APPRAISAL OF TECHNO-PEDAGOGICAL COMPETENCE OF PRE-SERVICE TEACHERS IN TERTIARY INSTITUTIONS IN NIGER STATE, NIGERIA.

BY

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ABSTRACT

The study appraised techno-pedagogical skills acquired by pre-service teachers for basic technological skills, planning and preparing a lesson plan, instructional delivery evaluating learning and providing feedback in Niger State. Descriptive survey research was adopted, and pre-service teachers in tertiary institutions in Niger State were employed as research participants. The population comprised 13,376 while the target population was 4,018 final year pre-service teachers, eight research questions and four null hypotheses guided the study, and a 40-item questionnaire was used as an instrument for data collection. The questionnaire was validated by two experts in the educational technology department and one expert from the computer science department. The pilot test was carried out, and reliability coefficients of 0.87, 0.92, 0.86, and 0.91 respectively were obtained for the four sections of the questionnaire. Data collected from the administration of the research instrument were analyzed using descriptive statistics of Mean and Standard Deviation for research questions and inferential statistics of t-test for research hypotheses. A decision rule was set, in which a mean score of 3.0 and above was considered agreed, while a mean score below 3.0 was considered disagreed. Findings from research question one revealed that pre-service teachers in Niger state possessed needed basic technological skills with a grand mean of 3.70. Research question two shows that pre-service teachers possessed the required technological skills for planning and preparing lesson plans with grand mean of 3.48.Research question three indicate that pre-service possessed the needed skills for instructional delivery with grand mean score of 3.82.From the result of the findings hypothesis one revealed that the differences between male and female Pre-service teachers basic technological skills indicate a mean score of 75.26 and 72.54 respectively, the t-value of 0.592, p-value of 0.536 is significant than0.05. hypothesis three revealed that the differences between male and female Pre-service teachers technological skills for instructional delivery shows a mean score of 76.28 and 75.52 respectively, the t-test of 0.168, p-value of 0.866 is significant. Based on these findings, it was recommended that facilities that would support the use of technological tools for basic technological skills, planning and preparing a lesson plan, instructional delivery and for evaluating learning and providing feedback should be made available in schools to ensure the skills already possessed by the pre-service teachers are put into use while practicing as in-service teachers.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The relevance of technology to human advancement cannot be overemphasized. Technology advancement in the 21st century within different industries has made society and institutions more dependent upon technologies to get information and stay connected worldwide. Umeh *et al.* (2015) opined that emerging technological trends have made students digitally literate and created more learning opportunities to explore. The term 'Technology" is broad, and there are different ways of understanding its meaning. Technology is a body of knowledge devoted to creating tools, processing actions and extracting materials. These tools, materials and systems are applied, which results in products. If technology is well used, it benefits humans (Agim *et al.*, 2020).

What is more central to the application of technology in the 21st century is the advancement in the communication process, which moderates the job of most organisations, including education. That is why many businesses employ technology to stay competitive; they also create new products and services using technology to deliver them to their customers on time. For example, mobile phones companies like Apple and Samsung use high-end technology to create new smartphones and other electronic devices to stay competitive (Agim *et al.*, 2020). The configuration of most of these mobile phones is Information and Communication Technologies (ICT) inclined. And this also serves as means of storing and providing information when needed.

ICT in education is an instrument par excellence that a nation can rely upon for self-reliance and development. Mathew *et al.* (2015) buttress that Nigeria still experiences a setback (among many other countries) in ICT implementation. These continue to widen

the digital and knowledge gap from accessing ICT facilities between Nigeria and other countries. There has been a significant challenge, especially in Nigeria, as they are yet to adopt them extensively for teaching and learning. The rapid rate at which ICT has evolved since the mid-20th century gives them a vital role in development and globalisation. ICT can accelerate, enrich, and deepen skills, motivate and engage students, help relate school experiences to work practices, create economic viability for tomorrow's workers, and strengthen teaching and assisting schools to advancement.

In a rapidly changing world, ICT knowledge is essential for an individual to access and apply ICT. The Economic Commission for Africa has indicated that accessing and using information is no longer a luxury but a necessity for development. Unfortunately, many developing counties in Africa are still backward in ICT application and use in schools (Matthew *et al.*, 2015).

The focus on ICT use and application in Nigerian schools will improve Nigeria's educational system and give students a better education. To this effect, the Federal Ministry of Education has launched an ICT-driven project known as School Net, intended to equip all schools in Nigeria with computers and communications technologies (Maisamari, 2018). The integration of ICT tools in education allows students to apply computer and technology skills to learning and problem-solving. However, most technology integration efforts intentionally establish innovative and creative best practices Davies and west (2014). Educational technology is also considered any tool, piece of equipment or electronic or mechanical that can help students accomplish specified learning goals (Williams, 2017). Teachers' role in ICT is the knowledge teachers require on using technology in pedagogically sound ways. Chukwuemeka and Iscioglu (2016) buttressed that full and effective technology integration cannot be achieved until the teachers change their mindsets positively

towards using technology in their daily educational activities. Therefore, it is not just the knowledge of the technology equipment provided with less or no training but a student-centred kind of knowledge needed to develop existing knowledge in conjunction with the integration of technology in education.

Educational technology uses hardware, software, and educational theoretic to facilitate learning and improve performance by creating, using, and managing appropriate technological processes and resources. It encompasses several domains, including learning theory, computer-based training, online learning, mobile technologies, m-learning (Kumar *et al.,* 2018). Educational technology is not restricted to high technology but is anything that enhances classroom learning by utilising blended, face to face or online learning. The phrase 'educational technology', a composite meaning of technology education, refers to the most advanced technologies available for teaching and learning in a particular era (Shifflet & Weilbache 2015). Teachers must understand their role in technologically-oriented classrooms. Knowledge about the technology is essential in itself, but not as a separate entity. Today, technology competency is necessary for teachers in the teaching and learning process, as it facilitates effective teaching and learning. This competence centres on the ability of teachers to make use of technology in a techno-pedagogical good way for effective teaching (Absari *et al*., 2020).

Techno-pedagogy can be considered the weaving of the technologies of the craft of teaching into the learning environment itself. It requires conscious recognition of electronically mediated courses that integrate the sound principle of education to ease the transmission of information. Acquiring techno-pedagogical proficiency will make teaching and learning a pleasurable and profitable exercise. It would lessen the pressure on the teachers and enable the students to plunge deeper into the knowledge acquisition

process. Therefore, techno-pedagogical competency is needed for teachers in their learning space, as it facilitates teaching and learning. Techno-pedagogical competency is the ability of teachers to make use of technology effectively in education. It is described as regularly applying the competency, knowledge, and skills that promote learning (Pradeep, 2018).

Techno-pedagogy is the hybrid method of teaching in which ICT resources are utilised in the classroom interaction process. It is the art and craft of incorporating technology in effectively tailoring teaching-learning experiences Koehler *et al.* (2013). Techno pedagogical skills are instrumental in making the teaching-learning process a joyful experience as it would bring about notable changes in the interaction pattern of teachers. However, teachers will have to commit to upgrade skills and integrate technology into the educational environment successfully. Education departments will need to provide ample training and support for instructional practitioners (Luna, 2015).

Furthermore, a techno-pedagogy method is a necessary component of teacher education. Thakur (2015) found in his study that good teaching was not simply adding technology; instead, the introduction of technology causes the representation of new concepts and requires developing sensitivity to the dynamic, transactional relationship among technology, pedagogy, content and knowledge. Application of technological skills carried out to increase the effectiveness and efficiency of learning and teaching process for professional development by technology integration. Vanajhaa and Pachaiyappan, (2017) found that meaningful use of techno-pedagogy in the classroom requires the teachers to integrate technological affordances with pedagogical approaches for the specific subject matter to be taught. For that courses, techno-pedagogical knowledge needs to be added to teacher training programs. Moreover, the technology centers in teaching and learning must be established in a higher education institution. Thakur

(2014) opines that the techno-pedagogical competency needs to be improved to equip teachers to face the students belonging to the digital era and the challenges in the modern classroom.

In techno-pedagogy, there are three areas of knowledge, namely: content, pedagogy, and technology. Thakur (2014) revealed in a study that techno-pedagogical skill fosters the students for further development, attainment of learning outcomes and maintain the context of designing classroom-based resources through the use of ICT by the teachers and educators.

Educators widely use content knowledge; content knowledge refers to the body of information that teachers teach and that students are expected to learn in a given subject or content areas, such as English language, Arts, Mathematics, Sciences or Social studies. Content knowledge generally refers to the facts, concepts, theories, and principles taught and learned, rather than related skills – such as reading, writing, or researching- that students also learn in academic courses.

Valtonen *et al*. (2015) stated that Pedagogical knowledge- is the deep knowledge about the processes and practices or methods of teaching and learning and how it encompasses overall educational purposes, values and aims. It is a generic form of knowledge involved in all student education issues, classroom management, lesson plan development and implementation, and student's evaluation. It includes knowledge about techniques or methods to be used in the classroom, the nature of the target audience, and strategies for evaluating student understanding. A teacher with deep pedagogical knowledge understands how students construct knowledge and acquires skills; develop habits of mind and positive dispositions towards learning. As such, pedagogical

knowledge requires an understanding of cognitive, social and developmental theories of learning and how they apply to students in their classroom.

According to Agyei and Voogt, (2012) Technological knowledge is knowledge about standard technologies such as books, chalk, and blackboard and more advanced technologies such as the Internet and digital video. It would involve the skills required to operate particular technologies. In the case of digital technologies, this would include knowledge of operating systems, computer hardware, and the ability to use a standard set of software tools such as word processors, spreadsheets, browsers, and e-mail. In addition, technological knowledge would include installing and removing software programs and creating and archiving documents. Most standard technology workshops and tutorials tend to focus on the acquisition of such skills.

These basic skills refer to your ability to interact and complete tasks using computer-based technologies and other associated technologies. These tasks can either be digital or physical. Sometimes, these skills may be referred to as technical skills (Chu *et al.*, 2021). These skills are practical; examples of these skills include connecting the projector to the system, saving and retrieving information in a computer, creating and naming a folder, typing and printing documents, capturing and editing images, which the teacher uses for planning and preparing the lesson.

Lesson planning is a necessary first step in implementing curriculum themes. Creating a lesson plan with clearly defined learning objectives, goals, and a metric for measuring progress towards these goals is vital to ensuring students benefit as much as possible from weekly lessons. Making an effective lesson plan takes time, dedication, and understanding students' abilities and goals. In education, every teacher strives to motivate students to retain as much as possible and apply it. Lesson planning plays a

vital role in providing students with stable classroom environments that best support their learning (Alderman, 2013).

A teacher needs the following technical knowledge to prepare a lesson plan, lesson notes on the computer system and acceptably arrange them, interact with my supervisor using online platforms, download information sent by my supervisor via E-mail. Use the school internet facilities to access online materials for lesson preparation. Use CorelDraw to draw and design diagrams as instructional material, operate a projector and use it to teach by connecting it to a computer. use various video clips to produce content for learning and effective instructional delivery

Instructional delivery is methods, strategies, approaches, or even techniques teachers employ to deliver their learners' subject matter. It can also represent a pattern in which a study is presented Vesin and Budima, (2013). The instructional delivery process must be based on the stated objectives of the lesson; it is based on this that when the process of instructional delivery is over, then the opportunity to determine if the aim of the task has been achieved or not. There are different methods of instructional delivery which includes Lecture, Explicit Teaching, Drill & Practice, Demonstrations, project method, Field Trips, Experiments, Simulations & Games, Observations. In a technologically oriented classroom, a teacher possess the ability to use PowerPoint to make a recording of delivered instructions and send to the online platform for students to access at their convenience, present lessons in the classroom, hyperlink videos to PowerPoint presentation to enhance learning. convert an instruction to various software packages, use social media platforms to deliver education, use the Internet to provide instruction asynchronously at an agreed time, manipulate instruction using diagrams, thereby putting into consideration individual differences of the students, use an image to present

a lesson to the student through their Internet, use PowerPoint to show summary and conclusion within a short time, prepare user-friendly instructional packages using the online platform, for easy assessment, examination and feedback for teachers

Educational evaluation is usually about monitoring the methods used by teachers and the rate of success with which they can assist students in learning. This type of evaluation is typically performed at a large scale for an entire school and a specific scale for individual teachers. It is also the process that a teacher uses to check the teaching and learning process; in the educational context, it is the degree of understanding and integration of knowledge to achieve the proposed competence and goals in what has been assimilated by the learners. In addition, though, it seeks to measure the effectiveness and performance of teachers. (Sharma *et al.,* 2016) opined that educational evaluation and feedback is an essential part of the assessment process. It has a significant effect on students learning and has been described as the most powerful single moderator that enhances achievement, justify to students how their mark or grade was derived, identify and reward specific qualities in student work, guide students on what steps to take to improve and motivate them to act on their assessment, develop their capability to monitor, evaluate and regulate their own learning, a teacher should be able to compute students' result using excel package, track students' online progress or activities, assess student's result through the net, interact with students using online platform, create an online group were teachers can send Assignments to students, get feedback from students' using online platforms, conduct online examinations, assess student's performance at their own pace and time through the net, evaluate large group of students without difficulty using online medium, align interval of assessment base on the lesson content the provided by pre-service teachers or the in-service teachers.

The pre-service teacher is the student enrolled in a teacher preparation program who must complete degree requirements, including course work and field experience, before being awarded a teaching license. Hamdan (2015) defined a pre-service teacher as a student in a tertiary institution involved in learning the art of teaching and acquires mandatory teaching practice programme experienced by practicing teaching profession under the supervision of an experienced teacher by gradually taking on more classroom management and instructional responsibilities. The purpose of pre-service experiences is to allow students to practice the strategies and concepts they have learned in their tertiary education courses. Pre-service teaching is one of the most beneficial components of preparing teachers for the classroom. During student teaching, participants can observe their assigned host/cooperating teachers as they model best practices, assess students readiness, design and implement effective lesson plans and activities, and develop rich, rewarding experiences. Upon completion of their programs, pre-service teachers are then expected to demonstrate pedagogical content knowledge, meet the diverse learning needs of their students academically, developmentally, and socially, and adhere to the ethical and professional responsibilities of being an educator. Within these expectations, pre-service teachers are also responsible for effectively managing classroom behavior, collaborating and communicating with parents, colleagues, and stakeholders, administrative tasks and technological skills for instructional delivery.

While these requirements and expectations are the intended outcomes for most teacher preparatory programs, there are times when teacher candidates are not always able to experience the intricate scenarios or details of the classroom setting. For pre-service preparation in classroom management to be effective and adequate, sufficient opportunities to practice implementing evidence-based strategies during field experiences should be provided (Allday *et al.*, 2013). In addition, teacher candidates

may not always encounter confrontational parental conferences, disagreements with colleagues, or disruptive students during their field experiences or through online discussions with other classmates. As a result, pre-service teachers often enter the profession intimidated by specific environments and situations or feeling unprepared to take on the full array of classroom responsibilities. Their lack of confidence and preparation ultimately impacts their overall classroom performance and student achievement and experiences; these pre-service teachers can be male and female students.

Gender is a significant variable in appraising the techno-pedagogical competencies possessed by pre-service teachers, and gender is socially and culturally constructed differences among males and females. Therefore, the manner gender works vary from place to place; Gender is the collection of socially constructed roles and relationships, personality traits, attitudes, behaviors, values, relative power, and influence the society ascribes to the two sexes on a differential basis Marcelle (2015). Furthermore, gender is relational; its roles and characters do not exist in isolation but are defined through the relationships between females and males. However, both sexes may possess the same competencies when exposed to the content, pedagogical and technological knowledge.

According to Luna (2015) defined competence as the skills and knowledge that enable a teacher to succeed. Therefore, to maximize student learning, teachers must have expertise in a wide-ranging array of competencies in basic technological skills, planning and preparing lesson plans, technical skills in instructional delivery, and specialized skills for evaluating learning and providing feedback. Therefore, the researcher seeks to assess the techno-pedagogical competence possessed by pre-service teachers in tertiary institutions in Niger State, Nigeria.

1.2 Statement of the Research Problem

The gap between the teacher-centered approach (low-tech) and the student-centered (high-tech) method of imparting knowledge cannot be over-emphasized. According to Hsu (2016), The application of ICT by pre-service teachers in transferring knowledge is below expectation. Over the years, significant emphasis has been on Pedagogy and Content knowledge, thereby giving rise to the need for Technology Knowledge. This knowledge can be transferred through ICT development programs if aligned with the curriculum of the Colleges of Education and universities where pre-service teachers are trained (Cetin-Berber & Erdem 2015). Training pre-service teachers in this 21st century should be with recent technological gadgets to ensure their exposure and awareness of these device(s). Pre-service teachers are expected to implement the use of technology in teaching to support the digital native students. How prepared are they? What skills do they possess? What competencies do they have?

Furthermore, many pre-service teachers cannot still think about teaching and learning as a process requiring technology in this new dispensation. Therefore, it could be due to a lack of proper knowledge of Techno-pedagogical skills. Hence, the need to appraise the techno-pedagogical competence of pre-service teachers in tertiary institutions in Niger State, Nigeria, by determining the current level of technology, pedagogy and content knowledge.

1.3 Aim and Objectives of the Study

The study aimed to appraise the techno-pedagogical competence of pre-service teachers in tertiary institutions in Niger State, Nigeria. Specifically, the objectives of the study were to:

1. Determine basic technological skills possessed by pre-service teachers

2. Examine the technological usage skills for planning and preparing lesson plans possessed by pre-service teachers.
3. Determine the technological skills for instructional delivery possessed by pre-service teachers.
4. Examine the technological skills for evaluating learning and providing feedback possessed by pre-service teachers.
5. Observe whether differences exist in the basic technological skills possessed by pre-service teachers based on gender.
6. Determine whether differences exist in technological usage skills for planning and preparing lesson plans possessed by pre-service teachers based on gender.
7. Investigate whether differences exist in technological skills for instructional delivery possessed by pre-service teachers based on gender.
8. Determine whether differences exist in technological skills for evaluating learning and providing feedback possessed by pre-service teachers based on gender.

1.4 Research Questions

The following research questions guided the study:

1. What are the basic technological skills possessed by pre-service teachers in Niger state, Nigeria?
2. To what extent do pre-service teachers possess technological usage skills for planning and preparing lesson plans?
3. To what extent do pre-service teachers have technological skills for instructional delivery?
4. To what extent do pre-service teachers have technological skills for evaluating learning and providing feedback?

5. What is the Influence of Gender on pre-service teachers' technological skills possessed in Niger state?
6. What is the Influence of Gender on pre-service teachers' technological for planning and preparing lesson plans?
7. What is the Influence of Gender on pre-service teachers' technological skills for instructional delivery in Niger State, Nigeria?
8. To what extent does gender influence technological skills for evaluating learning and providing feedback?

1.5 Research Hypotheses

The following null hypotheses were formulated and tested at a 0.05 level of significance:

HO_1: There is no significant difference in the basic technological skills possessed by male and female pre-service teachers.

HO_2: There is no significant difference in the technological usage skills for planning and preparing lesson plans possessed by male and female pre-service teachers.

HO_3: There is no significant difference in the technological skills for instructional delivery possessed by male and female pre-service teachers.

HO_4: There is no significant difference in the technological skills for evaluating learning and providing feedback possessed by male and female pre-service teachers.

1.6 Significance of the Study

The findings of this study would benefit in-service teachers, pre-service teachers, curriculum planners, policymakers, educational administrators, researchers and research organizations, and the society at large.

The findings of this study could benefit in-service teachers by helping them to see reasons to develop themselves away from the traditional talk and chalk method of teaching whereby teachers could effectively use technology knowledge, pedagogical knowledge, and content knowledge in consideration with other knowledge constructs arising from the techno-pedagogical knowledge interceptions for better learning and teaching experience. Furthermore, teachers would be enlightened on the importance of keeping up to date with their technology knowledge and how to harness it for effective integration in the whole learning process to develop technology-integrated content and pedagogical approaches. Also, this study could aid in raising the awareness of teachers to the development of thoughtful pedagogical uses of technology.

Pre-service teachers would also benefit by being aware of the technical skills needed for instructional delivery that will enhance the effectiveness and efficiency of both teachers and learners. In addition, pre-service teachers will brace up to training and retraining on the technological skills s for effective and efficient instructional delivery due to their awareness.

Curriculum planners at the tertiary level will incorporate this research work into their course outline by promoting technology usage skills for planning and preparing lesson plans, instructional delivery, evaluating learning, and providing feedback that entails effective and efficient teaching and learning processes for the learner and teacher.

Policymakers such as the National Universities Commission (NUC) and National Council of Colleges of Education (NCCE) through this study would be informed concerning the state of Technology integration in tertiary institutions in Niger state Nigeria and know how to improve the technology knowledge, content knowledge, and pedagogy knowledge in the system. Furthermore, NCCE and NUC can extend this Study to other education colleges within the geopolitical zones as an evaluation tool to help plan and carter for their training needs.

Through this study, educational administrators such as provosts, registrars, and vice-chancellors could learn and understand the training needs or specific technology knowledge that needs to be developed amongst their trainers or teachers. Furthermore, by understanding the techno-pedagogical competency framework, educational administrators can adopt periodical knowledge monitoring patterns or surveys that can help expose the teachers' content, pedagogical, and technological knowledge; this can help plan adequate training for teachers' development and effective technology integration. Furthermore, through this framework, educational administrators would understand the knowledge area lacking and know necessary actions to take.

Educational researchers and research organizations would be spurred into advancing research in areas of technology integration to develop an effective learning environment, hoping to lead to more concerns given to technology-oriented instructional material designs that will help in the teaching and learning process.

The fundamental issue in this research, which is the techno-pedagogical competency, will significantly benefit society as it could help integrate innovation in society. Pre-service teachers will adopt technology knowledge in carrying out day to day activities in the classroom and outside the classroom situation.

1.7 Scope of the Study

The scope of the study "appraisal of techno-pedagogical competence of pre-service teachers in tertiary institutions in Niger state Nigeria" The study was restricted to Niger State; four government tertiary institutions offering education courses were selected. The names of these institutions are Federal University of Technology (FUT) Minna, Niger State College of Education (COE) Minna, Ibrahim Badamasi Babangida University Lapai (IBBUL), and Federal College of Education Kontagora. The participants of this study were final year pre-service teachers from Schools/Faculties of Education of the selected institutions. It is because they have undergone technology or computer studies and have completed teaching practice exercises. Therefore, the variables of this study are techno-pedagogical competence of pre-service teachers (basic technological skills, technological skills for planning and preparing lesson plans, technical skills for instructional delivery, and technological skills for evaluating learning and providing feedback).The study lasted for six weeks.

1.8 Operational Definition of Terms

The following terms were defined as used in the work

Appraisal: This is the act of assessing the techno-pedagogical competencies possessed by students undergoing teachers' training.

Basic Technology Skills: These are skills pre-service teachers possess in operating equipment that aids teaching and learning.

Competency: The capability of pre-service teachers to apply or use a set of related techno-pedagogical knowledge and skills to the process of planning, delivery and evaluating teaching and learning effectiveness.

Instructional Delivery: The various ways through which pre-service teachers transmit learning contents to their learners.

Learning Evaluation: The process employed by pre-service teachers to assess, determine and obtain feedback regarding the quality of their teaching from their learners.

Pedagogy: The methods, techniques, process and procedure a pre-service teacher uses in instructional delivery.

Pre-service Teachers: Student teachers or teacher candidates who are technologically inclined and undergoing the teacher education program in Colleges of Education or Universities.

Techno-Pedagogy: The act of incorporating technology processes and products into teaching and learning experiences to bring about efficiency and effectiveness as exhibited by the pre-service as used in this study

Technology: The application of scientific knowledge for practical purposes.

Technology usage: This is the number of times pre-service teachers who possess basic technical skills use technology for the teaching and learning process during the course of this study.

CHAPTER TWO

2.0 LITERATURE REVIEW

In this chapter relevant literature to this study were reviewed and this was done under the following sub-headings: Conceptual framework, Theoretical framework, Empirical studies and Summary of Reviewed Literature.

2.1 Conceptual Framework

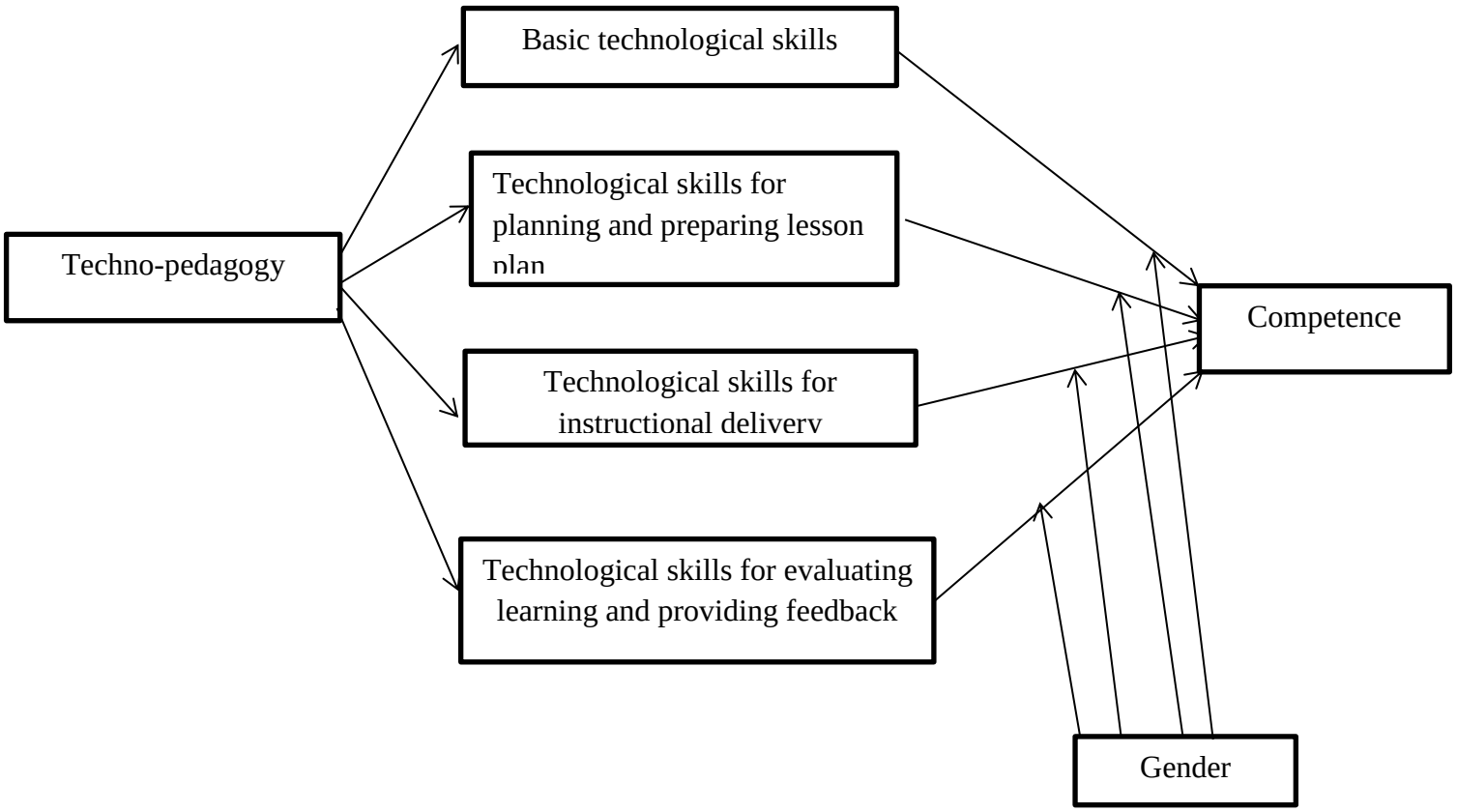

Figure: 2.1: CONCEPTUAL FRAMEWORK FOR THE STUDY
Source: Source: Ravith and Riggan 2012.

The construct, conceptual framework, is viewed from at least three perspectives. The first and most superficial view defines it as a visual representation of the structure of the study and its alignment with the relevant theoretical foundations. According to this view, conceptual framework is a figure, typically presented as a concept map that summarizes all key the information presented in the literature review of the study (Ravitch & Riggan, 2012).

The second perspective defines conceptual and theoretical frameworks as essentially the same phenomenon. What the construct conceptual framework means then depends entirely on the researcher's understanding of the construct of theory. As Ravitch and Riggan (2012) argue, problems can arise when researchers are vague about such definitions, as conceptual/theoretical frameworks in this sense can refer to either ''off-the shelf'' (existing), or ''homegrown'' (personal integration of concepts) theories.

Finally, another perspective on the definition of a conceptual framework views it as a way of aligning all key components of the research process (researcher disposition, literature, theory, methods, and interpretation of findings) to create a compelling argument for why the topic of the study is significant and the means proposed to study it are appropriate and rigorous (Maxwell, 2013). In this view, a conceptual framework is a ''series of sequenced, logical propositions the purpose of which is to convince the reader of the study's importance and rigor'' (Ravitch & Riggan, 2012). It represents a system of beliefs, assumptions, theories, and concepts that support and inform research (Robson, 2011).

The Figure 2.1 shows the variable of the study how competent pre-service teachers possessed the basic technological skills needed for imparting knowledge, The technological skills for planning and preparing lesson plan, Technological skills for instructional delivery, Technological skills for evaluating learning and providing

feedback in the process of teaching and learning. Gender serve as the moderating variable.

2.1.1 The Concept of Information and Communication Technology

Information technology (IT) covers any form of technology, that is, any equipment or technique used by a company, institution, or any other organization which handles information. Information technology was probably coined in the late 1970s to refer to this nexus of computer-based technologies for managing data. It incorporates computing, telecommunication technologies, consumer electronics and broadcasting as it is getting more and more digitized. Spearheaded by the computer, the decades since the mid-1960s have been characterised by extreme development. Since the late 1970s, cheap microelectronics have permitted the diffusion of these technologies into almost all aspects of daily life and have furthermore almost inextricably cross-fertilised and intermingled their multiple application branches, which include industry, commerce, administration, education, medicine, scientific and professional work, entertainment, and domestic work. Marchewka (2016) explained that Information and Communication Technology (ICT) first appeared in the mid-1980s and was defined as "all kinds of electronic systems used for broadcasting telecommunications and mediated communications", with examples including personal computers, video games, cell phones, Internet, and electronic payment systems and computer system. ICT is made of computer and communication technology.

Computer technology is a tool for storing and processing information in digital form. In contrast, communication technology helps us transfer and disseminate digital information Kaware and Sain (2015) stated that ICT means various technological applications in the process and communication of information. The word ICT is a combination of two words information, communication and technology. The

information implies knowledge, and technology means the use of computers and communication. Therefore, the term ICT can be defined as "the integration of computing, networking, and information processing technologies and their applications" Thus, ICT means a combination of computer applications and communication technology for gathering, processing, storing and disseminating Information (Seels & Richey, 2012).

Information Communication Technology is a common term referring to the technologies used for collecting, storing, editing and communicating information in various formats. ICT means using computer-based technology and the Internet to make information and communication services available to many users. ICT Is hardware and software that enable society to create, collect, consolidate and communicate information in a multimedia format and for various purposes. The term ICT includes any communication device or application, encompassing; radio, TV, cellular phones, computers and network, hardware and software, satellite systems, and so on, and the various services and applications associated with them. (Csapó *et al.,* 2012) says that ICT is playing a vital role in the current and future development of society and nation. ICT has affected all spheres of life and also the library. Information and communication technology (ICT) is a diverse set of technological tools and resources used to communicate, create, disseminate, store, and manage information (Alkamel *et a.l,* 2018).

Information and communication technologies (ICTs) are often associated with the most sophisticated and expensive computer-based technologies. ICTs are information-handling tools- a varied set of goods, applications, and services used to produce, store, process, distribute, and exchange information. ICT-Information and Communication Technology is a varied collection of technological gear and resources used in

communication to generate, distribute, collect, and administer information (Pannu & Tomar, 2010).

According to JP *et al.* (2016) Information technology is "the use of manufactured tools for collecting, generating, communication, recording, re-management and exploitation of information. It includes those applications and commodities, by which information is transferred, recorded, edited, stored, manipulated or disseminated. ICT is a means that has changed many aspects of the way we live. ICT includes the computer hardware, software, application of telecommunication technologies, projection devices, Local Area Network (LAN), Wide Area Network (WAN), digital cameras, Compact Disks (CDs), Digital Video Disks (DVDs), cell phones, satellites, and fibre optics (Thool, 2020).

The Information Communication Technology (ICT) in modern teaching, which is pivotal for national development, has not been taught in third world countries. It will ensure that the third world countries educational system would meet best global practices in teaching, which is pivotal for development. The rapid growth of information and communication technologies (ICT) has led to significant changes in modern society's social, economic, and political relations.

Since the past few years, the most drastic alteration in our lives is the penetration and massive progress of Information technology, which has become more of a necessity for us now rather than a facility. These drastic changes that information technology has introduced have entirely changed our lives and perhaps our lifestyles. Life has become much less manual and a lot hassle-free for people all around the globe that have active access to the innovations of information technology (Rezwan *et al.*, 2018).

The world is fast becoming a global village. The thirst for more knowledge and information has been a driving force for the drastic changes in information technology

worldwide. These changes are what people have termed as the "third industrial revolution". One can see the fundamental trends in the Information Communication Technology revolution regarding its structural changes, from telephony to the Internet, fixed to mobile telephone and from narrowband to broadband. The development in information technology has left an impression on us as individuals, not just in the western world but generally. Today, information technology has an entirely distinct essence compared to how it was perceived back in the day. The drastic changes that information technology has introduced in our lives have completely changed our lives and perhaps our lifestyles as buttress by (Tidd & Bessant, 2018). Life has become much less manual and a lot hassle-free for people all around the globe that have active access to the innovations of information technology. It is a commonplace to say that nowadays, we live in an information society, that is, a world of media saturation, which is heavily influenced by information technology, rapid movement of information across time, and space, which come under communication in information technology (Hajkowicz *et al.*, 2016).

New technologies, devices, machines, and services that make dealing with more information than ever before possible surround everyone. Information networks and services are available that can connect everyone and provide new opportunities for productivity, learning, and entertainment. The technologies include accessing information through computers, the Internet, telephones, pagers, cellular phones, television sets, and public electronic kiosks (Brynjolfsson & McAfee, 2014). These information technologies include electronic methods of communicating and accessing databases that allow us to bank, shop, pay bills, get books to read, and make travel plans and arrangements from home. They make telecommunication possible and provide more options for running a business from home. Many job functions can be easily performed

when access to needed information resources and telecommunication services are provided. Access to multimedia educational materials on CD-ROM or the World Wide Web (WWW) give students experiences that were never possible before and are available by using a computer anywhere. Courses and degree programs are also offered electronically and allow people to participate without leaving their homes or communities. These information technologies are also a great source of entertainment, such as "surfing the web" to learn and share more about hobbies, places, and people and playing the latest multimedia games (Rainer, 2013).

Importantly, these technologies have the potential to serve all people. Information technologies are flexible and have the potential to be accessible to anyone who can understand their use. People with vision, hearing, physical and cognitive limitations can be able to use information technologies. It can be achieved with adaptive hardware, software, and services added to personal and public equipment such as telephones, computers, and kiosks.

The designers of information technologies should also address the needs and abilities of people with disabilities by adding features that facilitate accessibility. It can be achieved through the more widespread use of universal design in which as many people as possible, including people with disabilities, use these specially designed products. Currently, universal design is being incorporated into many but not all Web pages and into the design of publicly accessed equipment such as electronic kiosks (Sohlberg & Mateer, 2017).

Information technologies are also affecting how services to people with disabilities are provided. Programs, databases, and electronic text on CD-ROM and the Internet are valuable resources for becoming more aware of the available technology and how it is being used. In addition, consumers and service providers can use the Internet to

brainstorm their assistive technology questions and problems with others worldwide and obtain current information from manufacturers (Scott *et al.*, 2016).

Information and Communications Technology (ICT) has an essential role in the world since we are now in the information age era. With ICT, the company can make the business more accessible to the client, supplier and distributor. It is also crucial in our daily lives. The lack of appropriate information at the right time will result in low productivity, low-quality research works, and waste of time pursuing knowledge and even doing research that others had done or in other countries. Nowadays, ICT cannot be separated from our daily needs. Therefore, ICT has a significant impact on our daily lives. For example, we can read our local newspaper using the online newspaper. Another example is we still can get connected with our family, relatives, or colleagues even if we are abroad by using electronic mail, yahoo messenger, call conference, or video conference (Lyon, 2013).

Digital computers and networking have changed our economy concept to an economy with no boundary in time and space because of ICT. It brings many advantages for economic development, enabling millions of transactions to happen in an easy and fast way. ICT is one of the economic development pillars to gain national competitive advantage. It can improve the quality of human life because it can be used as learning and education media, the mass communication media in promoting and campaigning practical and important issues, such as the health and social area. It provides broader knowledge and can help in gaining and accessing information. ICT has become an integral part of everyday life for many people. Therefore, it increases its importance in people's lives. It is expected that this trend will continue, to the extent that ICT literacy will become a functional requirement for people's work, social, and personal lives (Buczynski, 2013).

We are living in a constantly evolving digital world. ICT impacts nearly every aspect of our lives – from working to socialising, learning to playing. The digital age has transformed how young people communicate, network, seek help, access information and learn. We must recognise that young people are now an online population, and access is through various means such as computers, TV and mobile phones (Baym, 2015).

Livingstone, (2012) revealed in his study that information and communication technologies (ICT) are widely seen as enhancing learning in both schools and homes, this hope fuelling their rapid diffusion and adoption throughout developed societies. But they are not yet so embedded in the social practices of everyday life as to be taken for granted, with schools proving slower to change their lesson plans than they were to fit computers in the classroom.

2.1.2 Role of ICT in Education

ICT stands for "Information and communication technology". It refers to technologies that provide access to information through telecommunication. It is similar to Information Technology (IT) but focuses primarily on communication technologies, including the Internet, wireless networks, cell phones and other communication mediums. It means we have more opportunities to use ICT in teacher training programmes nowadays and improve the quality of teachers to teach effectively. According to UNESCO,"ICT is a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters". Therefore, the teacher is the central part of the educational field in our society (Zuppo, 2012).

In this digital era, ICT use in the classroom is essential for giving students opportunities to learn and apply the required 21st-century skills. ICT improves teaching and learning and its importance for teachers in performing their role of creators of pedagogical environments. ICT helps a teacher sent his education attractively and le Information and Communication Technologies (ICTs) exemplified by the Internet and interactive multi an essential focus for future education. They need to be effectively integrated into formal teaching and learning – especially in a teacher education institution (Kaul, 2014). The use of ICT in education adds value in teaching and learning by enhancing the effectiveness of learning or adding a dimension to knowledge that was not previously available. ICT may also be a significant motivational factor in students' learning and support students' engagement with collaborative learning. Information and Communications Technology (ICT) is our society's efforts to teach its current and emerging citizens valuable knowledge and skills around computing and communications devices, software that operates them, applications that run on them, and systems built with them (Venkatesh, 2014).

Teachers can play a social role with the learner. The rapid development of technology has made great impact on the workplace and everyday life, today's teacher education institutions try to restructure their education programs and classroom facilities ICTs are making dynamic changes in society by influencing all aspects of life. Because ICTs provide both students and teachers with more opportunities to adapt learning and teaching to individual needs, culture forces schools to respond to this technical innovation (Starko, 2017). The use of the following technology in teaching training programmes increases the quality of teaching effectively. A well-designed teacher training program is essential to meet the demand of today's teachers who want to learn how to use ICT effectively for their teaching.

A. E-learning– E-learning is also known as online learning. E-learning encompasses learning at all levels, both formal and non-formal, that uses an information network– the Internet, an intranet (LAN) or an extranet (WAN). The components include e-portfolios, cyber infrastructures, digital libraries and online learning object repositories. All the above features create a digital identity for the user and connect all the stakeholders in the education. It also facilitates interdisciplinary research. Group Discussion– Internet Relay Chat (IRC) is among the famous Internet services people mostly use for live chatting. Group of people with common interests can exchange views/opinions with each other instantly through the Internet. Description of the internet technologies required to support Education via ICTs (www, video conference, Tele-Conference, Mobile Conference, CD Database, Word-Processor, Intranet, and Internet). E-Modules–Modules written are converted and stored into digital versions into a computer using a word processor accessible by the user through the Internet.

B. Audio – Conferencing–

The telephone (or simply, "phone") is a telecommunications instrument that sends and receives sound such as voice messages and data across a certain distance. The telephone is a specific type of telecommunications that permits people to carry direct conversations over any distance Leamer and Storper (2014). It involves the live real-time exchange of voice messages over a telephone network when low–bandwidth text and still images such as graphs, diagrams or pictures can also be exchanged along with voice messages. This type of conference is called audio-graphic. Non-moving visuals are added using a computer keyboard or drawing/writing on a graphics tablet or whiteboard.

Figure: 2.2: A TELEPHONE

Source: (Leamer & Storper 2014)

C Video – Conferencing

Video conferencing is an online technology that allows users in different locations to hold face-to-face meetings without having to move to a single location together. it allows the exchange of voice and graphics and moving images. Video-Conferencing technology does not use telephone lines but either a satellite link or television network (broadcast/cable). Video conferencing can also be used as a medium for conducting training, with the instructor teaching a remote class from almost anywhere Simamora (2020). This can be done in a corporate context, especially for getting workers the knowledge they need to better perform their jobs. The academic world can also make use of video conferencing to connect a traditional classroom setting with students who are located a considerable distance from the school.

FIGURE: 2.3: VIDEO CONFERENCE

Source: (Simamora,2020)

D Web-Based Conferencing – involves the transmission of text and graphic, audio and visual media via the Internet; it requires the use of a computer with a browser, and communication can be both synchronous and asynchronous. Oloyede (2022) defines as Web conferencing is an online service that allows you to hold live meetings, conferencing, presentations and training via the internet particularly on TCP/IP connections. You can connect to the conference either by telephone or using your computer's speakers and microphone through a VoIP connection.

Figure: 2.4: Web Conference

Source: (oloyede, 2022)

E Open and Distance Learning–All these services through ICT play a significant role in teacher education. It allows higher participation and more substantial interaction. It also improves the quality of education by facilitating learning by doing, directed instruction, self-learning, problem-solving, information seeking and analysis, critical thinking, and the ability to communicate, collaborate and learn.

2.1.3 Benefits of ICT in Education

Education is an instrument for developing an individual's social, mental, physical, emotional, moral and psychological aspects. Education can be considered a process that enables people to understand the difference between good and bad attitudes, right and wrong behavior. (Patterson, 2016) define education as a combination of tools and techniques used to gain empirical knowledge about the valuable elements of life and how to make use of them. The education system is now shifting from the traditional chalk-and-talk teaching methodology to digitizing the pedagogical approach through technical devices. Such transformation increases the potentiality of the teachers and widening the information base of students to make them competitive in the international arena.

ICT brings countless benefits, enabling children to stay ahead in the race with the right skill and outlook. ICT, or information and communication technology, makes many ordinary tasks uncomplicated and facilitates communications from virtually any part of the globe. Today, the emergence of modern education technologies has altered how students approach learning and Education (Sachs, 2015). The failing conventional methods prompted the birth of new-age education models that provide and support innovative pedagogy. Information and Communications Technology (ICT) in Education has been linked with the upward shift in the quality of people's lives by improving

teaching and learning. Many schools are increasingly integrating ICT in their primary school education system. Through this unique teaching method, students gain a genuine learning experience, collaboratively constructing their knowledge and applying their learning's in a real-world context. The use of ICT techniques in learning/teaching positively influences a student's learning capabilities. It is established that students reflect simply towards work and education when using computers to complete tasks given to them, encouraging and motivating them to soak in the knowledge. Students who use technology to learn in school have increased self-esteem and self-confidence (Buckingham, 2013). According to (Yoruk, 2016) there are ways how children/students can benefit from this methodology in the times to come: The barrier this technology breaks are both linguistic and geographic as the information can be shared quickly and efficiently over the cloud thus, providing them access to quality education anytime and anywhere.

The ICT methods are very effective in clearing the core concepts of the subject matter; this has been proven to enhance the students' level of understanding and retain the knowledge. This method makes content more enjoyable through engaging narratives and high-quality animation, making the whole session more interactive. Improves the retention capacity of the students, brings in more focus and makes the entire process enjoyable.

The content can be tweaked to add value to the student's learning curve depending on the shortcoming of a student. Active and independent learning are the forte of this method which inculcates self-responsibility and maturity for learning. A student's spatial reasoning capacity gets sharpened over a period of time and the ability to solve complex geometric questions without relying on formulas gets a formidable boost. The child's progress can be mapped in the form of an electronic journal which will help

teachers and students to identify the strong and weak points. ICT-based learning assumes an imperative part in a student's academic development and essentially perceives the youngster's personal, social and enthusiastic advancement. Advanced and present-day systems, such as video conferencing, virtual reality and 3D animation, empower students and teachers to work together in ways that mirror a comprehensively constructive way to deal with training. Also, it augments the student's immediate learning environment, offering extraordinary chances to push learning past the bounds of the classroom. Lidström and Hemmingsson, (2014) conducted a study that Information and communication technology (ICT) can enhance participation in educational activities for students with physical disabilities. Even though incorporating ICTs into teaching and learning in education has become an important issue. ICT seemed beneficial for writing, spelling, and communication students with visual, hearing, and communication disabilities.

2.1.4 Challenges of ICT in Education

According to Ghoord (2013) identified barriers of ICT as inadequate power supply, inadequate staff training, negative staff attitudes towards ICT usage, lack of funds, impediments in procuring and managing ICT equipment, insufficient planning and assessment processes, short time, Inadequate technical support towards ICT at schools and lack of required access to the Internet were the significant impediments to the integration of ICT into the curriculum. Insufficient training and paucity of professional development programmes for integrating technology into the existing curriculum were also major hindrances toward ICT integration in schools (Habibu, 2012). Furthermore, limited school resources can seriously delay and limit the teachers' initiatives to implement ICT in classes. Yehya *et al.,* (2018) stated that the absence of technical support and maintenance is a significant impediment to ICT development in schools.

Without the good technical support in the classroom and the whole school resources, teachers cannot be expected to overcome the barriers preventing them from using ICT. In the same context, Yehya *et al.* (2018) found that lack of access, computers, and software are the enormous barriers to ICT implementation.

Mndzebele (2013) agreed that a significant challenge in teaching and learning is that the class time is too short. In addition, students' overpopulation makes it difficult for teachers to integrate computers in ICT oriented classes. (Du-Plessis & Webb, 2012). Their study attests that one of the challenges of integrating ICT is students' lack of classroom time to use computers. It is, therefore, clear that the current class time is not sufficient for the effective integration of ICT. In addition, some other challenges of ICT in educational institutions often lack adequate equipment and access to electricity. Moreover, scarcity of equipment and limited access to the Internet are roadblocks in integrating ICT in the classroom (Georgina *et al.*, 2009).

2.1.5 The National Policy on Education

The Federal Republic of Nigeria, through the National Policy on Education (NPE), released the guideline for the effective management, administration and implementation of education at all tiers of Government. The National Policy on Education in Nigeria is a statement of the Government's regulations, anticipations, expectations, goals, requirements and standards for quality education delivery in Nigeria. Babalola *et al.*, (2019) stated that Nigeria is undergoing the rapid economic, social, and political reforms of most other developing countries. Thirty years ago, the Nigerian education sector could be manual-driven but fast forward to technological advancements and national policy reforms. Later, there's the electronic or automatic-driven system of Education in Nigeria with the e-Books, e-Classrooms, e-Libraries and even e-Exams.

(Comfort, 2012) stated the latest reform on the national policy on Education in Nigeria included changes and innovations like: -

i. Open and Distance Learning Programme by the Government, which was resumed after the suspension was ended.
ii. Expansion and revitalization of the NMC (National Mathematical Centre).
iii. Teachers Registration Council (TRC) was established.
iv. Information and Communication Technology (ICT) was instructed to be included in the school curriculum as a second official language.
v. To ensure balance and fair opportunity and effective implementation of the Universal Basic Education (UBE) by including primary education into the scheme of Quranic schools was instructed.
vi. Simultaneous teaching of science, technical and vocational education in national education scheme for total student capacity and optimum performance.
vii. General contextual change to reflect the state of professional education practice.

Education can be described as an agent of social mobility. Education helps to move an individual from the lower to the upper class. Nigeria's philosophy of education implies that education is an instrument for national development, and the interaction of persons and ideas are all aspects of education. Education fosters the worth of action of the individual, for each individual's sake, and the general development of the society (Fägerlind & Saha, 2016). The National Policy on Education in Nigeria includes five main national aims and objectives, proven to be the necessary foundation for building the country's future. They are a free and, democratic society a just egalitarian society, a united, strong and self-reliant nation, a great and dynamic economy, a land full of bright opportunities for all citizens Adebisi (2014). Nigerian educational policy provides the aims and objectives for the long-term development of the education system in the

country. They are the following: Education shall be highly rated in the national development plans because education is an essential charge instrument. Any fundamental change in the intellectual and social outlook of any society has to be preceded by education. Therefore, life-long education shall be the basis of the nation's educational policy. (Bamigbose, 2016) revealed that education and training facilities shall continue to be expanded in response to social needs and made progressively accessible to afford the individual a far more diversified and flexible choice. Educational activities shall be centered on the learner for maximum self-development and self-fulfillment.

2.1.6 Technologies for Teaching

Technologies for teaching are the tools, equipment, gadgets, and media used in imparting knowledge to learners. Mislevy *et al.* (2016) revealed that educational media and tools could be used. Task structuring support: help with how to do a task (procedures and processes), access to knowledge bases (help a user find information needed) And alternate forms of knowledge representation (multiple representations of knowledge, e.g. video, audio, text, image, data). There are numerous physical technology that currently uses digital cameras, video cameras, interactive whiteboard tools, document cameras, electronic media, and LCD projectors. These techniques combine blogs, collaborative software, ePortfolios, and virtual classrooms (Anita & Ramakrishnan, 2015).

The following are technologies that can be used for teaching and learning activities:

A. Audio and Video technologies

Lerman *et al.,* (2013) opine that Video technology has included VHS tapes and DVDs and on-demand and synchronous methods with digital video via server or web-based

options such as streamed video and webcams. Telecommuting can connect with speakers and other experts. Interactive digital video games are being used at K-12 and higher education institutions. Radio offers a synchronous educational vehicle while streaming audio over the Internet with webcasts and podcasts can be asynchronous. Classroom microphones, often wireless, can enable learners and educators to interact more clearly. Screen-casting allows users to share their screens directly from their browser and make the video available online so that other viewers can stream the video now. The presenter thus can show their ideas and flow of thoughts rather than explain them as straightforward textual content. In combination with audio and video, the educator can mimic the one-on-one experience of the classroom. Learners can pause, rewind, and review at their own pace, something a classroom cannot always offer (MacLeod, 2015).

A video home system

A television

Figure: 2.5: A VIDEO HOME SYSTEM AND A TELEVISION

Source: (Lerman *et al.*, 2013)

B. Computers, tablets and mobile devices

With recent developments in smartphone technology, modern mobiles' processing powers and storage capabilities allow for advanced development and use of apps. Many app developers and education experts have been exploring smartphone and tablet apps as a medium for collaborative learning. Computers and tablets enable learners and educators to access websites as well as applications. Many mobile devices support m-learning. Mobile devices such as clickers and smartphones can interact with audience response feedback Fichten *et al*. (2014). Mobile learning can provide performance support for checking the time, setting reminders, retrieving worksheets and instruction manuals. Such devices as iPads are used for helping disabled (visually impaired or with multiple disabilities) children in communication development and in improving physiological activity, according to the stimulation Practice Report.

Figure: 2.6: A COMPUTER, TABLET AND A MOBILE PHONE
Source: (Fichten *et al*., 2014)

C. Collaborative and social learning

Group webpages, blogs, wikis, and Twitter allow learners and educators to post thoughts, ideas, and comments on a website in an interactive learning environment. Social networking sites are virtual communities for people interested in a particular subject to communicate by voice, chat, instant message, video conference, or blogs. The National School Boards Association found that 96% of students with online access have used social networking technologies and more than 50% talk online about schoolwork. Social networking encourages collaboration and engagement and can motivate students' self-efficacy (Gikas, 2013).

According to the stimulation Practice Report, such devices as iPads are used for helping disabled (visually impaired or with multiple disabilities) children in communication development and in improving physiological activity,

D. Interactive Whiteboards

The term whiteboard is also used metaphorically to refer to virtual whiteboards in which computer software applications simulate whiteboards by allowing writing or drawing. It is a common feature of groupware for virtual meetings, collaboration, and instant messaging. Interactive whiteboards allow learners and instructors to write on the touch screen. The screen markup can be on either a blank whiteboard or any computer screen content. Depending on permission settings, this visual learning can be interactive and participatory, including writing and manipulating images on the interactive whiteboard (Graham, 2020).

Figure 2.7: AN INTERACTIVE WHITEBOARDS

Source: (Graham, 2020)

E. Interactive flat-panel displays

Similar to the interactive whiteboard is the interactive flat-panel display. This touch-enabled, high-definition display can be wall-mounted and used as a digital presentation surface in classrooms and lecture halls. Interactive Flat Panel Displays come with a list of features that can truly enhance the educational experience for both students and teachers (Rao, 2021). It has a build-in software apps in these devices make it easier for teachers to present various pictures and statistics, supplementary materials, or videos that are related to the lesson. And if those apps are not enough, teachers can benefit from the option of a slot-in computer, which allows them to use their IFPD as a smart display for a functional Windows PC.

Figure 2.8: INTERACTIVE FLAT-PANEL DISPLAYS

Source: (Rao, 2021)

F. Virtual learning environment

A virtual learning environment (VLE), also known as a learning platform, simulates a virtual classroom or meetings by mixing several communication technologies simultaneously. Web conferencing software enables students and instructors to communicate via webcam, microphone, and real-time chatting in a group setting. Participants can raise hands, answer polls or take tests. Students can usea whiteboard and screencast when given rights by the instructor, who sets permission levels for text notes, microphone rights and mouse control (Pineteh, 2012). Sharples (2016) opines that a virtual classroom provides the opportunity for students to receive direct instruction from a qualified teacher in an interactive environment. Learners can have direct and immediate access to their instructor for instant feedback and direction. The virtual classroom provides a structured schedule of classes, which can be helpful for students who may find the freedom of asynchronous learning to be overwhelming. In addition, the virtual classroom provides a social learning environment that replicates the traditional "brick and mortar" classroom. Most virtual classroom applications provide a recording feature. Each class is recorded and stored on a server, allowing instant playback of any type over the school year. It could be beneficial for students to retrieve missed material or review concepts for an upcoming exam. Parents and auditors have the conceptual ability to monitor any classroom to ensure that they are satisfied with the education the learner is receiving.

In higher education, especially, a virtual learning environment (VLE) is sometimes combined with a management information system (MIS) to create a managed learning environment, in which all aspects of a course are handled through a consistent user interface throughout the institution (Kaware *et al*., 2015). Physical universities and newer online-only colleges offer select academic degrees and certificate programs via

the Internet. Some programs require students to attend some campus classes or orientations, but many are delivered entirely online. In addition, several universities offer online student support services, such as online advising and registration, e-counseling, online textbook purchases, student governments and student newspapers (Voss, 2013).

2.1.7 Pedagogical Approach in Education

Education has gone through a lot of transformation over the past decades. It is within reach of more learners than before. Also, today, formal teaching is available in many learning disciplines for various categories of learners and is deliverable through technology-enabled channels. It has been possible because the manner of imparting education has also evolved. This manner of imparting education to students is pedagogy. Pedagogy defines the methods adopted for conducting teaching-learning sessions. It includes the various strategies and approaches adopted by teachers to ensure meaningful learning sessions for students. So, practical pedagogical approaches are of critical importance in providing quality education. The importance of pedagogy to teaching is paramount. It improves the quality of learning, makes students more active during lessons, and improves participation and development of higher cognitive skills.

Haukås (2016) opines that learning is dependent on the pedagogical approaches teachers use in the classroom. Various pedagogical approaches are common in schools, but some strategies are more effective and appropriate than others. The effectiveness of pedagogy often depends on the particular subject matter to be taught, on understanding the diverse needs of different learners, and on adapting to the on-the-ground conditions in the classroom and the surrounding context. In general, the best teachers believe in the capacity of their students to learn and carefully utilise a range of pedagogical approaches to ensure this learning occurs. The different pedagogical approaches could

be broken down into four categories: integrative, constructivism, inquiry-based approach.

Integrative Approach:

The integrative approach relates classroom education with real-world applications. The students, thus, find the classroom teaching more meaningful and relevant. The students learn to improve their knowledge in a subject. Therefore, this approach kindles the interest of students in mathematics and science. Kirkwood (2014) stated that the process promotes the educator to connect skills and knowledge from multiple sources and experiences to yield an exciting lecture delivery. It will enhance the learning environment to be more significant as the lecture is being delivered properly. Indirectly, the students will tend to develop the ability to use diverse learning activities and experiences. The students seem to grasp more as to compare with other approach. the learning process becomes meaningful, and the installation of connecting skills and knowledge from experiences help the students sustain the lecture for an extended period. With this learning approach, learners can easily relate and interact with each other.

Constructivism Approach

Constructivism is a theory that people learn through experiences and reflection. A Constructivist pedagogy puts the child at the centre of the learning and is sometimes called 'invisible pedagogy'. A constructivist approach would incorporate project work, inquiry-based learning and might adopt a Montessori or Steiner method. Wei and Karin (2021) buttress that Constructivism is based on the pedagogical research of Piaget (1896-1890). Piaget wrote extensively about 'schemas', an idea that learners come ready to learn, and the teacher must build activities to facilitate their learning. Younger children work things through physically, whereas older children tackle symbolic and abstract ideas. A lesson might include individualization, a slower pace, hidden

outcomes, the mantle of the expert, and less teacher talk. Some adopters of this pedagogy would also emphasis being outdoors and engaging with nature. Constructivism is also sometimes described as a progressive teaching style (Bada *et al.,* 2015). This approach puts the student at the Centre of the learning process. The student develops new ideas and concepts based on their existing and past knowledge. The instructor merely facilitates the process by developing activities. Students discover and learn by solving problems. Learning might happen at a slower pace owing to limited conversations between the student and instructor. Leaners can learn synchronously and asynchronously via the different platforms.

Inquiry-Based Approach:

An inquiry-based approach is a learning and teaching approach that emphasises students' questions, ideas and observations. Instructors actively encourage students to share their thoughts and to challenge, test and redefine ideas respectfully. With inquiry-based learning, instructors and students share responsibility for learning. This approach puts the student at the centre of the learning process. Hwang and Chen (2017) opined that the inquiry-based approach requires Students to ask questions and use reasoning and problem-solving skills to reach a solution. An inquiry-based system may be of four types: confirmation, structured, guided and open. With this learning approach, students can interact with themselves and track their progress through the various online packages

Collaborative Approach:

Alraddadi (2020) defines the collaborative approach as requiring students to work together in small teams. The students may have different levels of ability. The reason: isolated learners do not learn as much as students working together in a group. In a research-oriented set-up, this small team may also comprise a teacher and a researcher.

A collaborative (or cooperative) learning approach involves students working together on activities or learning tasks in a group small enough for everyone to participate in a collaborative study that has been assigned. Students in the group may work on separate tasks contributing to a common overall outcome or work together on a shared mission. Some collaborative learning approaches put mixed ability teams or groups to compete to drive more effective collaboration. There is a vast range of collaborative and cooperative learning approaches involving different kinds of organisation and tasks. Peer tutoring can also be considered a type of collaborative learning. The impact of combined policies on education is consistently positive. However, the size of the effect varies, so it is crucial to get the detail right. Effective collaborative learning requires more than just sitting students together and asking them to work in a group; structured approaches with well-designed tasks lead to the most significant learning gains. There is some evidence that collaboration can be supported with competition between groups, but this is not always necessary and can lead to learners focusing on the competition rather than the learning it aims to help. Approaches that promote talk and interaction between learners tend to result in the best gains.

2.1.8 Competency Skills of Pre-service Teachers

Competence with technologies is instrumental in whether teachers and administrators support and integrate technology into the curriculum. Loogma and Kruusvall (2012) found that Information and Computing Technologies (ICT) competence in teachers (especially e-Learning and computer skills) were predictors of innovativeness in using e-Learning technologies. Research has also shown that a teacher's openness can predict teacher technology competency to change Masry-Herzalah and Dor-Haim (2021). Technology competence, however, is not always equal in terms of the types and pedagogical ways that they are used in the classroom. Koehler and Mishra (2011)

developed a social networking model called "Learning Generation" for technology integration. They found that teachers involved were confident in their ability to use essential technology applications (word processing, online resources, primary computer use) but were less optimistic in technologies supporting constructive learning applications (spreadsheets, databases, and presentation software) that support critical thinking skills. When viewed through the lens of administration, technological competence can change the dynamic of school support for the technology. When school leaders have high levels of Information and Computing Technology (ICT) knowledge, specifically knowing about management and mechanics of technologies (i.e., technology competence), they tend to champion technology use in their schools. When they have low ICT experience or involvement using technology tools (i.e., technology self-efficacy), they do not support technology integration efforts (Rosebery et al., 2014).

Competence with technology use does not necessarily imply high levels of self-efficacy either. For example, in a study of pre-service teacher education, students who had high grades in technology courses, which indicated technology competence in their teacher education programs, reported low confidence levels with using the technologies for curriculum integration. The researchers also found that self-reports of high levels of lesson planning that included a technology component were not supported when predictor evaluations of lesson plans took place in the pre-service students teaching portfolios.

2.1.9 Concept of Technological Usage Skills.

Techno-pedagogy is defined by (Vanajhaa, 2017) as electronically mediated courses that integrate sound pedagogic principles of teaching/learning with technology. All the teachers are expected to have technical knowledge. Technology knowledge in education

means all the standard teaching technologies from books to the blackboard and the recent advanced technologies such as the internet and digital videos. The skills to operate these technologies are inevitable for today's higher education teachers, including teacher educators. The technology knowledge includes the knowledge about the hardware of a computer and to use the software like a word processor, PowerPoint, e-mail, excel spreadsheets, publisher. These basic skills refer to your ability to interact and complete tasks using computer-based technologies and other associated technologies. These tasks can either be digital or physical. Sometimes, these skills may be referred to as technical skills. They are practical. Examples of these skills include connecting the projector to the system, saving and retrieving information in a computer, creating and naming a folder, typing and printing documents, and capturing and editing images with a computer the teacher uses to plan and preparea lesson.

2.1.10 Concept of Technological Usage Skills for Planning and Preparing of Lesson Plan

A lesson plan is an essential methodological component of the learning process. A lesson plan is an auxiliary teacher‘s work for preparing, organizing and conducting a lesson. By preparing for studies, a teacher writes a plan. It includes a topic, objectives, teaching structure, material for independent work of students, their position at separate stages, which students should be checked. Schleicher (2012) defines a lesson plan as a description of methodically-based lessons. Teachers are developing a lesson plan that stimulates teachers to take a deeper look at the everyday teaching process; encourage teachers to think of specific needs of each student: proper learning styles and methods are chosen for planning, and particular needs of students are taken into account, There is a splendid basis for cooperation of colleagues: teachers can render their experience to

beginners teachers, thus encouraging professional improvement, stimulate teachers to be innovators and propose new ways of teaching, to test new training aids and strategies for achieving better results, help teachers to be fit, to have more confidence in themselves and get the better of problems that may arise in the training process. Schleicher (2012) says it assists in deepening teachers' knowledge and skills: careful lesson planning allows them to get an idea of how and what is going on in reality.

Developing lessons does not require tightly scripting every interaction or rigidly adhering to a fixed plan. Effective teachers provide room for spontaneity and time to explore questions and topics in the students' minds. They recognize that well-designed classes retain structure and direction and that planning allows the leeway to vary an original design and then come back to it according to the flow of the course (Douglas & Jaquith 2018). Without a plan (or following a poorly designed program), students quickly become distracted or disinterested, moving through activities without a clear sense of purpose or engagement. Using technology in lesson development does not mean planning all your lessons on a computer or asking students to use technology during every classroom activity. Instead, it means always keeping in mind technology's broad potentials and recognising the ways technology can contribute to how teachers develop lessons. A teacher needs the following technical knowledge to prepare lessons on a computer and acceptably arrange them, interact with my supervisor using online platforms, download information sent by my supervisor via E-mail. Use the school internet facilities to access online materials for lesson preparation. Use CorelDraw to draw and design diagrams as instructional material, operate a projector and use it to teach by connecting it to a computer. use various video clips to produce content for learning, use CorelDraw to manipulate diagrams and explain lessons for effective instructional delivery

2.1.11 Concept of Technological Usage Skills for Instructional Delivery

Techno-pedagogy can help in the effective and efficient delivery of knowledge, thereby enhancing the equity in education, promoting universal access to education, supporting the delivery of quality learning and teaching, teachers' professional development and more efficient education management governance and administration. Study materials can be developed using techno-pedagogy. The linguistic abilities and research activities can be acquired through techno-pedagogical skills. The teacher who develops techno-pedagogic skills may be a multi-tasking personality and highly respected by the students. Other uses of techno-pedagogic skills include improving life skills among students, augmentation of enrollment and examination processes, and strengthening cognitive learning. Teachers with techno-pedagogic skills for instruction delivery can also give strong guidance and counseling to the students for their future careers Seifert (2019). They can also encourage the self-learning ability of the students by directing the students towards various online courses. In a technologically oriented classroom, a teacher can use PowerPoint to record delivered instructions and send them to an online platform for students to access at their convenience, present lessons in the school, hyperlink videos to PowerPoint presentations to enhance learning. Convert Instruction to various software packages, use social media platforms to deliver instructions, use the net to provide instructions asynchronously at an agreed time, manipulate instructions using diagrams, thereby putting into consideration individual differences of the students, use images to present a lesson to a student through the net, use PowerPoint to give summary and conclusion.

2.1.12 Technological Usage Skills for Evaluating Learning and Providing Feedback

Technology is a powerful ally for teachers, especially in measuring student learning. With digital formative assessments, teachers can expedite their ability to provide student

feedback in real-time. Also, students interact with their assignments, receive teacher input, and are invested and motivated in their learning (Timmis *et al.,* 2016).Giving effective feedback for learning is one of the best ways to improve student performance. Constructive feedback allows teachers to build and maintain a conversation over time. Education technology empowers teachers to help students on an individual basis. With the right technology, instructors deliver timely, effective feedback to achieve more excellent learning. Effective feedback doubles how quickly students learn. The following are ways an assessment and feedback are conducted by a tutor. Create an online group where teachers can send Assignments to students. Get feedback from students' using online platforms, conduct online examinations, assess student's performance at their own pace and time through the net, evaluate a large group of students without difficulty using an online platform, align interval of assessment base on the lesson content provided by a pre-service teacher or the in-service teacher.

2.2 Theoretical Framework

The theoretical framework for this 'appraisal of techno-pedagogical competence of pre-service teachers in tertiary institutions in Niger State is based on the following theory connectivism, activity theory and Technological Pedagogical Content Knowledge (TPACK)

2.2.1 Connectivity Theory

George Siemens propounded Connectivism in 2004 on a blog post later published as an article in 2005 by George Siemens. It was later expanded in 2005 by two publications, Siemens' Connectivism: Learning as Network Creation and Downes' An Introduction to Connective Knowledge. Meyer (2013) in his study define Connectivism as a relatively new learning theory that suggests students should combine thoughts, views, and general information helpfully. He accepts that technology is a significant part of the learning

process and that our constant connectedness gives us opportunities to make choices about our learning.

Duke *et al.,* (2013) stated that George Siemen also worked with learners and employees in global business and education environments. Both are exponents of the openness and interpretive nature of knowledge and the connectedness of learning online and model connected online learning and knowledge sharing through their blogs and websites. He Proposes connectivism as a learning theory for the digital age, a successor to behaviourism, cognitivism and constructivism (Duke *et al.*, 2013). He identifies as limitations of these theories: their intrapersonal view of learning, their failure to address the learning within technology and organizations, and their lack of contribution to the value judgments that need to be made in knowledge-rich environments. The concept of network is prominent in the theory of connectivism that characterizes knowledge as a flow through a network of humans and non-humans (artefacts). A network comprises connections between entities (nodes), where the nodes can be individuals, groups, systems, fields, ideas, resources or communities. Siemens sets a bold research agenda around sharing cognitive tasks between people and technology, coping with rapid change in the 'information ecology', and the impact of theories of networks, complexity, and chaos. He established a set of principles for connectivism, broad guiding statements.

i. Learning and knowledge rest in a diversity of opinions.
ii. Learning is a process of connecting specialized nodes or information sources
iii. Learning may reside in non-human appliances.
iv. The capacity to know more is more critical than what is currently known.
v. Nurturing and maintaining connections is needed to facilitate continual learning.
vi. Ability to see connections between fields, ideas, and concepts is a core skill.

vii. Currency (accurate, up-to-date knowledge) is the intent of all connectivism learning activities.

viii. Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. Thus, while there is a correct answer now, it may be wrong tomorrow due to alterations in the decision's information climate.

Educators used connectivism to frame their learning. This theory would also be of use to learners in higher education. Educators who wish their students to use connected technology will give them models, examples, and activities. Presented in an appropriate form, a model of connectives that puts the student in the network could be of great use to them. Implications for Higher Education Educators becoming critical experimenters with new tools and services. One of the benefits of experimentation with technology becoming more widespread is that pragmatic, critical users can identify practical and sound academic uses rather than using technology for its novelty value. Extending the range of learning platforms in which students submit (and even publish) their work. Not only can students seek out sources on different technology, but they can also submit work in different formats., we could use online platforms to teach, assess, examine student performance. Encouraging and supporting students to move beyond institutional boundaries.

Students can be engaged to acquire the 21st Century Learning Skills that are needed to make effective use of technologies that were emerging for use within classrooms and the workplace Kukulska (2012) stated that it helps in organizing co-operative and collaborative work with massive numbers, are developed, and as more experience is gained. But, more importantly, connectivism is the first theoretical attempt to re-examine the implications in this modern age radically.

2.2.2 Activity Theory

Activity Theory has a foundation in the famous Russian psychologist Vygotsky and his students, particularly Leontiev in the 1920s. Activity Theory acts as a lens that helps to tease out and bring about a better understanding of the human activity. Vygotsky, in 1978 had a sincere view into the fundamentals of human consciousness and examined human reasoning as forthcoming through practical activity in a social environment. The concepts used in Activity Theory are overset from Russian words and often have specific meanings beyond their regular use in English. Thus, the critical concept activity is much more than being active; it is meaningful and delicate. Vygotsky countered the stimulus-response model of his more renowned counterpart, Pavlov, and promoted the point that, unlike animals, human activity is on purpose and carried out by sets of actions through the use of 'tools, which can be psychological or physical. The latter (set of action) include language, the essential tool for collaborative human activity. The relationship between the subject (human doer) and object (the thing being done) forms the core of activity. The object of activity entails the activity's focus and purpose while the subject, a person or group engaged in the activity, incorporates the subject's/various motives. The outcomes of an activity can be the intended ones, but there can also be others that are unintended. Often what people seem to be doing, what they say they are doing, and what they do can be pretty different. What is just a physical object for one person is something much more meaningful for someone else.

The philosophical notion of a dialectic relationship comes from the argument that any meaningful thesis (an idea or concept) can have a good antithesis or opposite. A synthesis of the theory and its antithesis gives a richer understanding of reality. Other elements of Activity Leontiev in 1981 is often recognized as the founder of Activity Theory as it is understood today. Hasan and Kazlauskas (2014) sees activity as

a holistic, high-level, usually collaborative, construct such as undertaking a work project, teaching a course, and should not be confused with more everyday uses of the word ‘activity’ in English Most significantly, an activity must always be understood in the context of its cultural and historical environment historical knowledge of how society works and is organized (Jackson, 2012). Tools can be primary (physical), secondary (language, ideas, models,) or tertiary (communities, context, or environments). Changing circumstances may require changes to the plans, which, in turn, change the course of the building activity. These are instances when there would be a dynamic mediating relationship between the activity and the various primary, secondary and tertiary tools. The Engeström (1987) representation of a collective activity system of popularized Activity Theory using the concept of a ‘collective activity system’, as depicted in the familiar triangle, with the elements: subject, object, tools, rules, division of labour and community. This model emphasizes the distinction between the object or motive of an activity and its outcomes, which may be many and not always those anticipated or desired. Engeström’s triangle is often used without reference to the rich understanding of the underlying work of Vygotsky, Leontiev and others. Still, it offers researchers and practitioners a holistic interpretation of a real-world situation that is comprehensive and clear.

In research that studies the complexities of real-world situations, such as modern workplaces, communities’ groups or places of learning, Activity Theory provides a language and a set of frameworks for making sense of what is discovered about the situation through observation, interviews and other methods. Using the Activity Theory lens for instructional delivery takes activity as the unit of analysis, where activity is defined by the ‘dialectic relationship between subject and object; in other words, ‘who is doing what for what purpose’. In most complex situations, many dynamic inter-

related activities form what could be seen as a system of activities. The analysis of a real-world context using the lens of Activity Theory proceeds as follows:

Step 1. Identify the significant activities of the system to be investigated together with each activity's subject(s), object and purpose.

Step 2. Identify the actions and mediating tools of the activity or activities, which can be primary, secondary or tertiary.

Step 3. Identify the dynamics and tensions within and between the identified activities. Following these steps provides a holistic and insightful mechanism for describing a situation for the researcher and those being researched. It enables researchers to represent and explain the changes identified during a longitudinal case study in complex environments. It can also give managers a more profound understanding of what is happening in their business over time as perceived by different stakeholders such as employees, clients and customers.

The novelty, contribution and significance of the theory Activity Theory provides a rich holistic understanding of how people collaborate, i.e. carry out purposeful collective activities, with the assistance of sophisticated tools (information systems) in the complex dynamic environments of modern organizations (Hasan & Kazlauskas, 2014). The main advantage that Activity Theory offers practitioners and researchers is a holistic lens in understanding the patterns of situations and problems in different industrial sectors and other cultural contexts. Moreover, activity Theory is grounded in almost a century of research and has a rich tradition applied to many fields of study. (Foot, 2014).

Since teachers focus on task completion, this theory helps teachers address each student individually. It can personalize tasks and teaching there, making every student participate effectively in the learning process.

2.2.3 Technological Pedagogical Content Knowledge (TPACK)

The TPACK framework was propounded by Mishra and Koehler (2006).They explain that their theory comes after five years of studying teachers at different grade levels with design experiments to see how their classrooms operated. They based their initial idea on Lee (1986) work. To integrate technology into their teaching, teachers need knowledge, which falls into three major domains, namely content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK). Technological Pedagogical Content Knowledge (TPACK) is the effectiveness of the delivery of the lesson with technology integration. It is an ideal application in all aspects of learning

TPACK represents a class of knowledge that is central to teachers' work with technology. This knowledge would not typically be held by technologically proficient subject matter experts, or by technologists who know little of the subject or pedagogy, or by teachers who know little of that subject or about technology."

Fewer studies involving in-service teachers have been conducted using TPACK theoretical framework in mathematics education (Koehler *et al*., 2014).

However, the TPACK theoretical framework has been used by various researchers in various educational disciplines in ICT integration. One of the strengths of the TPACK theoretical framework has been on teacher assessment and evaluation. For example, kamau (2014) developed a survey instrument to validate middle school teachers' technological pedagogical content knowledge (M-TPACK). The study supported teachers' in-service training to understand the role of technology in mathematics teaching. Other studies have also developed survey instruments to study teachers' TPACK. For example, Archambault and Crippen, (2009) developed a survey instrument to measure TPACK for K-12 online teachers. The findings indicated that teachers felt confident about their content knowledge, pedagogical knowledge and technology

knowledge. However, teachers felt incompetent when it came to the domain of technology. Canbazoglu *et al.,* (2016) developed a survey instrument to measure TPACK for pre-service teachers. They claimed that the device could help teacher educators design appropriate longitudinal studies to assess pre-service teachers' development of TPACK.

The TPACK theoretical framework has not been without criticism for varied reasons. Originating from Shulman's initial conception of PCK, several researchers have raised concerns about the relationship between content knowledge and pedagogical knowledge (McEwan & Bull, 1991; Segall, 2004). These researchers have argued that it is not easy to think about content knowledge without pedagogical knowledge. This problem based on Shulman's notion of PCK has persisted in the TPACK theoretical framework. On the one hand, the TPACK theoretical framework looks fancy both in text and graphics; however, its complexity to comprehend and apply it in educational settings has been faulted because researchers and educational practitioners have not clearly understood the relationship between content, pedagogy, and technology.

On the other hand Chai (2016) highlighted that TPACK theoretical framework lacks implementation and evaluation strategies, and the boundaries to the constructs are not distinguishable. Moreover, considering professional learning for teachers, TPACK fails to clarify the knowledge teachers need to know about content, pedagogy, and technology (Koehler *et al.,* 2014). In agreement, Tzavara and Komis (2015) argued that TPACK needs to be rebuilt. The distinction between the content, pedagogy, and technology may be clarified, and the role of tool affordances and limitations of constraints are elaborated.

In addition to these new knowledge overlap areas, Mishra and Koehler quickly point out that all of this knowledge lies in specific contexts. You, as the teacher, form part of the

context, while students and the environment also contribute to the context. With each situation, the context changes slightly, and your set of knowledge shifts with it to create the learning environment. Keeping technology as a separate knowledge set causes problems, but when we understand the framework of TPACK, we can integrate technology into the content and pedagogy of our classrooms. The integration will help our students learn more effectively. Mishra and Koehler suggest that TPACK should guide curriculum development and teacher education plan our daily lessons. They describe a planning process where we first choose the learning outcomes we will be working on in instruction delivery or during that class session. The learning outcomes are the content. The figure below shows how content, technology and pedagogy interact to provide efficient and effective learning outcomes.

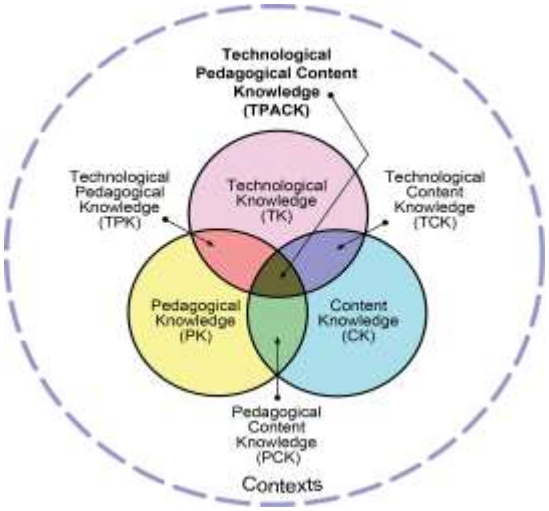

Figure: 2.9: TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK)

Source: (Koehler *et al.*, 2014)

2.3 EMPIRICAL STUDIES

Yurdakul (2011) conducted a study examining techno pedagogical knowledge competencies of pre-service teachers based on ICT usage. The participants of the study consist of 3105 pre-service teachers from seven higher education institutions in Turkey.

This study reveals that pre-service teachers for the study had high-level techno-pedagogical knowledge competency. Furthermore, a significant difference was found between pre-service teachers' Techno-pedagogical knowledge competencies and the general ICT usage level. Also, it was determined that there is a substantial difference between pre-service teachers' techno pedagogical knowledge competencies and the usage level of each ICT category.

Almerich et al., (2011) studied training needs of teachers in ICT competencies: training profiles and elements of complexity. The study questionnaire design has been used as a sample of 868 primary and secondary education teachers in the Valencia community (E.Spain) to collect information. The results showed that teachers demand higher-level training in the personal-professional area. In addition, they require more training with students in classrooms and to integrate ICT into classrooms.

Coutinho and Lisboa (2014) investigated 'Pre-service teachers´ perceptions on educational networking' integrated social networking activities in an ICT program at a Portuguese university enrolling 26 pre-service teachers from humanities. For data collection, the Investigators used observation of the interactions (sociometric analysis) and two online questionnaires (initial and final) to evaluate students´ perceptions of educational networking. As a result, the study verified that the participants interacted in the discussion forums actively. Furthermore, the feedback obtained on the online questionnaires showed positive perceptions towards the use of educational networking in teaching practices that encourage its inclusion in formal education programs that intend to prepare digital competent beginning teachers.

Valtonen *et al.* (2015) focus on how experiences of learning with ICT in pedagogically meaningful ways can affect pre-service teachers' intentions to use ICT for teaching and

learning. The research is based on the framework of the theory of planned behaviour (TPB). It is a quasi-experimental design study with pre-and post-testing. The effects of a 12-week course using collaborative, inquiry-based learning practices and several ICT applications on four pre-service teachers' TPB areas are investigated. The research was conducted using repeated measures *t*-tests and structural equation modelling (SEM). The results indicate no differences in pre-service teachers' attitudes and behavioural intentions towards ICT for teaching and learning. However, statistically significant changes were found in pre-service teachers' self-efficacy and subjective norms concerning ICT use for teaching and learning. Also, differences between pre-and post-testing were found in the relationship between subjective norms and self-efficacy and other areas of TPB.

Thakur (2015) conducted a study on the implementation of techno-pedagogical skills, their challenges and their role to release at a higher level of education. The study views techno-pedagogical skills as the way to make accessible and affordable quality education to all. It in detail analyses the challenges of using techno-pedagogy in higher education and the roles to overcome these challenges. The significant difficulties are the destitute infrastructure of ICT, scarce competence in English language and online content, calamity, and lack of incentives and awareness of teachers, evils on research and development, the hitch of using software, limited techno-pedagogical resources, lack coordination among the departments, frequent power outages and fluctuations. However, these challenges can be way-out by the bumping of infrastructure, enhancing competence on English language and online content, dissolving the crisis of teachers, comprising of incentives of teachers, resolution on research and development, encompassing of awareness of existing techno-pedagogical services, using of licensed software, eternal techno-pedagogy supportive resources, improving coordination among

the departments, removing of frequent power outages and fluctuations, developing e-Content and web page for techno-pedagogical skills, developing Computer Based Learning Resources Management Systems, increase publicity about existing ICT services.

Ndongfack (2015), through his study, developed a model for teacher professional development on technology integration, named Mastery of Active and Shared Learning Processes for Techno-Pedagogy (MASLEPT). The study employed a quantitative survey methodology to collect data towards developing a model on technology integration in classrooms and identifying training needs for teachers. Four hundred teachers were selected to participate in this study using the stratified random sampling technique from primary schools in 10 Regions of Cameroon to identify their preferences in a professional development model. The data were analysed using percentages, frequency counts, mean and standard deviation. The results indicated that teacher-participants preferred an ongoing school-based professional development model that supports collaborative learning and problem-solving and involve classroom follow-up. A review of the weaknesses in current models and literature on best practices in in-service teacher training led to the proposed Mastery of Active and Shared Learning Processes for Techno-pedagogy (MASLEPT) model.

Yildiz (2017) investigated Students' high-level thinking skills, like critical thinking, have been developed thanks to technology. When the previous researches in the literature are analyzed, it will be understood that this research is original by providing significant contributions to the literature. This research investigates whether techno-pedagogical competencies and critical thinking skills show statistically significant differences in some variables and whether there is a statistically significant relationship between necessary thinking skills and techno-pedagogical competencies of pre-service

elementary mathematics teachers. At that point, this research is remarkable for presenting an idea of educating more qualified mathematics teachers. This study was designed as a descriptive study. The sample of the study consists of 552 pre-service elementary mathematics teachers. This study used two data collection tools: the "TPACK Self-Efficacy Scale" and the "Critical Thinking Scale". The study data were analyzed by using the Statistical Package for Social Science (SPSS) 21.0. The study results reveal that the techno-pedagogical competencies and critical thinking skills of pre-service mathematics teachers are mid-level. On the other hand, there is a significant relationship between the pre-service mathematics teachers' necessary thinking skills and techno-pedagogical competencies.

Yorulmaz *et al.*, (2017) researched the relationship between the pre-service classroom teachers' epistemological beliefs and techno pedagogical subject-area competencies in Mugla Sıtkı Kocman University, Turkey. The study used a descriptive survey to determine the relationship between the pre-service classroom teachers' epistemological beliefs and techno pedagogical subject-area competencies within the area. 187 senior pre-service teachers attended the Department of Classroom Teacher Education in Mugla Sıtkı Kocman University in the 2014-2015 academic session. The sampling consisted of 141 pre-service teachers selected through the random sampling method from among the universe. The reason for choosing the senior students for the universe of the study was that they had already taken the subject-area, pedagogical and general culture courses. The data were analyzed by using IBM SPSS 21.0 program package. During the analysis process, first, it was tested whether the data displayed a normal distribution, and after it was determined that the data showed a normal distribution, from among the descriptive statistics, t-test and one-way ANOVA were used to reveal the differences and Pearson-product Moment Correlation Coefficient analysis was used to elicit the correlations. As

a result, the studies showed that the pre-service classroom teachers' level of techno pedagogical competencies is high, and their level of epistemological beliefs is medium.

Shittu *et al.,* (2017) examined predictors of pre-service science teachers' behavioural intention toward e-resources use for teaching in Nigeria. The study used a cross-sectional survey research method and a questionnaire with a set of items that measure technology preparedness, perceived usefulness, perceived ease of use, and behavioural intention to gather the study's data. The study sample comprises 124 pre-service science teachers graduating from a teacher education program in a Nigerian university. The study's findings showed that technology preparedness does not statistically influence students' behavioural intention towards e-resources use for teaching. Still, perceived usefulness and perceived ease of use do.

Bala (2018) The present study aimed to explore the predictors of Techno-Pedagogical Competence among a teacher of senior secondary schools as the nature of the research was descriptive, so the investigator applied survey method to gather the pertinent data. A stratified random sampling technique was used. The study collected data from 100 teachers of senior secondary schools, both from government and private schools. In this study, the Teachers Techno-Pedagogical Competence scale by Rajashekar and Sathiyara (2013) was used to collect the data. Statistical methods such as percentage, mean, t-test, standard deviation helped analyse the data. The research findings indicated no significant difference between male and female senior secondary school teachers concerning their techno-pedagogical competence. On the other hand, Government and Private senior secondary school teachers differ significantly regarding their techno-pedagogical competence. Private senior secondary school teachers possess more techno-pedagogical competence as compared to government senior secondary school teachers.

Yurdakul (2018) had undertaken a study to build a structural equation model that predicts the relationship between Technological Pedagogical Content Knowledge (TPACK) competencies and digital nativity in Balıkesir University. The data was collected from 1493 Turkish pre-service teachers. Two instruments were used in the data collection; a TPACK-deep scale and a Turkish adaptation of the Digital Native Assessment Scale (DNAS). Structural equation modelling (SEM) was conducted to investigate the assumption that digital nativity was a predictor of TPACK competency. It was found that pre-service teachers considered the high-level ability in both digital nativity and TPACK competency. The most prominent finding of the study was that digital nativity is a significant predictor of TPACK competency.

Farjon *et al*., (2019) examined the overall aim of this study was to map the technology integration of pre-service teachers at the start of their initial teacher education program since beginning teachers indicated that they do not feel fully prepared to integrate technology effectively in the classroom. Attitudes and beliefs towards technology (will), learning experience in technology use (knowledge), competency of technology use (skill), and access to technology (tool) (expansion of the WST model, (Knezek & Christensen, 2008) of 398 pre-service teachers were examined. The regression analyses indicated that the WST model explained the pre-service teachers' technology integration ($R^2 = 0.60$). The attitudes and beliefs were the most substantial influence, and access to technology was the weakest. Adding experience to the model (WEST model) did not improve the prediction, although experience significantly affected technology integration when the measurements were considered one scale. Concerns about the structure of the WST model were discussed.

Birisci (2019) investigated the prediction levels of techno-pedagogical education competency for technology integration self-efficacy beliefs of pre-service teachers. The

study group comprised 174 pre-service teachers at the Faculty of Education of a university located in Turkey's Eastern Black Sea region. As data collection tools, both the “Techno-pedagogical Education Competency Scale” and “Technology Integration Self-Efficacy Perception Scale” were administered. The study results showed that pre-service teachers had high technology integration self-efficacy beliefs, with a high-level positive correlation with techno-pedagogical education competency.

Sarita (2019) focuses on how technology permeates all walks of life. Almost every field of human endeavour and technological skills are becoming essential for all subject areas because of the acquisition and dissemination of information in all fields. The techno-pedagogical competency is nothing but the teachers' ability to use technology effectively in teaching. The teachers develop techno-pedagogical competencies then try to make use of this often in education, which will make the learning process simple and effective. Acquiring techno-pedagogical competency makes teaching and learning a pleasurable exercise. It would lessen the pressure on the teachers and enable the students to plunge deeper into the knowledge acquisition process. The present research paper talks about the techno-pedagogical competencies of faculty members teaching in the higher education system. The data was collected using Teacher’s Techno-Pedagogical Competency Scale (TTPCS) developed by Rajsekar and Sathiyaraj, (2013) from 40 faculty members randomly selected from science and social science departments Visva-Bharati, Santiniketan, West-Bengal for the study. The findings of the study revealed that the faculty members had above average Techno-pedagogical Competency. It was also found that there is no significant difference in Techno-Pedagogical Competency between males and females and science and social science faculty members. The study suggests that faculty members should utilize the platforms like SWAYAM and NPTEL to be updated themselves and their students.

Emeka (2019) studied pre-service teachers' technological pedagogical content knowledge (TPACK) self-efficacy towards technology integration. The study employed a descriptive survey research design. A multistage sampling technique was used to obtain the sample comprised of 603 NCE II pre-service teachers from southwest education colleges, Nigeria. TPACK self-efficacy questionnaire (TPACK-SQ) instrument was used to collect data on pre-service perceived self-efficacy. This instrument consisted of 42 items used to measure the 7 TPACK knowledge constructs (technology knowledge, content knowledge, pedagogy knowledge, pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge, and technological content knowledge). The instrument's reliability was determined using the Cronbach Alpha formula within the ranges of 0.71 to 0.86. Mean, Standard Deviation and independent samples t-test were used to analyze the data. The data collected revealed significant difference in technology knowledge ($t = 2.431$, $p = .015$) and technological pedagogical content knowledge ($t = -2.072$, $p = .039$) self-efficacy. Based on the findings, it was recommended that the TPACK framework be used to aid effective technology integration and assessment of teachers' knowledge to improve teacher education curriculums and build higher self-efficacy in pre-service teachers.

Terzi (2020) study focused on understanding prospective teachers' (PTs) preparedness to teach before starting working in the profession. In particular, the causal effects of "understanding the learner" and "techno-pedagogical competency" on "forming effective learning environments" by "designing the instructional process" were investigated. Structural equation modelling was carried out to estimate the effects of these variables on effective learning environments. A cross-sectional survey design was used with 314 PTs studying in a state university in Turkey in the 2019-2020 spring

semester. The Preparedness to teach scale was used for this study to obtain the data after investigating the scale for validity and reliability properties. The results suggested that understanding the learner had both direct and indirect effects on forming effective learning environments. That is, the better PTs could understand the learner, the more appropriately they could design the instructional process and, ultimately, create an effective learning environment. However, techno-pedagogical competency had only indirect impacts on forming an effective learning environment. This finding suggests that the higher-competency PTs had in techno-pedagogy, the more effectively they could establish a learning environment by adequately designing the instructional process.

Öztürk (2020) examined the pre-service teachers' cognitive flexibility levels and techno-pedagogical education competencies in terms of several variables and whether there is a relationship between their cognitive flexibility levels techno-pedagogical education competencies. The study was conducted with 616 pre-service teachers and designed using the exploratory correlational research model. The sample was determined by using convenience sampling methods. "Cognitive Flexibility Scale" and "Techno-pedagogical Education Competency Scale" were used for data collection. Pearson's correlation coefficient was calculated to determine the relationship between the pre-service teachers' cognitive flexibility and techno-pedagogical education competency scores, and a moderately significant association was found.

Siregar (2020) aimed to explore pre-service English teachers' view towards the effective 21st-century teachers' pedagogical competence and how they develop their pedagogical competence for their future teaching. The data were obtained through interviews and questionnaires. The study was qualitatively conducted as a case study involving 12 pre-service English teachers purposively chosen due to their familiarity with the study issue.

The results indicated that in 21st-century education, the participants perceived that the pedagogical competence focused on teachers' capability to integrate the technology in classrooms and teachers' ability to exploit adjusted methods and materials that furnish students with skills appropriate to their future real-life careers.

Özgür (2020) studied the proliferation of information technology products and services in learning environments due to rapid innovation, leading to a more significant requirement of meticulous planning in integration processes. In this regard, the burden placed upon teachers within their classrooms increases. This phenomenon, referred to as technostress, has recently been studied extensively in its causes and adverse effects. However, there is not much research into factors that contribute to the alleviation of technostress of teachers. This study employs statistical structural equation modelling (SEM) to examine the causal relationships among certain variables that are thought to relieve technostress over data collected from 349 in-service high school teachers in Turkey. Results of the modelling effort indicate that both school support and teachers' technological-pedagogical content knowledge (TPACK) negatively predict their technostress level.

Rugel (2021), in a study, examined how technology is commonly used to improve education at all levels. It means that combining its efficient use with professional learning can develop and reinforce collaboration in foreign language teaching. Edu-tech is all about linking theories, methodologies, tools, devices, strategies, procedures, programs and resources with learning content and activities to be developed by learners. In this light, the main objective of this study was to determine how educational technology is used to generate the speaking skills of English language learners. This objective helped analyze the use of technological resources and identify the tools and activities managed in lessons. In addition, this investigation aimed to compare the

perceptions of teachers and learners about the use of technology for educational purposes. In the development of this research, a descriptive phenomenological methodology was applied. The participants were a total of 24: 23 students from the fifth semester of Carrera de Pedagogía de los Idiomas Nacionales y Extranjeros at Universidad Técnica de Ambato, as well as one teacher of this group. The data was collected using a survey, applied to students; an interview directed to the teacher; and four class observations. Through the investigation, it was possible to find out that the effective use of technology and technological resources for educational purposes provided opportunities to expand communication interactions through the frequent application of web-based activities to develop speaking skills and reinforce pronunciation and vocabulary building.

2.4 Summary of Reviewed Literature

The importance of technology to the human cannot be overemphasized. The application of technology to education is possible through the use of ICT. the emergence of information and communication technology is seen as one of the breakthroughs in the teaching and learning process, the ability of teachers to administer and disseminate knowledge has been enhanced through technologies and has also provided new opportunities for students to acquire new skills and knowledge.

The hybrid teaching method in which ICT resources are utilized in the classroom interaction process is techno-pedagogy. It is also the art and craft of incorporating technology in effectively tailoring teaching-learning experiences. In techno-pedagogy, there are three areas of knowledge, namely: content, pedagogy, and technology; Content knowledge refers to the body of information that teachers teach and that students are expected to learn in a given subject or content area, Pedagogy knowledge is deep

knowledge about the processes and practices or methods of teaching and learning and how it encompasses overall educational purposes, values and aims. Finally, technology knowledge is knowledge about standard technologies such as books, chalk,blackboard, and more advanced technologies such as the internet and digital video. To maximize student learning, teachers must have expertise in a wide-ranging array of basic technological skills in planning and preparing lesson plans, technological skills in instructional delivery, and technological skills for evaluating learning and providing feedback.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The research design that was adopted for this study was a descriptive survey design. The design is considered appropriate whenever a study aims at collecting data from a large population, and a representative sample will be required. Through the descriptive survey, data can be collected from a portion of the population, and findings will be generalized to the entire population. In the study, the techno-pedagogical competence in (basic technological skills, technological skills for planning and preparing a lesson plan, technological skills for instructional delivery, and technological skills for evaluating learning and providing feedback) possessed by pre-service teachers in tertiary institutions in Niger State was assessed using survey instrument – questionnaire.

3.2 Population of the Study

The study population comprised the entire thirteen thousand three hundred and six (13,376) students of 2019/2020 academic session in tertiary institutions offering educational courses in Niger State. The names of the institutions are Federal University of Technology Minna, Ibrahim Badamasi Babangida University Lapai, Federal College of Education Kontagora, and Niger State College of Education, Minna). The target population was four thousand and eighteen (4,018) final year students in the institutions.

3.3 Sample and Sampling Techniques

A total of 351 respondents constituted the sample size of the study. Firstly, a purposive sampling technique selected the four institutions offering educational courses in Niger State. Pre-service teachers could only be found in those institutions. The names of the institutions are Federal University of Technology Minna, Ibrahim Badamasi Babangida University Lapai, Federal College of Education Kontagora, and Niger State College of

Education, Minna). After that, students in Schools/Faculty of education in the selected institutions were chosen because this is the only School/Faculty running education programme in all the four established institutions. After this, a purposive sampling procedure was used to select final year students in the chosen institutions because students at this level have undergone teaching practice exercises and are thus already familiar with the concept of techno-pedagogy. After that, a simple random sampling technique was used to select the 351-sample size using the Krejcie and Morgam (1970) table for determining sample size as a guide.

3.4 Research Instrument

A researcher-designed questionnaire named "Questionnaire for Appraising Techno-pedagogical Competency of Pre-service Teachers' (QATCPT)'' was used in the study for data collection. The questionnaire was divided into five sections; section A was about the respondents' demographic information. Section B consisted of items that examined pre-service teachers' basic technological skills. Section C consisted of statements on Pre-service teachers' technological skills for planning and preparing a lesson plan. Section D consisted of statements to assess Pre-service teachers' technological skills for instructional instructional instructional delivery. Section E consisted of statement to assess Pre-service teachers' technological skills for assessment, examination, and feedback using the 5-point Likert scale of Strongly Agree (SA) awarded 5 points, Agree (A) awarded 4 points, Undecided (U) awarded 3 points, Disagree (D) awarded 2 points, and Strongly Disagree (SD) awarded 1-point scale. A mean score above 3.0 was adjudged as Agreed, while a mean score below 3.0 was adjudged Disagreed.

3.5 Validity of Research Instrument

To determine the face and content validity of QATCPT, the questionnaire was validated by two experts in the department of Educational Technology, the Federal University of Technology Minna, and one Computer Science specialist at College of Education Minna. These experts assessed the items of the questionnaire based on their suggestions; some items were modified while others were added. The final draft of the questionnaire was approved before proceeding to the field.

3.6 Reliability of the Instrument

A pilot test was conducted to determine the reliability of QATCPT. A total of 30 pre-service teachers from the affiliated programmes at the School of Education, Niger State College of Education Minna, who form part of the study population, but that will not form part of the study sample, were used for the pilot study. The questionnaire was administered once, and the Cronbach Alpha reliability formula was used to determine the internal consistency of the items. The reliability coefficients of 0.87, 0.92, 0.86, and 0.91 were obtained, and the instrument was considered reliable.

3.7 Method of Data Collection

A letter of introduction was collected from the Head of the Department of educational technology. The researcher forwarded the letter to each sampled institution to obtain permission to conduct the study on their students. And when the approval was granted, the researcher administered the questionnaire copies to the pre-service teachers with the help of four trained research assistants. The completed documents of the questionnaire were retrieved immediately. Anonymity was ensured as all information collected was treated with the utmost confidentiality. The data collection period lasted for six weeks.

3.8 Method of Data Analysis

The data collected were analyzed using descriptive and inferential statistics. Mean and Standard Deviation were used to answer the eight research questions. A Mean score of 3.0 and above was considered agreement to the items, while a mean score below 3.0 was considered disagreement. For hypotheses testing, an independent t-test was used to determine whether a significant difference exists between the mean scores of the two groups. If a substantial difference exists, the hypothesis was rejected, if otherwise, it was retained. The level of significance was ascertained at a 0.05 level significance.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Data Obtained from the Research Questions

Research Question 1: What are the basic technological skills possessed by pre-service teachers in Niger state, Nigeria?

In answering research question one, item by item mean and standard deviation were established as presented in Table 4.1.

Table 4.1: Mean and Standard Deviation of Pre-service Teachers' Response on Basic Technological Skills Possessed in Teaching

S/N	STATEMENT	N	$\bar{x}$	S.D	DECISION
1	I can connect a projector to the system.	351	3.99	0.97	Agree
2	Save and retrieve information on computer.	351	3.91	0.84	Agree
3	Can create and name folders for a different purpose.	351	4.18	0.76	Agree
4	Interact with the system in the absence of a mouse.	351	3.96	0.81	Agree
5	Type and produce document with computers.	351	3.98	0.80	Agree
6	Draw and edit image with computer.	351	2.79	1.04	Disagree
7	Play multimedia application with a computer.	351	3.72	0.89	Agree
8	Print with a computer.	351	4.21	0.90	Agree
9	Develop and run a programme package with a computer.	351	2.48	0.73	Disagree
10	Capture image with a computer webcam.	351	3.78	0.85	Agree
	Grand Mean		**3.70**		**Agree**

Decision mean = 3.0

Table 4.1: showed the Mean and Standard Deviation Response of Pre-service Teachers' Response on Basic Technological Skills Possessed in Teaching. The table showed the calculated mean score of 3.99 with a Standard Deviation of 0.97 for item one, a mean of 3.91 with a Standard Deviation of 0.84 for item two, a mean of 4.18 with a Standard

Deviation of 0.76 for item three, mean of 3.96 with Standard Deviation of 0.81 for item four, mean of 3.98 with Standard Deviation of 0.80 for item five, mean of 2.79 with Standard Deviation of 1.04 for item six, mean of 3.72 with Standard Deviation of 0.89 for item seven, mean of 4.21 with Standard Deviation of 0.90 for item eight, mean of 2.48 with Standard Deviation of 0.73 for item nine and mean of 3.78 with Standard Deviation of 0.85 for item ten. The table revealed that the grand mean score of responses to the 10 items is 3.70,more significant than the decision mean score of 3.0. it implied that pre-service teachers in tertiary institutions in Niger State possessed the basic technological skills for teaching.

Research Question 2: Do pre-service teachers have technological usage skills for planning and preparing lesson plans?

1. **Table 4.2: Mean Response of Pre-service Teachers' Technological Skills for Planning and Preparing a Lesson Plan**

S/N	STATEMENT	N	$\bar{x}$	S.D	DECISION
1	I possess the ability to browse the internet or web for information on new ideas for lesson preparation.	351	3.75	0.55	Agree
2	I can prepare lessons on the computer and acceptably arrange them.	351	3.24	0.71	Agree
3	I can interact with my supervisor using an online platform.	351	3.22	0.67	Agree
4	I can download information sent to me by my supervisor via e-mail.	351	3.23	0.64	Agree
5	I can use the school internet facilities to access online materials for lesson preparation.	351	3.36	0.61	Agree
6	I can use CorelDraw to draw and design diagrams as instructional materials.	351	3.41	0.60	Agree
7	I can operate a projector and use it to teach by connecting it to a computer.	351	3.70	0.99	Agree
8	I can use a projector to teach within a given time.	351	3.98	1.02	Agree
9	I can use various video clips to produce content for learning.	351	3.86	1.03	Agree
10	I can use CorelDraw to manipulate diagrams and explain the lesson.	351	3.03	0.89	Agree
	Grand Mean		**3.48**		**Agree**

Decision Mean = 3.0

Table 4.2 shows the Mean and Standard Deviation of pre-service teachers' technology skills for planning and preparing a lesson plan. The table showed the calculated mean

score of 3.75 with a Standard Deviation of 0.55 for item one, a mean of 3.24 with a Standard Deviation of 0.71 for item two, a mean of 3.22 with a Standard Deviation of 0.67 for item three, mean of 3.23 with Standard Deviation of 0.64 for item four, mean of 3.36 with Standard Deviation of 0.61 for item five, mean of 3.41 with Standard Deviation of 0.60 for item six, mean of 3.70 with Standard Deviation of 0.99 for item seven, mean of 3.98 with Standard Deviation of 1.02 for item eight, mean of 3.86 with Standard Deviation of 1.02 for item nine and mean of 3.03 with Standard Deviation of 0.89 for item ten. In addition, the table revealed the grand mean score of responses to the ten items is 3.48, which was more significant than the decision mean score of 3.0. Thus, it implied that pre-service teachers in Niger State possesses needed technological skills for planning and preparing a lesson plan.

Research Question 3: Do pre-service teachers have technology skills for instructional delivery?

Table 4.3: Mean Response of Pre-service Teachers Technological Skills for Instructional Delivery

SN	STATEMENT	N	$\bar{x}$	S.D	Decision
1	I can use PowerPoint to present lessons in the classroom	351	4.23	0.80	Agree
2	I can hyperlink videos to my PowerPoint presentation to enhance learning.	351	4.20	0.92	Agree
3	I can convert Instruction to various software packages	351	4.02	1.07	Agree
4	I can use social media platforms to deliver instructions	351	4.08	1.03	Agree
5	I can record delivered instructions and send an online platform for students to access at their convenience.	351	3.94	1.10	Agree
6	I can use the net to deliver instruction asynchronously at an agreed time.	351	3.79	1.04	Agree
7	I can manipulate instruction using diagrams, thereby putting into consideration the individual differences of the students.	351	3.02	0.89	Agree
8	I can use an image to present a lesson to the student through the net	351	3.16	0.90	Agree
9	I can use power point to present a summary and conclusion within a short time	351	3.84	1.10	Agree
10	I can prepare user-friendly instructional packages using an online platform	351	3.89	0.85	Agree
	Grand Mean		**3.82**		**Agree**

Decision Mean = 3.0

Table 4.3 shows the Mean and Standard Deviation of pre-service teachers' technological skills for instructional delivery. The table revealed the computed mean score of 4.23 with a Standard Deviation of 0.80 for item one, 4.20 with a Standard Deviation of 0.92 for item two, 4.02 with a Standard Deviation of 1.07 for item three, 4.08 with a Standard Deviation of 1.03 for item four, 3.94 with Standard Deviation of 1.10 for item five, 3.79 with Standard Deviation of 1.04 for item six, 3.02 with Standard Deviation of 0.89 for item seven, 3.16 with Standard Deviation of 0.90 for item eight, 3.84 with Standard Deviation of 1.10 for item nine, and 3.89 with Standard Deviation of 0.85 for item ten. In addition, the table revealed the grand mean score of responses to the ten items was 3.82, which was more significant than the decision mean score of 3.0. Thus, it implied that pre-service teachers in Niger state possessed the needed technological skills for instructional delivery.

Research Question 4: Do pre-service teachers have technological skills for evaluating learning and providing feedback?

Table 4.4: Mean Response of pre-service teachers' technological skills for evaluating learning and providing feedback

S/N	STATEMENT	N	$\bar{x}$	S.D	Decision
1	I can compute students' result using excel package	351	2.43	0.61	Disagree
2	I can track students' online progress or activities.	351	3.23	0.68	Agree
3	I can assess student's results through the internet.	351	3.25	0.73	Agree
4	I can interact with students using an online platform	351	3.66	0.95	Agree
5	I can create an online group where I can send Assignments to students.	351	3.81	1.01	Agree
6	I can get feedback from students' using online platforms	351	3.93	0.79	Agree
7	I can conduct online examinations	351	2.32	0.65	Disagree
8	I can assess student's performance at their own pace and time through the net	351	3.19	0.77	Agree
9	I can evaluate a large group of students without difficulty using an online platform	351	3.15	0.70	Agree
10	I can align interval of assessment base on the lesson content	351	3.49	1.05	Agree
	Grand Mean		**3.25**		**Agree**

Decision Mean = 3.0

Table 4.4 shows the Mean and Standard Deviation of pre-service teachers' technological skills for evaluating learning and providing feedback. The table showed the calculated mean score of 2.43 with a Standard Deviation of 0.61 for item one, a

mean of 3.23 with a Standard Deviation of 0.68 for item two, a mean of 3.25 with a Standard Deviation of 0.73 for item three, mean of 3.66 with Standard Deviation of 0.95 for item four, mean of 3.81 with Standard Deviation of 1.01 for item five, mean of 3.93 with Standard Deviation of 0.79 for item six, mean of 2.32 with Standard Deviation of 0.65 for item seven, mean of 3.19 with Standard Deviation of 0.77 for item eight, mean of 3.15 with Standard Deviation of 0.70 for item nine and mean of 3.49 with Standard Deviation of 1.05 for item ten. In addition, the table revealed the grand mean score of responses to the ten items is 3.25, which was more significant than the decision mean score of 3.0. it implied that pre-service teachers in Niger State possessed the needed technological skills for evaluating learning and providing feedback.

Research Question 5: What is the influence of gender on pre-service teachers' technological skills possessed in Niger state?

Table 4.5: Mean and Standard Deviation Response of Pre-Service Teachers' Technological Skills Possessed in Teaching in Niger State Based on Gender

Gender	**N**	$\bar{x}$	**mean diff**	**Std. Deviation**
Male	213	75.26		10.96
			2.72	
Female	138	72.54		9.91
Total	**351**			

Table 4.5 shows the mean and standard deviation of male and female pre-service teachers' technological skills possessed in teaching. The result indicated that the mean and standard deviation of the two groups differ with a mean score of 75.26 with a standard deviation of 10.96 for male pre-service teachers and a mean score of 72.54 with a standard deviation 9.91 for female pre-service teachers. To determine if the difference in the mean is significant, the corresponding hypothesis is tested in table 4.1

Research Question 6: What is the influence of gender on pre-service teachers' technology for planning and preparing lesson plans?

Table 4.6: Mean and Standard Deviation Response of Pre-Service Teachers' Technological Skills Possessed for Planning and Preparing Lesson Plan Based on Gender

Gender	N	$\bar{x}$	mean diff	Std. Deviation
Male	213	71.46		8.74
			3.52	
Female	138	67.94		9.18
Total	**351**			

Table 4.6: shows the mean and standard deviation of male and female pre-service teachers' technological skills possessed in teaching. The result indicated that the mean and standard deviation of the two groups differ with a mean score of 71.46 with a standard deviation of 8.74 for male pre-service teachers and a mean score of 67.94 with a standard deviation 9.18 for female pre-service teachers. To determine the difference in the mean is significant, the corresponding hypothesis is tested in table 4.2.

Research Question 7: What is the influence of gender on pre-service teachers' technological skills possessed for instructional delivery in Niger State, Nigeria?

Table 4.7: Mean and Standard Deviation Response of Pre-Service Teachers' Technological Skills Possessed for Instructional Delivery

Gender	N	$\bar{x}$	mean diff	Std. Deviation
Male	213	76.28		10.02
			0.28	
Female	138	75.52		13.20
Total	**351**			

Table 4.7 shows the mean and standard deviation of male and female pre-service teachers' technological skills possessed for instructional delivery. The result indicated that the mean and standard deviation of the two groups differ with a mean score of 76.28 with a standard deviation of 10.02 for male pre-service teachers and a mean score of 75.52 with a standard deviation of 13.20 for female pre-service teachers. To determine if the difference in the mean is significant, the corresponding hypothesis is tested in table 4.3

Research Question 8: Does gender influence pre-service teachers technological skills for evaluating learning and providing feedback?

Table 4.8: Mean and Standard Deviation Response of Pre-Service Teachers' Technological Skills for Evaluating Learning and Feedback

Gender	N	$\bar{x}$	mean diff	Std. Deviation
Male	213	65.31		9.44
			0.42	
Female	138	64.89		8.64
Total	**351**			

Table 4.8 shows the mean and standard deviation of male and female pre-service teachers' technological skills possessed for evaluating learning and providing feedback. The result indicated that the mean and standard deviation of the two groups differ with a mean score of 65.31 with a standard deviation of 9.44 for male pre-service teachers and a mean score of 64.89 with a standard deviation 8.64 for female pre-service teachers. To determine if the difference in the mean is significant, the corresponding hypothesis is tested in table 4.2.4

4.2 Hypotheses Testing

4.2.1 Hypothesis 1: There is no significant difference between the basic technological skills possessed by male and female pre-service teachers.

To test the hypothesis, an independent sample t-test was applied on the male and female pre-service teachers response scores regarding their basic technological skills possessed for teaching, as presented in Table 4.2.1

Table 4.2.1:t-test Analysis of the Cumulative Mean Response of Male and Female Pre-Service Teachers' Basic Technological Skills

Gender	N	Df	$\bar{x}$	S.D	t-value	p-value
Male	213		75.26	10.96		
		349			0.592^{ns}	0.536
Female	138		72.54	9.910		

NS: Not Significant at 0.05 level

Table 4.2.1 showed the t-test analyses of mean response of male and female pre-service teachers' basic technological skills for teaching in Niger State. The result indicated the mean score of the male and females are 75.26 and 72.54, respectively. The t-value of 0.592 was not significant at the 0.05 alpha level, and the p-value of 0.536 is significant than 0.05. Therefore, hypothesis one was retained. It indicated no significant difference between male and female pre-service teachers' basic technological skills for teaching in Niger State. Consequently, It implied that both male and female pre-service teachers possessed adequate basic technological skills for teaching.

Hypothesis 2: There is no significant difference between male and female pre-service teachers' technological usage skills for planning and preparing lesson plans.

To test the hypothesis, an independent sample t-test was applied on the male and female pre-service teacher's response scores regarding their technological usage skills for planning and preparing lessons, as presented in Table 4.2.2

Table 4.2.2:t-test Analysis of the Cumulative Mean Response of Male and Female Pre-Service Teachers' Technological Usage Skills for Planning and Preparing Lesson Plan

Gender	N	Df	$\bar{x}$	S.D	t-value	p-value
Male	213		71.46	8.74		
		349			1.760^{ns}	0.081
Female	138		67.94	9.18		

NS: Not Significant at 0.05 level

Table 4.2.2 showed the t-test analysis of the mean response of male and female pre-service teachers' technological usage skills for planning and preparing a lesson. The result indicated the mean score of the male and female are 71.46 and 67.94, respectively. The t-value of 1.760 was not significant at the 0.05 alpha level, and the p-value of 0.081 is significant than 0.05. Therefore, hypothesis two was retained. It indicated no significant difference between male and female pre-service teachers' technological skills for planning and preparing a lesson plan. Thus, it implied that both male and female pre-service teachers possessed adequate technology usage skills in planning and preparing a lesson plan.

Hypothesis 3: There is no significant difference in the technological skills for instructional delivery possessed by male and female pre-service teachers. To test the hypothesis, an independent sample t-test was applied on the male and female pre-service teachers response scores regarding their technological skills for instructional delivery, as presented in Table 4.2.3

Table 4.2.3: t-test Analysis of Cumulative Mean Responses of Male and Female Pre-service Teachers' Technological Skills for Instructional Delivery in Niger State

Group	N	df	$\bar{x}$	S.D	t-value	p-value
Male	213		76.28	10.02		
		349			0.169^{ns}	0.866
Female	138		75.52	13.20		

Not Significant at 0.05 Alpha level

Table 4.2.3 shows the t-test analyses of mean response of male and female pre-service teachers' technological skills for instructional delivery in Niger State. The result indicated the mean score of the male and female are 76.28 and 75.52, respectively. The t-value of 0.169 was not significant at the 0.05 alpha level, and the p-value of 0.866 is significant than 0.05. Therefore, hypothesis one was accepted. Furthermore, it indicated no significant difference between male and female pre-service teachers' technological skills for instructional delivery in Niger State. Therefore, it implied that both male and female pre-service teachers possessed adequate technological skills for instructional delivery.

Hypothesis 4: there is no significant difference between the technological skills for evaluating learning and providing feedback possessed by male and female pre-service teachers. To test the hypothesis, an independent sample t-test was applied on the male and female pre-service teacher's response scores regarding their technological skills for evaluating learning and providing feedback, as presented in Table 4.2.4

Table 4.2.4: t-test analysis of cumulative mean responses of male and femalepre-service teachers' technological skills possessed for evaluating learning and providing feedback

Group	N	Df	$\bar{x}$	SD	t-value	p-value
Male	213		65.31	9.44		
		349			3.178^{ns}	0.002
Female	138		64.89	8.64		

Significant at 0.05 Alpha level

Table 4.2.4 shows the t-test analyses of mean response of male and female pre-service teachers' technological skills for evaluating learning and providing feedback. The result indicated that the mean score of the male and female are 65.31 and 64.89, respectively. The t-value of 3.178 was significant at 0.05 alpha level, and the p-value of 0.002 is less than 0.05. Therefore, hypothesis four was rejected. It indicated a significant difference between male and female technological skills for evaluating learning and providing feedback. It implied that both maleand female do not possessed the same technological skills for evaluating learning and providing feedback.

4.3 Summary of the Findings

From the data collected, computed, analyzed and interpreted in the study, the findings were summarized as follows:

1. Pre-service teachers in tertiary institutions in Niger State possessed the basic technological skills needed for teaching.
2. Pre-service teachers in Niger State possessed the needed technological skills for planning and preparing a lesson plan.
3. Pre-service teachers in Niger state possessed the needed technological skills for instructional delivery.
4. Pre-service teachers in Niger State possessed the needed technological skills for evaluating learning and providing feedback.

5. Male and female pre-service teachers possessed the needed basic technological skills for teaching in Niger State.
6. Male and female pre-service teachers possessed the needed technological skills for planning and preparing lesson plans in Niger State.
7. Male and female pre-service teachers possessed the needed technological skills for instructional delivery in Niger State.
8. Male pre-service teachers possessed the needed technological skills for evaluating learning and providing feedback than female pre-service teachers in Niger State.

Discussion and Conclusion

Hypothesis one finds no significant difference in the basic technological skills possessed by male and female pre-service teachers. Finding that emanated from this study on pre-service teachers' basic technological skills indicated that pre-service teachers possessed adequate basic technological skills for the teaching and learning process. This finding is in line with the earlier results of Valtonen *et al.,* (2015) and Yurkadul, (2011) who found out that pre-service teachers possessed the needed basic technological skills at a high-level rate. However, the other hand, this study was not in line with the earlier finding of Almerich *et al.,* (2011), who found out that pre-service teachers' do not possess the needed basic technological skills of techno pedagogical competencies.

This study revealed that gender has no influence on pre-service teachers' basic technological skills for teaching. This finding is in line with the earlier discovery of Bala, (2018), who found out that pre-service teachers' basic technological skills for education vary based on the variables of gender. The clear implication of these findings is that although ICT is not currently used at the highest levels, pre-service teachers recognize the benefits of the ICT components incorporated in the teaching and learning

process. The present study was related to the previous research of Valtonen *et al.* (2015), Yurkadul (2011), Almerich *et a.*, (2011) and Bala (2018) in terms of the variable's techno-pedagogical basic skills and gender.

Hypothesis two finds out if there is no significant difference in the technology usage skills for planning and preparing a lesson plan by male and female pre-service teachers. Finding that emanated from this study on pre-service teachers' technology usage skills for planning and preparing a lesson plan indicated that pre-service teachers possess adequate technological skills for planning and preparing a lesson plan. This finding is in line with the earlier results of Shittu, (2017) and Yurdakul (2018), found out that pre-service teachers possessed the needed technological skills for planning and preparing a lesson plan. However, the study is not in line with the earlier finding of Sarita, (2019), found out that pre-service teachers' do not possess the needed technological skills for planning and preparing a lesson plan.

The study revealed that gender influences pre-service teachers' technological skills for planning and preparing lesson plans. This finding is not in line with the earlier result of Sarita, (2019). found out that pre-service teachers' technological skills for planning and preparing a lesson plan vary based on the variables of gender. On the other hand, this finding is in line with the earlier discovery of Farjon *et al*., (2019), who found out that pre-service teachers' technological skills for planning and preparing a lesson plan vary based on the variables of gender. The clear implication of these findings is that although ICT is not currently used at the highest levels, pre-service teachers recognize the benefits of the ICT components incorporated in the teaching and learning process. This present study was related to the previous research of Farjon *et al.,* (2019), Yurkadul (2018), Shittu, (2017) and Sarita, (2019) in terms of the variable's technological skills for planning and preparing a lesson plan and gender.

Hypothesis three finds out if there no is significant difference in the basic technology skills for instruction delivery possessed by male and female pre-service teachers. Findings that emanated from this study on pre-service teachers' technological skills for instructional delivery indicated that pre-service teachers possess adequate technological skills for instructional delivery in the teaching and learning process. This finding is in line with the earlier results of Valtonen *et al.,* (2015) and Yorulmaz *et al.,* (2017), who found out that pre-service teachers' level of techno pedagogical competencies was high. However, this study is not in line with the earlier finding of Almerich *et al.,* (2011) who found that pre-service teachers' level of techno pedagogical competencies was low.

The study revealed that gender influences pre-service teachers' technological skills for evaluating learning and providing feedback. The finding is not in line with the earlier discovery of Valtonen *et al.,* (2015), who found that pre-service teachers' technological skills for evaluating learning and providing feedback vary based on the variables of gender. However, these findings imply that although ICT is not currently used at the highest levels, pre-service teachers recognize the benefits of the ICT components incorporated in the teaching and learning process. This present study was related to the previous research of Valtonen *et al., (2015),* Yorulmaz *et al., (2017)* and Almerich *et al.,* (2011) in terms of the variable's techno-pedagogical competence in instructional delivery and gender.

Hypothesis four finds a significant difference in the technology skills for evaluating learning and providing feedback possessed by male and female pre-service teachers. The study on pre-service teachers' technological skills for evaluating learning and providing feedback indicated that pre-service teachers possessed appropriate technological skills for evaluating learning and providing feedback in the teaching and learning process. This finding is in line with the earlier results of Birisci (2019), who

found out that pre-service teachers had high levels of technology integration self-efficacy beliefs, with a high level of positive correlation with techno-pedagogical education competency.

The study's findings also revealed that gender influences pre-service teachers' technological skills for evaluating learning and providing feedback. However, the finding is not in line with the earlier discovery of Yorulmaz *et al.,* (2017) and Birisci, (2019) who found that no significant difference was established between male and female pre-service teachers who possessed adequate technological skills for evaluating learning and providing feedback in teaching and learning process.

This finding is specifically influenced by the developments found among the participants in the study. Positive outcomes will significantly be supported if the pre-service teachers can attend educational seminars specifically covering the integration of ICT in education. The need to consider the interdependency of content, pedagogy and technology knowledge cannot be overemphasized in an educational settings.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Findings of the study have revealed that pre-service teachers in tertiary institutions in Niger State possessed the basic technological skills needed for teaching. There is no significant difference between male and female pre-service teachers' basic technological skills necessary for education. The study revealed further that pre-service teacher possesses needed technological skills for planning and preparing a lesson plan. There is no significant difference between the technological skills of male and female pre-service teachers for planning and preparing a lesson plan. Furthermore, the study revealed that pre-service teachers in Niger state possess needed technological skills for instructional delivery. There is no significant difference between the skills possessed by male and female pre-service teachers. Pre-service teachers possess the required technological skills for evaluating learning and providing feedback. Still, there is gender difference in technological skills for evaluating learning and providing feedback possessed by pre-service teachers. For effective and efficient teaching, pre-service teachers' technological skills, techno-pedagogical skills, and competence skills must be fully enhanced and utilized to provide extra information aside from the regular class materials. The use of techno-pedagogical skills when well-tailored would undoubtedly improve the teaching and learning process.

5.2 Recommendations

Based on the findings that emanated from this study, the following recommendation was made:

1. Integration of emerging technologies into educational settings to create the motivation and skills needed by pre-service teachers should be included explicitly in teacher education curricula.
2. Pre-service should be taught on the use of emerging technologies in other to improve the learning outcomes of the learners.
3. management of tertiary institutions should provide continuous training, workshops, and seminars in emerging technologies for pre-service teachers in tertiary institutions. It will further develop their techno-pedagogical skills for instructional delivery and learning outcomes.

5.3 Limitations of the Study

The following are the limitations of this study:

1. The study was limited to tertiary institutions offering educational courses in Niger state. Other departments and faculties were not captured.
2. Pre-service teachers in tertiary institutions in Niger who are studying other courses were not selected as part of the sample for this study. Therefore, the sample selection was limited to pre-service in school/faculty of education in the tertiary institutions in Niger State.
3. The study was limited to Niger state tertiary institutions, other educational schools were not captured

5.4 Contributions to Knowledge

The study has added to the pool of knowledge in the following ways:

1. It has found out that techno-pedagogical competence of pre-service teachers in tertiary institutions in Niger State, Nigeria. by determining the current level of technology, pedagogy and content knowledge possessed by pre-service teachers.
2. Techno-pedagogical skills could be effectively used to bridge the gap of between teachers and students in the process of teaching and learning.
3. The study contributed to the existing literature and provided a platform for further research on pre-service teachers' techno-pedagogical competence.

5.5 Suggestions for Further Studies

For further research in this area, the following suggestions should be considered;

1. The study focused on techno-pedagogical competencies of pre-service teachers. Other studies that will focus on pre-service teachers' flexibility levels and techno-pedagogical skills can be conducted in the future.
2. In the study, a quantitative research design was used. It is suggested that similar research may be conducted using a qualitative approach or mixed research method to determine whether pre-service teachers possessed the techno-pedagogical skills for teaching.
3. A Similar study on techno-pedagogical competencies of pre-service teachers can also be conducted in higher institutions in other states of the federation.

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ASSOCIATION FOR INNOVATIVE TECHNOLOGY INTEGRATION IN EDUCATION (AITIE)

CERTIFICATE OF PRESENTATION

This is to certify that

Usman, Hafsma Ndatsu

Participated in the 4th Conference and Workshop on Innovation, Technology & Education
Theme: Technology Integration for Instructional Delivery in Institution and Performance Enhancement in Non-Education Settings.

Presentation Title:

Assessing the Technological Skills Possessed by Pre-Service Teachers for Instructional Delivery and Evaluating Learning Outcomes in Niger State

Dated this 12th August, 2021

National President's Signature

LOC Chairman's Signature

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

POSTGRADUATE SCHOOL

CLEARANCE FOR SCHOOL FEES AND OTHER CHARGES

s to certify that Mr./Mrs./Miss Usman Hannah Ndatsu

tration Number MTECH/SSTE/2018/8327 Education Technology

rtment has duly cleared by the Postgraduate School, having fulfilled the payment of

hool fees and other financial obligations for the 1st and 2nd Semester

on: 2019/2020

tary, Postgraduate School: ..... Date: 15/08/2021

SECRETARY
15 SEP 2021
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Assignment title:	CORRECTED M.TECH THESIS
Submission title:	Appraisal of Techno-Pedagogical Competence of Pre-service ...
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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

QUESTIONNAIRE FOR APPRAISING TECHNO-PEDAGOGICAL COMPETENCY OF PRE-SERVICE TEACHERS (QATCPT)

Dear respondent,

I am a postgraduate student of the institution named above, researching the appraisal of your school's techno-pedagogical competency of pre-service teachers. Would you please assist me with the necessary information that will make the research work acceptable? Naturally, the information you supply will be treated with the utmost confidentiality.

SECTION A: PERSONAL DATA

Would you please tick like this (✓)

1 Institution.....

2 School.....

3 Level.....

4 Gender: male ( ) Female ( )

5 Age 16------20( ) 21-------25( ) 26--------30 ( )

SECTION B

BASIC TECHNOLOGICAL SKILLS

Please tick like (|) using the options below

SA - Strongly Agree, A – Agree, U – Undecided, D – Disagree, SD - Strongly Disagree

S/N	STATEMENTS	SA	A	UD	D	SD
1	I can connect the projector to the system					
2	I can save and retrieve information on a computer					
3	I can create and name folders for different purposes					
4	I can interact with the system in the absence of the mouse.					
5	I can type and produce a document with computers					
6	I can draw and edit the image with computer					
7	I can play multimedia applications with a computer					
8	I can print with a computer					
9	I can develop and run a programme package with a computer					
10	I can capture an image with a computer webcam					

SECTION C

TECHNOLOGICAL SKILLS FOR PLANNING AND PREPARING LESSON

Please tick like (√) using the options below

SA - Strongly Agree, A – Agree, U – Undecided, D – Disagree, SD - Strongly Disagree

S/N	STATEMENTS	SA	A	UD	D	SD
1	I possess the ability to browse the internet or web for information on new ideas for lesson preparation					
2	I can prepare lessons on the computer and arrange them in an acceptable manner					
3	I can interact with my supervisor using online platforms					
4	I can download information sent to me by my supervisor via E-mail.					
5	I can use the school internet facilities to access online materials for lesson preparation					
6	I can use CorelDraw to draw and design diagrams as instructional material					
7	I can operate a projector and use it to teach by connecting it to a computer.					
8	I can use a projector to teach within a given time					
9	I can use various video clips to produce content for learning					
10	I can use CorelDraw to manipulate diagrams and explain the					

Reliability Statistics

Section A: Basic Technological Skill

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.874	.852	10

Section B: Technological Skills for planning and preparing lesson plan

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.919	.916	10

Section C: Technology Skills for instructional delivery

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.857	.842	10

Section D: Technological Skills for Evaluating learning and providing feedback

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.905	.898	10

IBRAHIMBADAMASIBABANGIDA
UNIVERSITY, LAPAI
Directorate of ICT

Date: 25th February, 2020

Head of Department,
School of Science and Technology Education
Federal university of Technology,
Minna

Sir,

RE – USMAN HALIMA NDATSU (MTech/SSTE/2018/8327)

Above subject matter refers.

Attached is our contribution to assist her in carrying out her research work as requested by you.

Thank you.

Abdullahi Aliyu Enagi
Deputy Director, ICTAI

2019/2020 SESSION FACULTY OF EDUCATION & ART
CONTINUING EDUCATION AND COMMUNITY DEVELOPMENT

LEVEL	INDIGENE	NON-INDIGENE	TOTAL
100 LEVEL	120	52	172
200 LEVEL	126	28	154
300 LEVEL	129	21	150
400 LEVEL	174	82	256
TOTAL	549	183	732

COUNSELLING PSYCHOLOGY

LEVEL	INDIGENE	NON-INDIGENE	TOTAL
100 LEVEL	237	74	311
200 LEVEL	261	26	287
300 LEVEL	230	27	257
400 LEVEL	299	78	377
TOTAL	1027	205	1232

SCIENCE EDUCATION

LEVEL	INDIGENE	NON-INDIGENE	TOTAL
100 LEVEL	208	54	262
200 LEVEL	291	32	323
300 LEVEL	235	16	251
400 LEVEL	200	58	258
TOTAL	934	160	1094

HISTORY & INTERNATIONAL STUDIES

LEVEL	INDIGENE	NON-INDIGENE	TOTAL
100 LEVEL	87	50	137
200 LEVEL	111	30	141
300 LEVEL	81	36	117
400 LEVEL	77	56	133
TOTAL	356	172	528

HUMAN KINETHICS AND HEALTH EDUCATION

LEVEL	INDIGENE	NON-INDIGENE	TOTAL
100 LEVEL	49	15	64
200 LEVEL	67	10	77
300 LEVEL	62	5	67
400 LEVEL	33	14	47
TOTAL	211	44	255

NIGER STATE COLLEGE OF EDUCATION, MINNA
SCHOOL OF EDUCATION
100, 200 AND 300 LEVEL
FOR 2019/2020
ACADEMIC SESSION

COMBINATION	LEVEL	NO. OF STUDENT
1. ADULT AND NON-FORMAL EDUCATION	100	140
2. ADULT AND NON-FORMAL EDUCATION	200	90
3. ADULT AND NON-FORMAL EDUCATION	300	12
1. EARLY CHILD CARE EDUCATION	100	267
2. EARLY CHILD CARE EDUCATION	200	123
3. EARLY CHILD CARE EDUCATION	300	66
1. PRIMARY EDUCATION STUDIES	100	597
2. PRIMARY EDUCATION STUDIES	200	654
3. PRIMARY EDUCATION STUDIES	300	584

Coord
Academic Planning
(A. P. D.)
Niger State College of Educ
Minna

FEDERAL COLLEGE OF EDUCATION KONTAGORA

SCHOOL OF EDUCATION

TOTAL NO OF STUDENTS 100 – 300

S/N	LEVEL	NO OF STUDENTS'
1	100	1997
2	200	1313
3	300	1950
Total		5260

Federal University of Technology, Minna
School of Science and Technology Education
Department of Educational Technology

The number of students in educational technology 2019/2020 academic session

100 Level = 58

200 Level = 70

300 Level = 84

400 Level = 148

500 Level = 98

The total number of students in the department of educational technology 458.

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

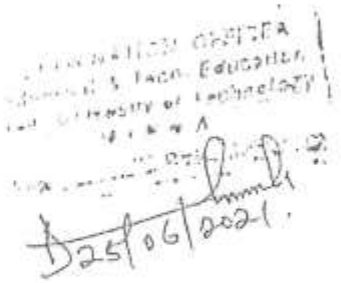
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF INDUSTRIAL TECHNOLOGY EDUCATION

2019/2020 Academic Section

- The total number to student at each level.
  - 100 Level 122
  - 200 Level 164
  - 300 Level 203
  - 400 Level 162
  - 500 Level 100

The Total Number of Students are 751



FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF SCIENCE EDUCATION

- The total number to student at each level.
  - 100 Level 117
  - 200 Level 129
  - 300 Level 174
  - 400 Level 23
  - 500 Level 90

The Total Number of Students are 533

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate the instrument. Kindly grant him/her the assistance.

Head of Department (Signature, Date & Official Stamp)

Student's Surname: USMAN Other Names: HALIMA NDATSU

Registration Number: M.tech/SSTE/2019/8827 Programme: M.tech

Title of the Instrument: Appraisal of technopedagogical competency by pre-service teachers in higher institution in Nigeria.

ATTESTATION SECTION

Summary of the Remark on the Instrument: ADEQUATE FOR THE PURPOSE OF THE STUDY

I hereby attest that the above named student brought his instrument for validation

Name of Attester: Dr. YAKUBU A. A

Designation: LECTURER 1

Name and Address of Institution: FUT MINNA.

Phone Number: E-Mail:

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for..... VERY APPROPRIATE
2. Clarity and simplicity for the level of the language used..... THE LANGUAGE IS VERY SIMPLE AND CLEAR FOR THE LEVEL OF THE STUDENTS
3. Suability for the level of the targeted audience ..... VERY SUITABLE
4. The extent in which the items cover the topic it meant to cover..... VERY ADEQUATE
5. The structuring of the Questionnaire..... SATISFACTORY
6. Others (grammatical errors, spelling errors and others ..... MINOR GRAMMATICAL ERRORS
7. General overview of the Instrument..... VERY SATISFACTORY

Suggestions for improving the quality of the Instrument

1. ALL OBSERVATION AND CORRECTION ARE HIGHLIGTED IN THE INSTRUMENT.
2. .....
3. .....
4. .....
5. .....

Name of Validator..... Dr. YAKI A. A.

Area of Specialization..... SCIENCE EDUCATION ..... Designation..... L1

Name of Institution.....

Signature..... ..... Date.....

Thank You

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the instrument was duly validated.

Thanks for your anticipated assistance.

Dept. of Educational Technology
Fed. University of Technology
04 MAY 2021
P.M.B. 65 Minna, Niger State
Sign.....

Dr. C.S. Tukur

Head of Department (Signature, Date & Official Stamp)

Student's Surname..... Other Names.....

Registration Number..... Programme.....

Title of the Instrument.....

ATTESTATION SECTION

Summary of the Remark on the Instrument... The instrument is suitable for the objectives of the study; little correction was made during validation

I hereby attest that the above named student brought his instrument for validation

Name of Attester... Insaf Isiaka

Designation... Asst. Lecturer

Name and Address of Institution... Niger State College of Education Minna

Phone Number... 07061820502 E-Mail... gloryadiaka@gmail.com

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for..... Appropriate
2. Clarity and simplicity for the level of the language used..... Satisfactory
3. Suability for the level of the targeted audience..... Suitable
4. The extent in which the items cover the topic it meant to cover..... Good Coverage
5. The structuring of the Questionnaire..... Well structured
6. Others (grammatical errors, spelling errors and others..... Satisfactory
7. General overview of the Instrument..... Satisfactory

Suggestions for improving the quality of the Instrument

1. Satisfactory
2. .....
3. .....
4. .....
5. .....

Name of Validator..... Yusuf Isiaka

Area of Specialization..... Computational Mathematics

Name of Institution..... COE Minna ..... Designation..... Asst. Lecturer

Signature..... ..... Date..... 04/04/21

Thank You

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument

Thanks for your anticipated assistance.

Dr C.S. Tukur 25/2/2020 25 FEB 2020

Head of Department (Signature, Date & Official Stamp)

Student's Surname..... Other Names.....

Registration Number..... Programme.....

Title of the Instrument.....

ATTESTATION SECTION

Summary of the Remark on the Instrument... The Instrument is well designed and Constructed based on the major constructs of the topic area.

I hereby attest that the above named student brought his instrument for validation

Name of Attester... DR. I. I. Kuta

Designation... S/L

Name and Address of Institution... FUT, Minna

Phone Number... 08035837865 ... E.- Mail ...

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for.....
.....The instrument is valid.....
2. Clarity and simplicity for the level of the language used.....
....Very clear and no unambiguous terms.....
3. Suability for the level of the targeted audience .....
.....The instrument is okay.....
4. The extent in which the items cover the topic it meant to cover.....
....Covers adequately the subject matter.....
5. The structuring of the Questionnaire.....
.....Good.....
6. Others (grammatical errors, spelling errors and others.....
.....Very minimal.....
7. General overview of the Instrument.....
.....The instrument is okay.....

Suggestions for improving the quality of the Instrument

1. .....effects the minor corrections pointed out
2. .....
3. .....accordingly.....
4. .....
5. .....

Name of Validator...DR. I. I. Kata.....

Area of Specialization...Educational Technology.....

Name of Institution...FUT, Minna.....Designation...S/L.....

Signature.....Date.18/2/2020

Thank You