these findings within the context of Nigeria's teacher preparation program. The high number of teacher educators' categorization to "Early Adopters" and "Early Majority" categories could be attributed to the explanation of Rogers (1995) that "Early Adopters" are more involved in the social system, and "Early Majority" value interaction and rarely held a position of authority. It is unclear whether this is a suitable explanation for this within the context of Nigeria's teacher preparation program.

Around the world, researchers have used TAM as a theoretical framework to conduct a wide variety of studies across disciplines (Echeng, Usoro, Majewski, & Mesto, 2013; Fathema, Shannon & Ross, 2015; Holden and Karsh, 2010; Park, 2009). They have focused on various components of TAM to determine the level of technology acceptance. Alharbi and Drew (2014) found that there was a strong correlation between attitudes, perceived ease of use, and perceived usefulness of faculty's behavioral intentions to use LMS. Olumide (2016) found that TAM constructs had a high prediction ability of users' acceptance and technology use in achieving information literacy in Nigeria's colleges. According to Echeng, Usoro, Majewski, and Mestro (2013) perceived usefulness, and perceived ease of use determine educators' behavioral intentions to accept and use technology. Moreover, Oye, Iahad, Madar, and Rahim (2012) found that faculty's perceived ease of use had a greater influence on their behavioral intention to use ICT for teaching. In this study, faculty reported positive attitudes toward the perceived usefulness and ease of use of technology. This is not surprising because they expressed positive

attitudes toward technology use. This could explain why they exhibit positive attitudes toward perceived usefulness and ease of use of technology.

Barriers to Faculty Utilization of Instructional and Web-Based Technologies

There is a growing body of research that explores barriers to technology utilization for teaching. Barriers to faculty technology integration may be institutional-based and faculty-based. Marzilli, Delello, Marmion, WcWhorter, Roberts, and Marzilli (2014) report faculty's lack of knowledge and technology skills as barriers to their technology utilization. Also, Mueller and Wood (2012) report teachers' limited technological pedagogical skills as a major barrier to technology integration in Canadian schools. According to Ajayi and Ekundayo (2009), Jude and Dankaro (2012), and Onwuagboke, Ranjit-Singh, and Soon Fook (2015), institutional-based barriers, like lack of access and technology accessibility are two major barriers to educators' use of technology. A similar trend was observed in this study. A descriptive analysis of responses related to barriers revealed a lack of technology access, lack of faculty involvement in technology decision across campuses, lack of technology vision, and lack of technology leadership. These findings are consistent with a study that identified institutional-based barriers as significant barriers to technology utilization in colleges and universities (Onwuagboke, Ranjit-Singh, & Soon Fook, 2015). Lack of technology vision may be attributed to the fact that Nigeria is in the infancy stage of technology integration and the lack of technology standards that guides the conduct of educators, administrators, and students. Technology standards could help colleges and universities to develop a sound technology vision in developing faculty competency and practice.

Nigeria, like many developing countries, has an unstable power supply. Researchers have documented poor power supply as another institutional-based barrier to technology use on

campuses (Ajoku, 2014; Onwugboke, & Singh, & 2015; Oye, Salleh, & Iahad, 2011). In state-owned colleges, the poor power supply is a major barrier to faculty technology utilization due to poor funding (Asiyai, 2014). Considering previous research findings related to barriers to faculty's use of technology for teaching, qualitative findings for this study buttressed quantitative results. Interviewees described the lack of stable electricity/power supply and lack of technology access as major barriers to technology use. Some interviewees reported poor internet, overcrowded classrooms, and lack of technology competence as barriers that prevented the use of technology for teaching.

In 1979, the National Education Technology Standards (NETS), presently called the International Society for Technology in Education (ISTE), developed technology standards that guide the practice of administrators, faculty, and students (ISTE, n.d.). Qualitative data revealed the lack of technology vision and leadership across Nigeria's teacher preparation colleges. The researcher reached out to various resources to locate professional technology standards, and this did not yield results. A set of standards like the ISTE standards could be used to improve the practice of administrators, faculty, and students in Nigerian colleges. Stakeholders should consider teaming up with the ISTE and develop technology standards for Nigeria's tertiary institutions in general, and teacher preparation program, in specific.

Relationships Between Faculty's Access to Technology, Technology Attitudes, Perceived Usefulness, Perceived Ease of Use, and Technology Utilization

Access to technology in the classroom and faculty technology attitudes have a profound effect on faculty's perceived usefulness and ease of use of technology (Larbi-Apau & Moseley, 2012; Okine, Agbemenu, & Marfo, 2013). While some researchers have found that access to technology resources has a strong correlation with teachers' use of technology for teaching

(Hennessey, Ruthven & Brindley, 2005; Pittman & Gaines, 2015). Others have argued that access to technology might not necessarily determine its adoption for teaching (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sandurur, 2012). For example, according to Larbi-Apau and Moseley (2012) technology access in Ghanian universities had an impact on faculty adopting technology for teaching. Similarly, Hassad (2013) reports that technology access determines faculty attitudes toward the use of statistical software in Mathematics. Similarly, Pittman and Gaines (2015) reported that technology access had a significant correlation with technology utilization, especially when students have direct access to computers. Sexena (2017) argues that technology access and teachers' technological knowledge are strong impediments to technology integration in the classroom and they may have a prolonged impact on teachers' attitudes and use of technologies for teaching. In this study, the quantitative results build on the existing literature on relationships between faculty's technology access and utilization. Results of a one-way ANOVA showed that there was a statistically significant difference at the .05 level ($p = .000$) for survey respondents' access to instructional and web-based technologies on technology attitudes and utilization. Results of Post-hoc comparison using Tukey HSD confirmed that actual differences exist between the groups (Not Used, Used, and Not Available) that have access to and use both instructional and web-based technologies. These group of faculty could be those that have little access to technology in their respective colleges thus enabling them to develop some degree of comfort to use these technologies for teaching.

Faculty's perceived ease of use and usefulness of technology may determine the use of that technology for teaching. Perceived usefulness and perceived ease of use are key components of the Technology Acceptance Model (TAM). Fathema, Shannon, and Ross (2015) studied faculty use of LMS in higher education institutions. They found that system quality, perceived

self-efficacy, and facilitating conditions in the TAM had a significant effect on the predictive ability of faculty attitudes towards LMSs. Alharbi and Drew (2014) found that there was a strong relationship between attitudes, perceived ease of use, and perceived usefulness of LMS as they determine educators' behavioral intention to use LMS. Similary, Larbi-Apau and Moseley (2012) reported that faculty affective attitudes were strongly correlated with perceived usefulness and behavioral intentions to use technology. Based on the results of this study, it appears that there was variability in the strength of the relationship between faculty technology access, technology attitudes, perceived usefulness and ease of use of instructional and web-based technologies. Findings of this study were similar to findings that were reported by Fathema, Shannon, and Ross, (2015), Alharbi and Drew, (2014), and Larbi-Apau and Moseley (2012) regarding relationships between access to technology, attitudes, perceived usefulness, perceived ease of use, and technology utilization. This study found a strong positive correlation between faculty's perceived ease of use and perceived usefulness of technology.

Group Differences in Faculty Technology Utilization Across Gender, Age, Years of Service, Years of Teaching With Technology, and Level of Education

In Nigeria and developing countries alike, faculty have limited access to technology as compared to developed countries (Acılar, 2011; Cruz-Jesus, Oliveira, & Bacao, 2012; Garba, 2014). The use of demographic factors as independent variables helps to provide an understanding of where the problem is, and how to provide recommendations for appropriate intervention.

Studies have shown that gender does not have an impact on technology utilization (Mehdi & Al-Dera, 2013; Onwuagboke & Singh, 2016). In line with the previous study, results of an independent-samples t-test show that mean scores between male and female for the

utilization of instructional and web-based technologies were not statistically significant. It is important to note that four-fifths of faculty who participated in this study were male. This situation is the same in all tertiary institutions in Nigeria. The number of male faculty outnumbered the females in all respect. This unequal sample size could explain why group differences across gender were not observed. Conducting a study with more robust tests would help to explore more on how this issue of unequal distribution of samples could be addressed.

Levels of education and teaching experiences determine to a large extent faculty technology utilization (Marzilli, Delello, Marmion, WcWhorter, Roberts, & Marzilli 2014). Mehi and Al-Dera (2013) did not observe a group difference in technology use based on teaching experience. However, this study showed a statistically significant difference in the mean scores for faculty's utilization of instructional and web-based technologies by the level of education. Survey respondents with an undergraduate degree had a higher mean score than those with a graduate degree for both instructional and web-based technologies. The literature helps to explore this finding. Faculty with 1-5 years of service were trained when technology started to be part of instruction across Nigeria's colleges and universities. Therefore, they may have some technologically-based pedagogical knowledge and developed a considerably high comfort level with classroom application of technologies.

Several researchers have studied faculty technology skills, competence, and experiences (Georgina & Hosford, 2009; Hassad, 2013, Marzilli, Delello, Marmion, WcWhorter, Roberts, and Marzilli, 2014; Morley, 2011). Marzilli, Delello, Marmion, WcWhorter, Roberts, and Marzilli (2014) examined faculty attitudes toward the use of technology for teaching at a regional university in the United States. They found that faculty technology skill level had a significant correlation with technology use in the classroom. Also, Georgina and Hosford (2009)

studied the impact of faculty technology competence and training on their technology adoption. They found that there was a significant correlation between faculty technology competence and integration into teaching. This study showed a statistically significant difference in the mean scores across years of teaching with technology for faculty's use of instructional and web-based technologies. The finding is expected, given that technology integration in Nigeria is in its infancy. Faculty who have just begun their career have probably use technology more often. This could be because they were trained when technology tools became more accessible.

Observed Theme: Political Influence

During the interviews, the researcher observed that interviewees expressed some dissatisfaction with the way administrators handled technology-related matters. For example, they used words "politics," and "politics involved," frequently. They mentioned several times that their voices were marginalized by administrators and they were scared to talk on several issues. Some feared that their voices would not be heard; others were afraid they might face some penalties. This suggested that the researcher raised it as a theme- Political Influence.

Of the five interviewees who commented, two interviewees directed their comments to administrators' inability to provide sufficient technology access, and how they get access only for some purposes. One interviewee said,

> In fact, administrators do not even provide us with technology support. Even if you write or forward a request, they hardly get back to you. Their words are always; school is running out of budget. But they will make a provision for it when forwarding another budget. This is where politics come in. I better not go into this. (Interviewee 5)

Another interviewee indicated that they only hear about technology access on research or some form of media, but, schools were not equipped with these technologies. An interviewee said,

> Access to technology is at the lowest low as compared to what we are hearing over the news or even in some research conducted by lecturers. But you know, you have to keep quiet. They say there is abundant technology. I will tell you, this, there is a lot of politics involved. I don't want to comment beyond this. (Interviewee 4)

Also, an interviewee acknowledged the government's efforts towards increasing technology access and faculty development. However, he expressed dissatisfaction with ways administrators handled technology activities in their various schools. This interviewee explained,

> NCCE as well send circulars on improving lecturers' technology capabilities that is why they partner with schools to organize workshops. But I will tell you this; there is a lot of politics involved. I would rather stop here. (Interviewee 10)

Recommendations

The key actors in Nigeria's teacher preparation program--administrators, faculty, and policymakers–can play a pivotal role in creating technology-rich environment for Nigerian pre-service teachers. The following recommendations can be used to guide practice and future research.

Recommendations for Administrators

Results indicate that technology access is inadequate across Nigerian teacher preparation colleges. This lack of access to technology affected their use of technology for teaching. It is imperative that administrators (Provosts, Registrars, Deans, and Chairs of Departments) understand the relationship between access to technology and integration for teaching. The following are recommended for administrators across Nigerian teacher preparation colleges:

1. Administrators should be open, supportive, and involved experts who are willing to take the lead on campus-wide technology initiatives. They should identify and

provide faculty with technologies that are essential for twenty-first century classrooms.

2. Administrators should survey faculty across campuses to identify hardware and software needs so that limited funds could be used appropriately.
3. Administrators should increase their efforts to provide sufficient access to relevant technologies and service centers within their colleges. This could include the establishment of the following on campuses, the establishment of an IT Support Center that will provide faculty, staff, and students with technology support. The IT Support Center should be equipped with adequate tech-savvy personnel who can provide timely in-class support for faculty in terms of hardware and programs failures. Also, a Center for Teaching Excellence (CTE) should be established. The CTE could organize workshops and seminars for faculty related to various topics including technology integration.
4. Results revealed that there was a lack of college-wide professional development opportunities for faculty. Administrators should provide college-wide technology professional development opportunities regularly. This could include seminars, workshops, and conferences that will provide faculty with theoretical and practical knowledge of technology utilization for teaching. This would enable faculty to learn how to integrate technologies for teaching in a meaningful way. Faculty who have technology expertise could also be invited to present seminars and workshops on various strategies that teachers could use technology for teaching.

5. Colleges may have a tight annual budget from the federal government, and the money may not be enough to support extra programs for faculty professional development. Colleges should conduct a fund-raising event annually and invite stakeholders, local companies and businesses, and alumni. Fund raised during this event can be dedicated to faculty's professional development.
6. Faculty expressed their dissatisfaction regarding the technology decision-making process in their respective colleges. They mentioned that their voices do not count in technology decision. College administrators should develop a mechanism to involve faculty in technology decisions. This may be done by creating technology committees at the departmental level. Each department could have a representative on the college-wide technology committee.
7. Administrators should work with stakeholders in general and faculty in particular to develop technology policies within their colleges. This will provide faculty with clear expectations regarding technology use.

Recommendations for Practitioners

This study shows a lack of adequate technology professional development opportunities. Faculty become more skilled when they enhance their repertoire of knowledge. Faculty can show commitment to their professional growth by

1. Attending technology conferences (local, regional, national and international).
2. Reading books written by experts, especially ones related to technological, pedagogical and content knowledge, and best practices of teaching with technology. Also, faculty could engage in book discussion groups within their

respective departments. This would enable them to learn and mentor each other in this regard.

3. Conducting mini-departmental Professional Development workshops by themselves without waiting for college-wide Professional Development to be organized by administrators. This exchange of ideas will encourage others to experiment and engage in reflective practice in technology use for teaching.
4. Faculty should be positive in learning how to use open educational resources that are available online. Through Open Educational Resources (OER) faculty can have free access to a variety of educational resources like open courses, open textbooks, open services and platforms, open media materials and E-Book. OERs will help faculty to engage in self-regulated learning to develop their technology competence.
5. Faculty should be informed of various educational opportunities that web 2.0 provides and make use of them. Solomon and Schrum (2014) explained that multitudes of educational software are web 2.0, most of which are free or very inexpensive. Consequently, faculty might be able to get students involved in Bring Your Own Device/Technology (BYOD/BYOT). By doing this, lack of technology access might be reduced to the very minimum, and students would get to learn and benefit from these opportunities that technology offers in teaching and learning.
6. Peer observation. While this practice is not common within the Nigerian higher education context, it could, overtime, help to transform the culture of the organization. Faculty could take advantage of this initiative and provide each

other with constructive feedback that would help shaped faculty technology use in their classroom.

7. Results of this study indicated that faculty's attitudes toward the use of technology were moderate. According to TAM, perceived usefulness and perceived ease of technology strongly determine attitudes toward the use of technology. Faculty should develop interests to learn how different technologies are useful for teaching. This exposure will help faculty to develop positive attitudes toward technology and may influence their decision to incorporate instructional and web-based technologies for teaching.

Recommendations for Policymakers

Based on an extensive review of literature, the researcher found that Nigeria teacher preparation program and the education system at large do not have stated technology standards for faculty and administrators. It is strongly recommended to policymakers in Nigeria's education system at large, especially the Federal Ministry of Education through the National Universities Commission (NUC), the National Commission for Colleges of Education (NCCE), the National Board of Technical Education (NBTE), Nigerian Educational Research Development Council (NERDC), National Institute for Educational Planning and Administration (NIEPA), National Teachers Institute (NTI), and Tertiary Education Trust Fund (TETFund) to

1. Adopt the ISTE standards and aligned them with Nigeria's minimum standard. These standards would help to serve the mission of the ISTE, and Nigeria's National Development Plan of becoming a technology literate society. The mission of the ISTE was to "inspire educators worldwide to use technology to innovate teaching and learning, accelerate good practice and solve tough

problems in education by providing community, knowledge and the ISTE Standards, a framework for rethinking education and empowering learners" (ISTE, n.d.).

2. Create a technology evaluation committee that will be charged with the responsibility of creating faculty technology accountability measures across all colleges.

Recommendations for Future Research

The purpose of his study was to use Rogers's Diffusion of Innovation Theory (1995) and Davis, Bagozzi, and Warshaws' (1989) Technology Acceptance Model (TAM) to describe faculty access, attitudes, and use of instructional and web-based technology for teaching at Nigeria's Teacher Preparation Colleges. The researcher provides the following recommendations for future research based on findings from this study:

1. Researchers in Nigerian could replicate this study with a larger sample, preferably one that includes all colleges across all six geopolitical regions.
2. This study could also be replicated with university faculty in teacher preparation program and colleges of education faculty. This will deepen our understanding of technology use in Nigeria's teacher preparation program.
3. Researchers should focus on the state of technology use in Nigeria. The specific focus could be placed on faculty technology needs and how to provide those services to them across campuses.
4. Research should study Nigerian faculty's technological, pedagogical and content knowledge and examine the interplay between these factors because it can affect faculty technology utilization across Nigeria's tertiary institutions.

5. Researchers should also consider using a case study approach with different types of institutions. This will provide an in-depth explanation of faculty technology access, attitudes, and use of instructional and web-based technologies.

Conclusion

The importance of technology integration in education cannot be overemphasized. According to Fu (2013), technology serves as an avenue for the expansion of educational access. This, therefore, makes learning possible at any time, wherever there is access. Castro- Sanchez, and Aleman (2011) reported that technology plays an integral role in transforming teaching and learning atmospheres into a more learner-centered one. Moreover, Onyia and Onyia (2011) reported that technology sustained education could promote students' acquisition of knowledge and skills for lifelong learning.

The purpose of this study was to use Rogers's Diffusion of Innovation Theory and Davis, Bagozzi, and Warshaw's Technology Acceptance Model to describe Nigeria's teacher educators' access, attitudes, and use of instructional and web-based technologies in teacher preparation colleges. Rogers's Diffusion of Innovation Theory helped described Nigerian teacher educators' use of instructional technology. Davis, Bagozzi, and Warshaw's TAM was used to describe the processes involved in technology adoption. Based on the recommendation of Hsieh and Hsu (2011), DOI and TAM were used to complement each other. Results obtained from the analysis of DOI and TAM deepen our understanding of relationships between faculty access, attitudes and use of instructional and web-based technologies for teaching in Nigerian teacher preparation colleges. The quantitative data show that faculty have positive attitudes toward the use of technology for teaching. However, technology access has been identified as a major obstacle to technology adoption. Similarly, qualitative data buttress this major finding in this regard.

Today, technology has changed our lives and our education systems. According to Toyoma (2011), technology "amplifies the capacity of the educational system" (p.1). Nigeria is in its infancy regarding technology integration for teaching. The federal government through various programs strives to provide access to technology within the educational institutions. However, access is still inadequate, and above all, the majority of educators are not skilled in using technology for teaching. Administrators, faculty, and policymakers need to familiarize themselves with the opportunities that technology offers. There is urgent need for stakeholders in Nigeria's education to equip schools with up-to-date technologies that are required to meet up the twenty-first century teaching and learning through effective instructional delivery.

There is a need for technology integration in classrooms across all levels of education. Therefore, it is imperative for administrators, faculty, policymakers in teacher preparation program to work together to provide lasting solutions to myriads of issues within the realm of technology integration in particular, and the teacher preparation program in general.

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Appendix A

Site Approval Letter from NCCE Nigeria

School of Graduate Studies and Research,
Stright Hall, Romm 113,
201 South Tenth Street,
Indiana University of Pennsylvania,
Indiana, PA 15705-1081.

SITE APPROVAL LETTER

Dear Human Subjects Committee,

This letter acknowledges that I have received and reviewed a request by ABDULSALAMI IBRAHIM to conduct a doctoral dissertation research titled *"Faculty Access, Attitudes, and Use of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Program: A Mixed Method Study"* at 5 Federal Colleges of Education located in Kano, Katsina, Kaduna, Sokoto and Zamfara States, and I approve of this research to be conducted at our colleges.

When the researcher receives approval for his research project from the Indiana University of Pennsylvania's Institutional Review Board, I agree to provide access for the approved research project. I support this effort and will provide any assistance necessary for the successful implementation of this study. If you have any question, please do not hesitate to contact me.

Sincerely,

Prof. Bappa Aliyu Muhammad
The Executive Secretary,
National Commission for Colleges of Education (NCCE),
Ralph Shodeine Street
P.M.B 0394,
Garki-Abuja, Nigeria.
P: (234) 9-234-6531
(234) 9-234-5484

Prof. Bappa Aliyu Muhammad
The Executive Secretary,
National Commission for Colleges of Education (NCCE),
P.M.B 0394,
Garki-Abuja, Nigeria.

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SOME FEDERAL COLLEGES OF EDUCATION

Dear Prof. Aliyu,

My name is Abdulsalami Ibrahim, a doctoral candidate in the Curriculum and Instruction Program at Indiana University of Pennsylvania, Indiana, Pennsylvania; United States of America. The purpose of this letter is to request a site approval to conduct my dissertation research at five federal colleges of education located within seven states in the north west geopolitical zone. The study will involve only faculty (instructors) at federal colleges of education Kano, Bichi, Zaria, Katsina, and Gusau.

Upon the approval from the Indiana University of Pennsylvania's Institutional Review Board (IRB) approval, I will be conducting this research under the guidance and supervision of Dr. Crystal Machado (Dissertation Committee Chair), Dr. Susan Sibert, and Dr. Daniel R. Wissinger.

The research is guided by the following tentative research questions:

1. What are faculty attitudes toward integration and utilization of computer and web-based technologies into teaching?
2. What is the relationship between faculty perceptions about benefits of technology integration and its adoption in teaching?
3. What is the relationship between faculty perceived technological competence and its integration into teaching?
4. In what ways does access to technology influence faculty attitudes toward integrating technology into teaching?
5. How often do faculty in teacher preparation colleges integrate web-based technologies in their classroom?

As the chairman of the National Commission for Colleges of Education (NCCE), I am hereby requesting your permission to conduct this study in five Federal Colleges of Education at the sites listed above.

I will provide you with a copy of my proposal which will include the research design and protocols, copy of instruments (survey and interview protocol), consent forms (I & II) that I would be using in the research process, as well as a copy of the approval letter received from the Institutional Review Board

(IRB). Upon your acceptance of my request, I will reach out to the administrators of the identified colleges as prescribed in the IRB protocol for data collection.

After the successful completion of my study, I accept to provide the National Commission for Colleges of Education (NCCE) and the five colleges, a hard copy of the dissertation report. If you need additional information, please contact me on email: a.ibrahim4@iup.edu or by phone at +1 724 541 4172.

I hope this site request will be granted.

Thank you.

Yours sincerely,
Abdulsalami Ibrahim,
Doctoral Candidate,
Curriculum and Instruction,
Indiana University of Pennsylvania.

PERMISSION

I……. grant permission requested on the terms stated in this letter.

Signature:……... Date:……

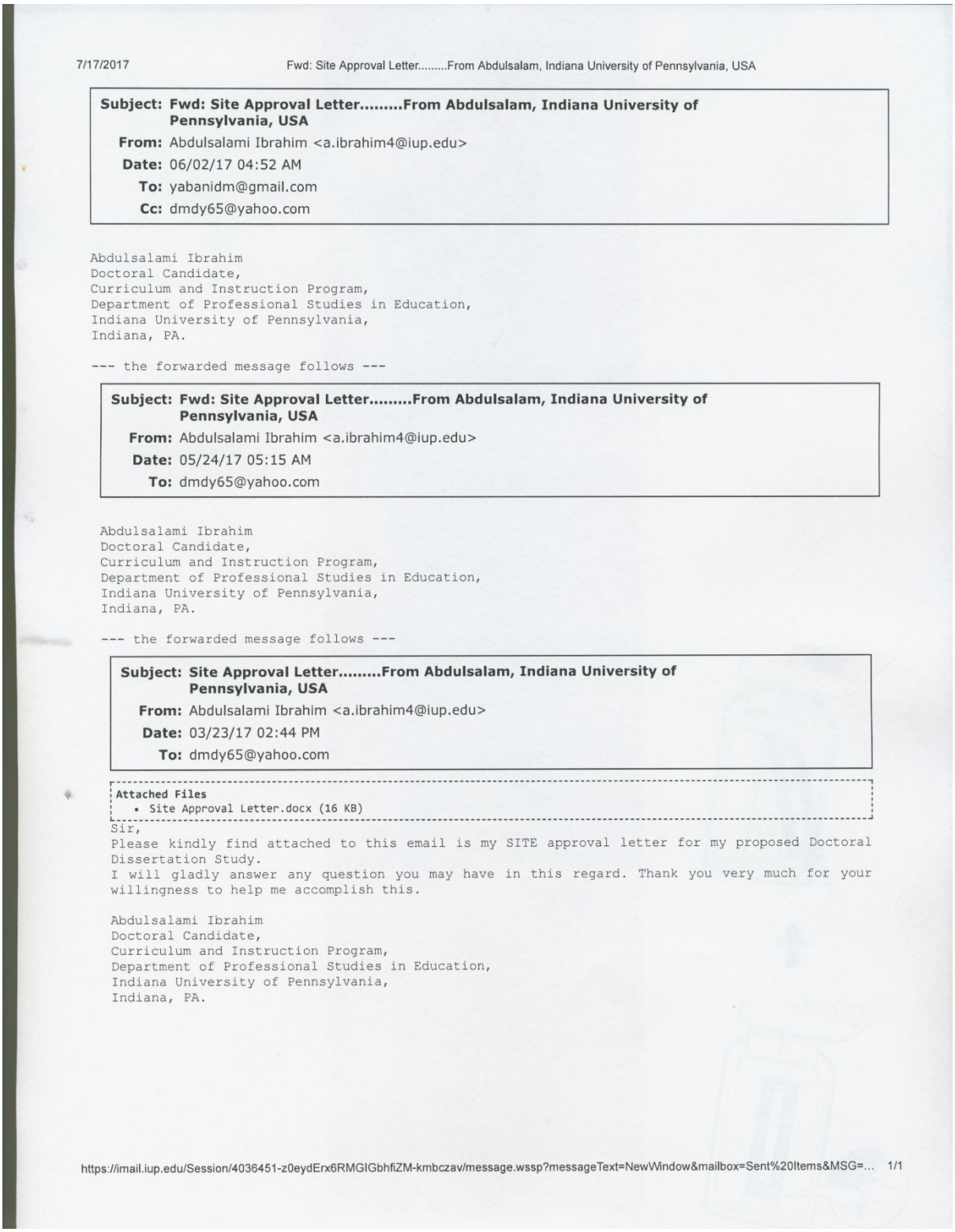
CURRICULUM AND INSTRUCTION, INDIANA UNIVERSITY OF PENNSYLVANIA.

PERMISSION

I..Prof. Bappa-Aliyu Muhammadu...grant permission requested on the terms stated in this letter.

Signature:.....Date:.....8/6/17.....

Email Correspondence



7/17/2017 Fwd: Site Approval Letter.....From Abdulsalam, Indiana University of Pennsylvania, USA

Subject: **Fwd: Site Approval Letter.....From Abdulsalam, Indiana University of Pennsylvania, USA**
From: Abdulsalami Ibrahim <a.ibrahim4@iup.edu>
Date: 06/02/17 04:52 AM
To: yabanidm@gmail.com
Cc: dmdy65@yahoo.com

Abdulsalami Ibrahim
Doctoral Candidate,
Curriculum and Instruction Program,
Department of Professional Studies in Education,
Indiana University of Pennsylvania,
Indiana, PA.

--- the forwarded message follows ---

Subject: **Fwd: Site Approval Letter.....From Abdulsalam, Indiana University of Pennsylvania, USA**
From: Abdulsalami Ibrahim <a.ibrahim4@iup.edu>
Date: 05/24/17 05:15 AM
To: dmdy65@yahoo.com

Abdulsalami Ibrahim
Doctoral Candidate,
Curriculum and Instruction Program,
Department of Professional Studies in Education,
Indiana University of Pennsylvania,
Indiana, PA.

--- the forwarded message follows ---

Subject: **Site Approval Letter.....From Abdulsalam, Indiana University of Pennsylvania, USA**
From: Abdulsalami Ibrahim <a.ibrahim4@iup.edu>
Date: 03/23/17 02:44 PM
To: dmdy65@yahoo.com

Attached Files
- Site Approval Letter.docx (16 KB)

Sir,
Please kindly find attached to this email is my SITE approval letter for my proposed Doctoral Dissertation Study.
I will gladly answer any question you may have in this regard. Thank you very much for your willingness to help me accomplish this.

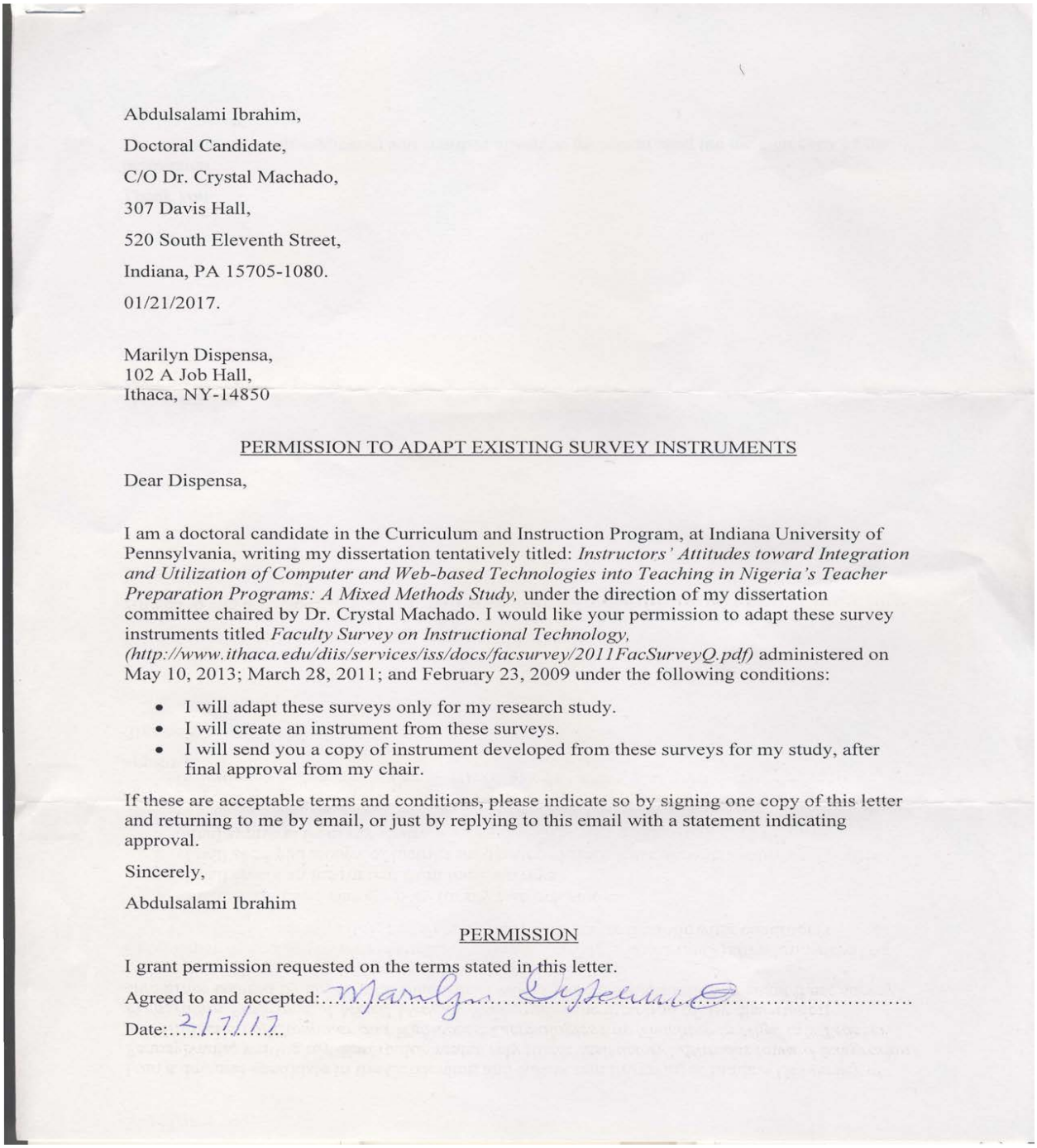
Abdulsalami Ibrahim
Doctoral Candidate,
Curriculum and Instruction Program,
Department of Professional Studies in Education,
Indiana University of Pennsylvania,
Indiana, PA.

https://imail.iup.edu/Session/4036451-z0eydErx6RMGIGbhfiZM-kmbczav/message.wssp?messageText=NewWindow&mailbox=Sent%20Items&MSG=... 1/1

Appendix B

Permission to Adapt Research Instruments

i. Ithaca College Faculty Survey on Instructional Technology (Dispensa, 2009, 2011 & 2013)



Abdulsalami Ibrahim,

Doctoral Candidate,

C/O Dr. Crystal Machado,

307 Davis Hall,

520 South Eleventh Street,

Indiana, PA 15705-1080.

01/21/2017.

Marilyn Dispensa,
102 A Job Hall,
Ithaca, NY-14850

PERMISSION TO ADAPT EXISTING SURVEY INSTRUMENTS

Dear Dispensa,

I am a doctoral candidate in the Curriculum and Instruction Program, at Indiana University of Pennsylvania, writing my dissertation tentatively titled: *Instructors' Attitudes toward Integration and Utilization of Computer and Web-based Technologies into Teaching in Nigeria's Teacher Preparation Programs: A Mixed Methods Study,* under the direction of my dissertation committee chaired by Dr. Crystal Machado. I would like your permission to adapt these survey instruments titled *Faculty Survey on Instructional Technology, (http://www.ithaca.edu/diis/services/iss/docs/facsurvey/2011FacSurveyQ.pdf)* administered on May 10, 2013; March 28, 2011; and February 23, 2009 under the following conditions:

- I will adapt these surveys only for my research study.
- I will create an instrument from these surveys.
- I will send you a copy of instrument developed from these surveys for my study, after final approval from my chair.

If these are acceptable terms and conditions, please indicate so by signing one copy of this letter and returning to me by email, or just by replying to this email with a statement indicating approval.

Sincerely,

Abdulsalami Ibrahim

PERMISSION

I grant permission requested on the terms stated in this letter.

Agreed to and accepted: Marilyn Dispensa

Date: 2/7/17

ii. Teachers' Use of Social Media Communication in the Teaching Practices Survey (Tozer, 2017)

Subject: Fwd: Re: Research.....Permission to Adapt your Research Instrument

Abdulsalami Ibrahim,

I grant permission requested on the terms stated in this letter.

You may use scales I developed for the attitudes, subjective norms, and perceived behavioral control of social media communications as a pedagogical tool for your own dissertation instrument development.

Date:5/22/17

Sincerely,
Brett Tozer

Brett C. Tozer, M. Ed.
Curriculum and Instruction D. Ed. Candidate
Graduate Student Assembly Treasurer
Indiana University of Pennsylvania
(724)840-4092
b.c.tozer@iup.edu

On Mon, 22 May 2017 13:09:31 -0400
"Abdulsalami Ibrahim" <a.ibrahim4@iup.edu> wrote:
Dear Mr. Tozer,
I am a doctoral candidate from Indiana University of Pennsylvania, writing my dissertation tentatively titled: Instructors' Attitudes toward Integration and Utilization of Computer and Web-based
Technologies into Teaching in Nigeria's Teacher Preparation Program: A Mixed Methods Study, under the direction of my dissertation committee chaired by Dr. Crystal Machado. Based on the recommendations of my Chair, I would like to adapt the research instrument for your study under the following conditions:

- I will adapt these surveys only for my research study.
- I will create an instrument from these surveys.
- I will send you a copy of instrument developed from these surveys for my study, after final approval from my chair.

If these are acceptable terms and conditions, please reply to this email with a statement indicating approval and a copy of the instrument.

PERMISSION

I grant permission requested on the terms stated in this letter.
Agreed to and accepted:..... Date:.....
Thank you.
Best,
Abdulsalami Ibrahim
Doctoral Candidate,
Curriculum and Instruction Program,
Department of Professional Studies in Education,
Indiana University of Pennsylvania,
Indiana, PA.

iii. TPACK Instruments (Nkwenti, 2014)

Hello Ibrahim,

Thanks for contacting me. By this email, I authorized you to use part of my publication in your study and cite appropriately. I also attach the test instruments.

Dr Michael Nkwenti

Michael N. NKWENTI, PhD
Lecturer of Educational Technology,
Higher Teacher College,
University of Yaounde I;
Lead Inspector of Pedagogy,
Educational Technologies
Ministry of Basic Education Cameroon
Office +237 222225145
http://www.linkedin.com/profile/view?id=127357215&trk=nav_responsive_tab_profile_pic

On Thursday, September 22, 2016 6:09 PM, Abdulsalami Ibrahim <a.ibrahim4@iup.edu> wrote:

Dear Ndongfack,
I am Abdulsalami Ibrahim, a doctoral candidate at Indiana University of Pennsylvania, Indiana-PA. I am currently conducting a research- 'Exploring Instructors' Understanding and Application of TPACK Model
in Online Instruction at National Open University of Nigeria. I was reviewing literature for this project and came across your paper- TPACK CONSTRUCTS: A SUSTAINABLE PATHWAY FOR TEACHERS PROFESSIONAL DEVELOPMENT ON TEACHING ADAPTATION. I really enjoyed reading the
paper. I learned a lot from the content you discussed.
I am soliciting for your permission to and a copy of your instrument (questionnaire) that you developed. I am hoping to use it or adapt a portion of it in my study, and my dissertation: Instructors' Attitudes Towards Integration and Utilization of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Program: A Mixed Methods Study, which of

course you will definitely be acknowledged.

Thank you in anticipation of your cooperation.

Regards,
Abdulsalami Ibrahim,
Graduate Assistant,
Doctoral Candidate in Curriculum and Instruction Doctoral Program,
Department of Professional Studies in Education,
Indiana University of Pennsylvania, Indiana- PA,
United States of America

iv. Scales for the Measurement of Innovativeness (Hurt, Joseph, & Cook, 1977).

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Aug 05, 2017

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Appendix C

Email for Survey Distribution (FCE Zaria)

Dear……..

The federal government through the federal ministry of education (department of education) have been encouraging faculty to use technology for teaching. Currently there are no enormous empirical evidences to show how faculty are using technology for teaching across all levels of higher education. This study will focus of investigating faculty access, attitudes and use of computer and web-based technologies for teaching in Nigeria's Teacher Preparation Colleges. This study is approved by Professor Bappa Aliyu Muhammad, the Executive Secretary, National Commission for Colleges of Education (NCCE). You can help by forwarding this email to 200 faculty in your colleges.

Dear faculty members,
You are invited to participate in a dissertation research: Faculty Access, Attitudes, and Use of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Colleges: A Mixed Methods Study.

Please, kindly click on the following link and take the survey:
Link: https://iup.co1.qualtrics.com/jfe/form/SV_6SDNCUepHHgxeLP

Your participation is completely voluntary. Participation or nonparticipation will neither affect your relationship with college administrators nor with the National Commission for Colleges of Education (NCCE). You can withdraw at any point during the study simply by closing the survey, and your data will be discarded. Data collected will be kept secured and can only be accessed by the lead researcher. After the completion of this research, the researcher may present the findings in conferences (international, national and regional), or publish in an academic journal. Overall, results of this study will only be used for academic purposes.

Sincerely,

Abdulsalami Ibrahim

Doctoral Candidate
Department of Professional Studies in Education
Indiana University of Pennsylvania
724-541-4172
mrlv@iup.edu

Appendix D

Email for Survey Distribution (FCE Kano, Bichi, Katsina, and FECT Gusau)

The federal government through the federal ministry of education (department of education) have been encouraging faculty to use technology for teaching. Currently there are no enormous empirical evidences to show how faculty are using technology for teaching across all levels of higher education. This study will focus of investigating faculty access, attitudes and use of computer and web-based technologies for teaching in Nigeria's Teacher Preparation Colleges. This study is approved by Professor Bappa Aliyu Muhammad, the Executive Secretary, National Commission for Colleges of Education (NCCE). You can help by forwarding this email to 100 faculty in your college.

Dear faculty members,
You are invited to participate in a dissertation research: Faculty Access, Attitudes, and Use of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Colleges: A Mixed Methods Study.

Please, kindly click on the following link and take the survey:
Link: https://iup.co1.qualtrics.com/jfe/form/SV_6SDNCUepHHgxeLP

Your participation is completely voluntary. Participation or nonparticipation will neither affect your relationship with college administrators nor with the National Commission for Colleges of Education (NCCE). You can withdraw at any point during the study simply by closing the survey, and your data will be discarded. Data collected will be kept secured and can only be accessed by the lead researcher. After the completion of this research, the researcher may present the findings in conferences (international, national and regional), or publish in an academic journal. Overall, results of this study will only be used for academic purposes.

Sincerely,

Abdulsalami Ibrahim

Doctoral Candidate
Department of Professional Studies in Education
Indiana University of Pennsylvania
724-541-4172
mrlv@iup.edu

Appendix E

Reminder Email to Administrators

Dear.....

I would greatly appreciate if you could send this follow-up email to faculty in your college. This is a reminder to participate in the survey that you previously sent weeks ago.

I appreciate your help.

Dear faculty members,
You are invited to participate in a dissertation research: Faculty Access, Attitudes, and Use of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Colleges: A Mixed Methods Study.

Please, kindly click on the following link and take the survey:
Link: https://iup.co1.qualtrics.com/jfe/form/SV_6SDNCUepHHgxeLP

Your participation is completely voluntary. Participation or nonparticipation will neither affect your relationship with college administrators nor with the National Commission for Colleges of Education (NCCE). You can withdraw at any point during the study simply by closing the survey, and your data will be discarded. Data collected will be kept secured and can only be accessed by the lead researcher. After the completion of this research, the researcher may present the findings in conferences (international, national and regional), or publish in an academic journal. Overall, results of this study will only be used for academic purposes.

Sincerely,

Abdulsalami Ibrahim

Doctoral Candidate
Department of Professional Studies in Education
Indiana University of Pennsylvania
724-541-4172
mrlv@iup.edu

Appendix F

Informed Consent I (For Survey)

My name is Abdulsalami Ibrahim. I am a doctoral candidate in the Department of Professional Studies in Education at Indiana University of Pennsylvania. Currently, I am conducting a dissertation research on Faculty Access, Attitudes, and Use of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Program: A Mixed Methods Study. To make an informed decision for participation or not to, this information is provided to you. You are eligible and invited to participate because you meet the criteria, 1) You are a faculty member (full time, part time, adjunct or temporary) in one of the teacher preparation colleges (Federal Colleges of Education) in Nigeria, and, 2) Your college is located within seven north-western states of Jigawa, Kano, Kaduna, Katsina, Kebbi, Sokoto, and Zamfara.

Purpose and Benefit of this Study:
The purpose of this study is to use Diffusion of Innovation Theory and Technology Acceptance Model to describe Nigeria's Teacher Preparation Colleges' Faculty Access, Attitudes and use of computer and web-based technology in teaching. After successful completion of this study, we anticipate gaining an efficient knowledge of the phenomena studied.

Your Involvement in this Study
Completion of the Educators' Attitudes, Access and Use of Technology Surveys which takes about 30 minutes will confirm your willingness to participate.

Potential Risks
No risk beyond the minimal risks of daily living will be involved.

Your Participation in this Study is Voluntary
Your participation is completely voluntary. Participation or nonparticipation will neither affect your relationship with college administrators nor with the National Commission for Colleges of Education (NCCE). You can withdraw at any point during the study simply by closing the survey, and your data will be discarded. Data collected will be kept secured and can only be accessed by the lead researcher. After the completion of this research, the researcher may present the findings in conferences (international, national and regional), or publish in an academic journal. Overall, results of this study will only be used for academic purposes.

THIS PROJECT IS HAS BEEN APPROVED BY THE INDIANA UNIVERSITY OF PENNSYLVANIA INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS (PHONE 724.357.7730).

Thank you for your consideration and assistance with this study. Should you have questions please contact me (phone: 724-541-4172, email: mrlv@iup.edu) or Dr. Crystal Machado (phone: 724-357-2400, email: cmachado@iup.edu).

Electronic Consent

Please select your choice below. You may print a copy of this consent form for your records. Clicking on the "Agree" button indicates that:

- You have read the above information
- You voluntarily agree to participate
- You are 18 years of age or older
    - Agree
    - Disagree

Your data would not be able to be withdrawn after submission as there would be no way of knowing which data belong to which individual.

Lead Researcher: Abdulsalami Ibrahim
Doctoral Candidate
Department of Professional Studies in Education
Indiana University of Pennsylvania
724-541-4172
mrlv@iup.edu

Dissertation Committee Chair: Dr. Crystal Machado
Associate Professor
Department of Professional Studies in Education
724-357-2400
cmachado@iup.edu
Room 307 Davis Hall, IUP

Appendix G

Educators' Technology Access, Attitudes, and Use (ETAAU) Survey

Informed Consent
Dear Faculty,

My name is Abdulsalami Ibrahim. I am a doctoral candidate in the Department of Professional Studies in Education at Indiana University of Pennsylvania. Currently, I am conducting a dissertation research on Faculty Access, Attitudes, and Use of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Program: A Mixed Methods Study. To make an informed decision for participation or not to, this information is provided to you. You are eligible and invited to participate because you meet the criteria, 1) You are a faculty member (full time, part time, adjunct or temporary) in one of the teacher preparation colleges (Federal Colleges of Education) in Nigeria, and, 2) Your college is located within seven north-western states of Jigawa, Kano, Kaduna, Katsina, Kebbi, Sokoto, and Zamfara.

Purpose and Benefit of this Study:
The purpose of this study is to use Diffusion of Innovation Theory and Technology Acceptance Model to describe Nigeria's Teacher Preparation Colleges' Faculty Access, Attitudes and use of computer and web-based technology in teaching. After successful completion of this study, we anticipate gaining an efficient knowledge of the phenomena studied.

Your Involvement in this Study
Completion of the Educators' Attitudes, Access and Use of Technology Surveys which takes about 30 minutes will confirm your willingness to participate.

Potential Risks
No risk beyond the minimal risks of daily living will be involved.

Your Participation in this Study is Voluntary
Your participation is completely voluntary. Participation or nonparticipation will neither affect your relationship with college administrators nor with the National Commission for Colleges of Education (NCCE). You can withdraw at any point during the study simply by closing the survey, and your data will be discarded. Data collected will be kept secured and can only be accessed by the lead researcher. After the completion of this research, the researcher may present the findings in conferences (international, national and regional), or publish in an academic journal. Overall, results of this study will only be used for academic purposes.

THIS PROJECT IS HAS BEEN APPROVED BY THE INDIANA UNIVERSITY OF PENNSYLVANIA INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS (PHONE 724.357.7730).

Thank you for your consideration and assistance with this study. Should you have questions please contact me (phone: 724-541-4172, email: mrlv@iup.edu) or Dr. Crystal Machado (phone: 724-357-2400, email: cmachado@iup.edu).

Electronic Consent: Please select your choice below. You may print a copy of this consent form for your record. Clicking on the "Yes" button indicates that:

- You have read the above information
- You voluntarily agree to participate in this study

- You are 18 years of age or older

Do you agree to participate in this survey?

Yes
No

Q1. Which of the following technologies did you use last year in your teaching?

Cell phones	Not Used	Used	Not Available
Clickers			
Desktop computer in the classroom			
Laptop in the classroom			
Tablet (like iPad, Android, Surface Pro etc.)			
Interactive whiteboards			
VCR/DVD player			
Instructor Run Computer Stations			
LCD projector/ Computer projection system			
Overhead projector/Document camera			
Assistive technology tools (like voice recognition programs, screen reader, screen enlargement application, auto-page turner etc.)			
Internet connection in the classroom			
Other			
Other			
Other			

Q2. How often did you use these technologies last year for teaching purposes?

Cell phones	Never	Rarely (2-4 times a semester	Seldom (once a month)	Occasionally (once every two weeks)	Frequently (1-2 times a week)	Regularly (Daily)
Clickers						
Desktop computer in the classroom						
Laptop in the classroom						
Tablet (like iPad, Android, Surface Pro etc.)						
Interactive whiteboards						
VCR/DVD player						
Instructor Run Computer Stations						
LCD projector/ Computer projection system						
Overhead projector/Document camera						
Assistive technology tools (like voice recognition programs, screen reader, screen enlargement application, auto-page turner etc.)						
Internet connection in the classroom						
Other						
Other						
Other						

Q3. I believe that using *technology* for instructional purpose is:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Good					
Unimportant					
Hard					
Engaging					
Inefficient					
Useless					

Q4. Please indicate how comfortable you are with using *technology* for instruction.

- Extremely uncomfortable
- Moderately uncomfortable
- Slightly uncomfortable
- Neither comfortable nor uncomfortable
- Slightly comfortable
- Moderately comfortable
- Extremely comfortable

Q5. Which of the following web-based technologies did you use last year in your teaching?

	Not Used	Used	Not Available
Content on Internet Sites			
Video/Vodcast (like YouTube, Vimeo etc.)			
Audio/Podcast			
Multimedia presentation (PowerPoint, Slideshare etc.)			
Sound system in the lecture room			
Email (Yahoo Mail, Gmail, etc.)			
Interactive content delivery and assessment (Nearpod, Zaption, Mentimeter, etc.)			
Social Media/Tools (Facebook, Twitter, etc.)			
Photo/Video sharing (Instagram, Flickr, Snapchat, Pinterest etc.)			
Video conferencing/Chatting systems (Skype, FaceTime, Zoom, Yahoo Messenger, Google+, Google Hangouts etc.)			
Classroom management/LMS (D2L, Moodle, WebQuest)			
Blogs (Wordpress, Wikis, etc.)			
Interactive Quizzes (Kahoot, Quizbox, Quizlet, Poll Everywhere)			
Google Tools (Docs, Slides, Sheets)			
Virtual world (Second Life)			
Plagiarism detection software/Sites (Turnitin)			
Other			
Other			
Other			

Q6. How often did you use these web-based technologies *last year for teaching purposes?*

	Never	Rarely (2-4 times a semester	Seldom (once a month)	Occasionally (once every two weeks)	Frequently (1-2 times a week)	Regularly (Daily)
Content on Internet Sites						
Video/Vodcast (like YouTube, Vimeo etc.)						
Audio/Podcast						
Multimedia presentation (PowerPoint, Slideshare etc.)						
Sound system in the lecture room						

Email (Yahoo Mail, Gmail, etc.)						
Interactive content delivery and assessment (Nearpod, Zaption, Mentimeter, etc.)						
Social Media/Tools (Facebook, Twitter, etc.)						
Photo/Video sharing (Instagram, Flickr, Snapchat, Pinterest etc.)						
Video conferencing/Chatting systems (Skype, FaceTime, Zoom, Yahoo Messenger, Google+, Google Hangouts etc.)						
Classroom management/LMS (D2L, Moodle, WebQuest)						
Blogs (Wordpress, Wikis, etc.)						
Interactive Quizzes (Kahoot, Quizbox, Quizlet, Poll Everywhere)						
Google Tools (Docs, Slides, Sheets)						
Virtual world (Second Life)						
Plagiarism detection software/Sites (Turnitin)						
Other						
Other						
Other						

Q7. I believe that using web-based technologies for instruction is

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Good					
Unimportant					
Hard					
Engaging					
Inefficient					
Useless					

Q8. Please indicate how comfortable you are with using *web-based technologies* in your instruction.

- Extremely uncomfortable
- Moderately uncomfortable
- Slightly uncomfortable
- Neither comfortable nor uncomfortable
- Slightly comfortable
- Moderately comfortable
- Extremely comfortable

Q9. Please indicate the degree to which each statement applies to you.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
My peers often ask me for advice or information					
I enjoy trying new ideas					
I seek out new ways to do things					
I am generally cautious about accepting new ideas					
I frequently improvise methods for solving a problem when an answer is not apparent					
I am suspicious of new inventions and new ways of thinking					

I rarely trust new ideas until I can see whether the vast majority of people around me accept them					
I feel that I am an influential member of my peers group					
I consider myself to be creative and original in my thinking and behavior					
I am aware that I am usually one of the last people in my group to accept something new					

Q10. Please indicate the degree to which each statement applies to you.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I am an inventive kind of person					
I enjoy taking part in the leadership responsibilities of the group I belong to					
I am reluctant about adopting new ways of doing things until I see them working for people around me					
I find it stimulating to be original in my thinking and behavior					
I tend to feel that the old way of living and doing things is the best way					
I am challenged by ambiguities and unsolved problems					
I must see other people using new innovations before I will consider them					
I am receptive to new ideas					
I am challenged by unanswered questions					

Q11. Please indicate if you agree/disagree with each of the following statements in terms of usefulness. I use technology if I think:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is useful to my students					
It enhances my ability to deliver content effectively					
It improves my productivity and efficiency in general					
It improves students' ability to develop their collaboration skills					
It enables me to model student centered strategies					
It improves students' computer skills					
It improves students' ability to engage in research					

Q12. Please indicate if you agree/disagree with each of the following statements in terms of ease of use. I use technology if I think:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is easy/simple to use					
It is user friendly					
It requires fewest steps possible to accomplish what I want to do with it in my teaching					
I have the skills and competency to use it					
I have the skills and competency to use it					
I can recover from my mistakes quickly and easily					
I can use it successfully every time					

Q13. Please indicate the extent to which the following have impeded your use of instructional technology:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Lack of access to computers in the classroom					
Inadequate software					
Technology is unpredictable					
Outdated computer/program/software available in the school					
Internet is too slow					
I don't have enough competence					
Not sure how to make technology relevant to my course					
Too many students in my class					
Too much course material to cover					
Lack of technology leadership in my school					
Faculty lack input in technology decisions					
No idea how my school wants us to use technology					
Lack of freedom to decide how to use technology in courses					
Other:					
Other:					
Other:					

Q14. What is you gender?

- Male
- Female

Q15. What is your age:
Q16. How long (in years) have you been engaged in college teaching? (E.g., 9.):
Q17. How long (in years) have you been using technology for teaching:
Q18. Highest Degree obtained:

- **Bachelor's**
- **Master's**
- **PhD/D.Ed.**
- **Other:**

Q19. If you would like to provide your cell phone number for a follow-up interview, please click "yes" and click "next." It will take you to a separate survey, where you can add your cell phone number. To ensure that your responses to this survey remain anonymous, data related to each survey will be tabulated separately:
Yes
No

Appendix H

Informed Consent Form II (for Interview Protocol)

My name is Abdulsalami Ibrahim. I am a doctoral candidate in the Department of Professional Studies in Education at Indiana University of Pennsylvania. Currently, I am conducting a dissertation research on Faculty Access, Attitudes, and Use of Computer and Web-Based Technologies in Nigeria's Teacher Preparation Program: A Mixed Methods Study. To make an informed decision for participation or not to, this information is provided to you. You are eligible and invited to participate because you meet the criteria, 1) You are a faculty member (full time, part time, adjunct or temporary) in one of the teacher preparation colleges (Federal Colleges of Education) in Nigeria, and, 2) Your college is located within seven north-western states of Jigawa, Kano, Kaduna, Katsina, Kebbi, Sokoto, and Zamfara, and (3) you provided your phone number from the survey for further contact.

Purpose and Benefit of this Study:
The purpose of this study is to use Diffusion of Innovation Theory and Technology Acceptance Model to describe Nigeria's Teacher Preparation Colleges' Faculty Access, Attitudes and use of computer and web-based technology in teaching. After successful completion of this study, we anticipate gaining an efficient knowledge of the phenomena studied. Your opinion matters

Your Involvement in this Study
The phone interview will be audio recorded, the researcher will transcribe your responses and sent back to you, so you can review it for accuracy.

Potential Risks
No risk beyond the minimal risks of daily living will be involved.

Your Participation in this Study is Voluntary
Your participation is completely voluntary. Participation or nonparticipation will neither affect your relationship with college administrators nor with the National Commission for Colleges of Education (NCCE). You can withdraw at any point during the study simply by closing the survey, and your data will be discarded. Data collected will be kept secured and can only be accessed by the lead researcher. After the completion of this research, the researcher may present the findings in conferences (international, national and regional), or publish in an academic journal. Overall, results of this study will only be used for academic purposes.

Your oral consent at the beginning of the interview indicates your consent. You can withdraw at any time during the interview. But after the completion of the interview, transcription, and member checking, your response will be used for data analysis and therefore, cannot be withdrawn.

Thank you for your consideration and assistance with this study. If you have any questions or would like additional information, please contact Abdulsalami Ibrahim, the lead researcher.

Lead Researcher: Abdulsalami Ibrahim
Doctoral Candidate
Department of Professional Studies in Education
Indiana University of Pennsylvania
724-541-4172
mrlv@iup.edu

Dissertation Committee Chair: Dr. Crystal Machado
Associate Professor
Department of Professional Studies in Education
724-357-2400
cmachado@iup.edu
Room 307 Davis Hall, IUP

Appendix I

Interview Protocol: Interviewees' Version

Mr. / Mrs. Pseudonym,

Q1. Thank you for agreeing to participate in this interview. The purpose of this study is to describe Nigeria's Teacher Preparation Colleges faculty access, attitudes and use of computer and web-based technology for teaching. I am specifically interested in describing how faculty access to technology and technology attitudes may influence their use of technology for teaching. Please, which technologies and web-based tools listed did you have access to and use for teaching in your school last year?

Technologies	**Web-Based Technologies**
Cell phones	Content on Internet Sites
Clickers	Video/Vodcast (like YouTube, Vimeo, etc.)
Desktop computer in the classroom	Audio/Podcast
Laptop in the classroom	Multimedia presentation (PowerPoint, Slideshare, etc.)
Tablet (iPad, Android, Surface Pro, etc.)	Sound system in the lecture room
Interactive whiteboards	Email (Yahoo Mail, Gmail, etc.)
VCR/DVD Player	Interactive content delivery and assessment (Nearpod, Zaption, Mentimeter, etc.)
Instructor Run Computer Stations	Social Media/Tools (Facebook, Twitter, etc.)
LCD projector/ Computer projection system	Photo/Video sharing (Instagram, Flickr, Snapchat, Pinterest, etc.)
Overhead projector/Document Camera	Video conferencing/Chatting systems (Skype, FaceTime, Zoom, Yahoo Messenger, Google+, Google Hangouts, etc.)
Assistive Technology Tools (like voice recognition programs, screen reader, screen enlargement application, auto-page turner, etc.)	Classroom management/LMS (D2L, Moodle, WebQuest)
Internet connection in the classroom	Blogs (Wordpress, Wikis, etc.)
	Interactive Quizzes (Kahoot, Quizbox, Quizlet, Poll Everywhere)
	Google Tools (Docs, Slides, Sheets)
	Virtual world (Second Life)
	Plagiarism detection software/Sites (Turnitin)

- When do you use them?
- How do you use them?
- How often do you use them?
- How do you model appropriate use of technology?
- Who provide these tools (school or personal)?
- Are there any technology or web-based tool that you use, and is not mentioned in the list?

Q2. How would you describe your attitude towards the use of computer and web-based tools for teaching?

Q3. Please describe the importance of using technology for teaching.

Q4. Please describe how you make decisions regarding what technology to use in your classroom.

Q5. What professional development experiences have you had over the last two years?

Demographics

Q6. What is your gender?

Q7. What is your age?

Q8. How long have you been teaching in FCE?

Q10. How long have you been using technology for teaching?

Q11. What is the highest degree you obtained?

Appendix J

Interview Protocol: Researcher's Version

General warm-up questions/comments

a. Thank you for agreeing to participate in this interview.
b. I want to assure you that your name and your institution's name will not be associated with this interview. What pseudonym would you like me to use during the interview?
c. I need to review the purpose of the study and get your oral consent to participate on record. May I turn the recorder on?
d. Thank you (Recorder turned on, and the interview begins)

Mr. / Mrs. Pseudonym,

Q1. Thank you for agreeing to participate in this interview. The purpose of this study is to describe Nigeria's Teacher Preparation Colleges faculty access, attitudes and use of computer and web-based technology for teaching. I am specifically interested in describing how faculty access to technology and technology attitudes may influence their use of technology for teaching. Please, which technologies and web-based tools listed did you have access to and use for teaching in your school last year?

Technologies	**Web-Based Technologies**
Cell phones	Content on Internet Sites
Clickers	Video/Vodcast (like YouTube, Vimeo, etc.)
Desktop computer in the classroom	Audio/Podcast
Laptop in the classroom	Multimedia presentation (PowerPoint, Slideshare, etc.)
Tablet (iPad, Android, Surface Pro, etc.)	Sound system in the lecture room
Interactive whiteboards	Email (Yahoo Mail, Gmail, etc.)
VCR/DVD Player	Interactive content delivery and assessment (Nearpod, Zaption, Mentimeter, etc.)
Instructor Run Computer Stations	Social Media/Tools (Facebook, Twitter, etc.)
LCD projector/ Computer projection system	Photo/Video sharing (Instagram, Flickr, Snapchat, Pinterest, etc.)
Overhead projector/Document Camera	Video conferencing/Chatting systems (Skype, FaceTime, Zoom, Yahoo Messenger, Google+, Google Hangouts, etc.)
Assistive Technology Tools (like voice recognition programs, screen reader, screen enlargement application, auto-page turner, etc.)	Classroom management/LMS (D2L, Moodle, WebQuest)
Internet connection in the classroom	Blogs (Wordpress, Wikis, etc.)
	Interactive Quizzes (Kahoot, Quizbox, Quizlet, Poll Everywhere)
	Google Tools (Docs, Slides, Sheets)
	Virtual world (Second Life)
	Plagiarism detection software/Sites (Turnitin)

- When do you use them?
- How do you use them?
- How often do you use them?
- How do you model appropriate use of technology?
- Who provide these tools (school or personal)?
- Are there any technology or web-based tool that you use, and is not mentioned in the list?

Q2. How would you describe your attitude towards the use of computer and web-based tools for teaching?

- What experiences did you have while using technologies for teaching?
    - Describe positive experiences.
    - Describe negative experiences.
- How comfortable are you in using technologies for teaching?
    - From 1-10, can you rate your comfort level? 1 being the lowest and 10 highest.
- What are some issues/problems you have encountered in using technologies for teaching?

Q3. Please describe the importance of using technology for teaching.

- How do you see yourself in terms of using technology for teaching?
- In what ways does use of technology impacts your teaching?
- How has technology use influenced your instructional method?
- How important is technology to students' learning?

Q4. Please describe how you make decisions regarding what technology to use in your classroom.

- Who decides on technology to be used in class?
    - Administrator?
    - Faculty (you)
- What hinders you from using technology for teaching?
- How do you overcome the barriers that prevent you from using technology for teaching?

Q5. What professional development experiences have you had over the last two years?

- How many times are such professional development workshops/seminars/conferences conducted in a year?
- Who organized them?
- What topics were covered?
- Why did you choose to attend?
    - Were you mandated to attend?
    - Were they interesting?
- What competencies did you develop?
- What additional training do you feel you would need use technology for teaching efficiently?

Demographics

Q6. What is your gender?

Q7. What is your age?

Q8. How long have you been teaching in FCE?

Q10. How long have you been using technology for teaching?

Q11. What is the highest degree you obtained?

Appendix K

List of Codes

Research Questions	Code	Description	Interview Protocol Items	
Theme: Faculty Access to Instructional and Web-Based Technologies				
RQ 1	Acc_Inst_Tech_Have	Have Access to Instructional Technologies	1	
	Acc_Inst_Tech_Low	Low Access to Instructional Technology		
	Acc_Inst_Tech_Inadequate	Inadequate Access to Instructional Technology		
	Acc_Inst_Tech_Not	No Access to Instructional Technology		
	Acc_WebB_Tech_Have	Have Access to Web-Based		
	Acc_WebB_Tech_Low	Low Access to Web-Based Technologies		
	Acc_WebB_Tech_Inadequate	Inadequate Access to Web-Based Technologies		
	Acc_WebB_Tech_Not	No Access to Web-Based Technology		
Theme: Faculty use of Instructional and Web-Based Technologies				
RQ 1	Use_Tech_ Inst	Use of Instructional Technology	1	
	Use_Not_Inst_Tech	Not Use Instructional Technology		
	Use_WebB_Tech	Use of Web-Based Technologies		
	Use_Not_WebB_Tech	Not Use Web_Based Technologies		
	Use_Tech_Once-a_Week	Faculty use Technologies once a week		
	Use_Tech_Twice-a_Week	Faculty use Technologies Twice a week		
	Use_Tech_Three-or-more-Times-a_Week	Faculty use Technologies Three or more Times a week		
Theme: Faculty Attitudes to Instructional and Web-Based Technologies				
RQ2	Att_Inst_Tech_Pos	Faculty Positive Attitude to Instructional Technology	2	
	Att_Inst_Tech_Neg	Faculty Negative Attitude to Instructional Technology		
	Att_WebB_Tech_Pos	Faculty Positive Attitude to Web-Based Technologies		
	Att_WebB_Tech_Neg	Faculty Negative Attitude to Web-Based Technologies		
	Adm_Att_Inst_Tech_Pos	Administrators Positive Attitude to Instructional Technology		
	Adm_Att_WebB_Tech_Neg	Administrators Negative Attitude to Web-Based Technologies		
Theme: Faculty comfort level to use of Instructional and Web-Based Technologies				
RQ 2	ComfL_Inst_Tech	Low Comfort Level Instructional Technology	2	
	ComfH_Inst_Tech	High Comfort Level Instructional Technology		
	ComfL_WEbB_Tech	Low Comfort Level Web-Based Technologies		
	ComfH_WEbB_Tech	High Comfort Level Web-Based Technologies		
	Theme: Faculty Technology use Experiences			

	Exp_ Positive	Faculty Positive Experiences with Technology		6
	Exp_Negative	Faculty Negative Experiences with Technology		3
Theme: Faculty Technology Competence				
RQ 2	CompL_Inst_Tech	Low Instructional Technology Competence	3	
	CompH_Inst_Tech	High Instructional Technology Competence		
	CompL_WebB_Tech	Low Web-Based Technologies Competence		
	CompH_WebB_Tech	High Web-Based Technologies Competence		
Theme: Barriers to faculty technology use				
RQ 2	Barr_Tech_Acc	Lack of Access to Technology	4	
	Barr_Tech_Comp	Lack of Technology Competence		
	Barr_Elect_Supp	Lack of Stable Electricity/Power Supply		
	Barr_OverCrowded_Classess	Overcrowded classrooms		
	Barr_Poor_Intern	Poor Internet Connectivity		
Faculty Technology Support				
	Tech_Supp_Avai	Technology Support Available		
	Tech_Supp_Abse	Technology Support Absent		
Theme: Faculty Professional Development Conferences/Seminars/Workshop				
	ProfD_Avai	Professional Development Available	5	
	ProfD_Abse	Professional Development Absent		
	ProfD_WorkS_Conf_Sem_Once_ Year	Professional Development Once a Year		
	ProfD_WorkS_Conf_Sem_Twice_ Year:	Professional Development Twice a Year		
	ProfD_WorkS_Conf_Sem_Three_ More_Year	Professional Development Three or More Times a Year		
	ProfD_Coercion	Faculty are/were forced to attended PD workshops/conferences/seminars		
	ProfD_Autonomy	Faculty are not forced to attend PD workshops/conferences/seminars		
	ProfD_Encouraged	Faculty are/were encouraged to attend PD workshops/seminars/conferences		
Theme: Faculty Technology Decision Making				
	Fac_Dec_Tech	Faculty Make Technology Decision	4	
	Adm_Dec_Tech	Adm Make Technology Decision		
	Fac_Adm_Dec_Tech	Faculty and Administrators Make Technology Decision		
Theme: Technology Procurement			1	
	Fac_Obt_Tech	Technologies/Tools obtained by Faculty		
	Sch_Prov_Tech	Technologies/Tools provided by the School/College		
Theme: Political Influence				
	Pol_Inf	Technology topics that faculty have no say on		
Theme: Suggestions for Further Studies				
	Add_Res	Faculty suggestion of topics for conferences/seminars/workshops		

Appendix L

Email Sent to Potential Interviewees After the Initial Contact

Dear Participant,

Thank you for speaking with me today. Attached are two documents; the Informed Consent Form II for interviews (Appendix H), will provide you with information about the study and a list of questions (Appendix I) that I will use during the semi-structured interview. Please note, to preserve confidentiality I will not be asking for any identifying information related to your name, college name and the state where your school is located.

I truly appreciate your commitment and time to help me in this study. This interview will help me to collect data and analyze results. Upon completion of this study, we expect to gain a better understating of faculty access, attitudes and use of technology in teaching in teacher preparation program.

Please confirm the date/time and for the interview, after reviewing the material. Your contact information will be retained separately; a pseudonym will be used during the interview.

Sincerely,

Abdulsalami Ibrahim (Lead Researcher)
Doctoral Candidate
Department of Professional Studies in Education
Indiana University of Pennsylvania
724-541-4172
mrlv@iup.edu

Appendix M

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Nury Rivas <nrivas@iste.org>

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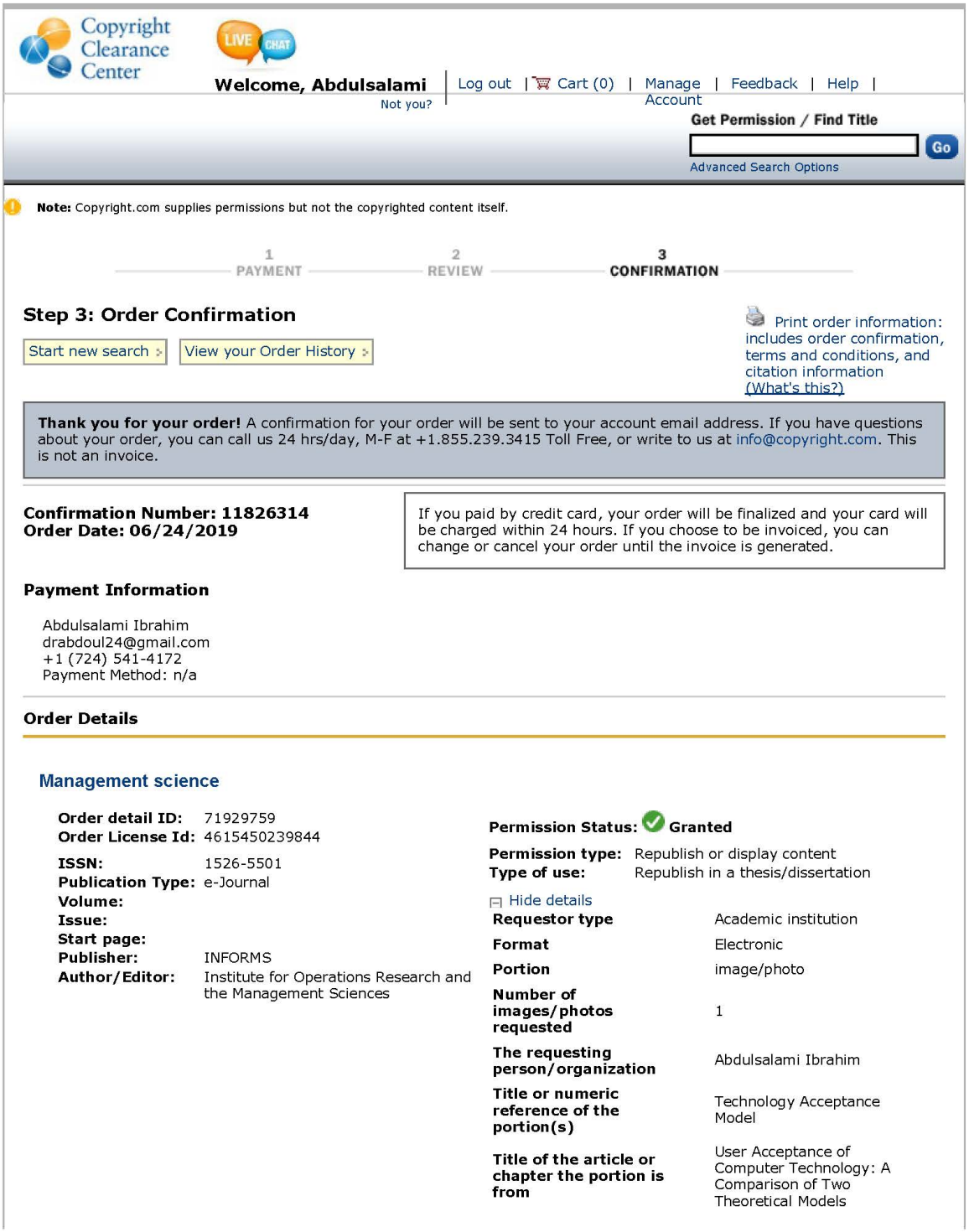

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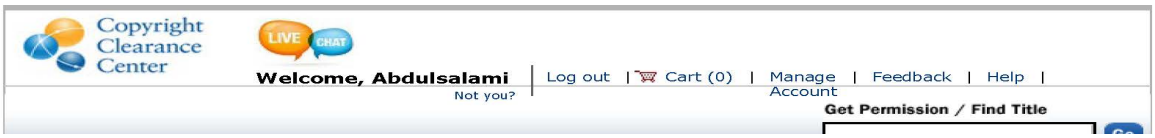

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