ASSESSMENT OF THE APPLICATION OF ICT FOR TEACHING AND LEARNING IN TVET PROGRAMMES IN TECHNICAL COLLEGES IN NIGER STATE, NIGERIA.

BY

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2016/1/63719TI

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA,

APRIL, 2023

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF INDUSTRIAL TECHNOLOGY AND EDUCATION

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA,

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHEALOR OF TECHNOLOGY DEGREE (B.TECH) IN INDUSTRIAL AND TECHNOLOGY EDUCATION

APRIL, 2023

DECLARATION

I AYANDOKUN, JANET OLUWASHEYI with matriculation number 2016/1/63719TI an undergraduate student of the Department of Industrial and Technology Education certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other university.

AYANDOKUN JANET OLUWASHEYI

2016/1/63719TI   Signature & Date

CERTIFICATION

This project has been read and approved as meeting the requirements for the award of B.Tech degree in Industrial and Technology Education, School of Science and Technology Education, Federal University of Technology, Minna.

Dr. C.O Igwe

Project Supervisor   Sign and Date

Dr. T.M Saba

Head of Department   Sign and Date

_____

External Examiner   Sign and Date

DEDICATION

I dedicate this project to my parents Pastor and Mrs, Ayandokun Joshua for their unending support throughout my study period. God Almighty reward them abundantly.

ACKNOWLEDGEMENTS

Abstract

Technical and Vocational Education and Training (TVET) is the key to development and ICT implemented TVET is the key to rapid educational development. This paper investigated the application of ICT for teaching and learning in TVET programmes in Technical Colleges in Niger State, Nigeria. It assessed the utilization of ICT in TVET's pedagogy and the TVET teachers ICT competency level. Three research questions and two hypotheses guided the study. Descriptive survey research design was adopted. The population consists of 122 TVET teachers, 51 with a 5-10 years teaching experience and 71 with 11 years and above teaching experience. A 4-point scale 35 items questionnaire validated by three (3) lecturers from the Department of Industrial and Technology Education, Federal University of Technology Minna was used for data collection. Mean, standard deviation and t-test statistical tool (SPSS) were used for data analysis. Results revealed that internet search engines (Google,) are the only ICTs applied in the teaching and learning process of TVET and desktop computer and printers are the only ICT resources utilized in TVET programmes. It also revealed that TVET teachers are not competent in using majority of ICT resources (hardware and software). Furthermore, there is no significant different between the mean response of TVET teachers with 5-10 years of experience and 11 years and above on the utilization of ICT resources (hardware and software) in TVET programmes and there is no significant difference between the mean response of TVET teachers with 5-10 years of experience and 11 years and above on the level of ICT competency. It is therefore concluded that ICT resources are grossly inadequate and therefore not applied in the teaching and learning process of TVET programmes in technical colleges. Hence, it is recommended that TVET teachers should be regularly and adequately trained and motivated in the use of ICT resources to help improve the quality of ICT enabled TVET in technical colleges in Niger State.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

We live in a technology- driven world. This has resulted in rapid changes across all dimensions of life. The use of internet in education has become a non-negotiable constant for effective teaching and learning. Therefore, it is not surprising to see a growing demand for the integration of Information and Communication Technology (ICT) into Technical and Vocational Education and Training (TVET) around the world. ICT within education are increasing exponentially because of the technological progression and social needs, ICT represents a master key which can pave way for the educational system globally to upgrade students' knowledge and abilities (Abdelmoiz et al., 2018). Advances in ICT have revolutionized education in many ways. It has increased access to instruction by improving the pedagogy and strategies of instructional delivery, availability of educational resources and facilitating meaningful interaction among learners. ICT provides access to information through telecommunication technologies to interact in the digital world (Akturk 2020).

Pedagogy is generally the method and practice of teaching. It is the study of how knowledge and skills are imparted to learners. Pedagogy encompassed teaching styles, methods of instructional delivery and teaching theories. Having a well-thought out pedagogy help put into operation the methods, strategies and approaches in a well-organized manner which improve the quality of teaching and the way students learn, it gives teachers an insight into the best practices suitable for the learners

ICT integration into TVET may be perceived as the array of hardware and software used in teaching and learning systems that include computer-based training systems, multimedia systems, electronic performance support systems, telecommunications systems, as well as the internet with World Wide Web systems. The use of ICT in TVET in this study, refers to the use of interactive white boards, computers, internet, and all ICT materials that facilitates teaching and learning. Many teachers now use multimedia projectors, computers, PowerPoint and CD-ROM to facilitate teaching and learning. As stated by Saidu & Abubakar (2020), ICT enables teachers to explain abstract content more clearly which enhance effectiveness and better understanding. The use of ICT in teaching and learning changes how ideas and practices are being communicated to students, creates access to a wide range of information and improves the attitude and confidence of both teachers and students (Jaji 2020).

Assessment refers to a wide variety of methods or tools used to evaluate, measure, and document the academic readiness, learning progress, skill acquisition or educational needs of the students. However, assessment reveals more than a simple diagnosis and identification of students learning needs. According to Tomas (2018), assessment provides feedback on performance and ways to enhance the performance in future. Therefore, assessing the application of ICT in TVET programmes involves: collecting, reviewing and evaluating relevant information for the purpose of improving the current performance of its programs.

Technical and Vocational Education and Training (TVET) is a crucial aspect of the Nigerian educational system. It is different from other forms of education, as TVET is aims at the provision and acquisition of practical and applied skills as well as basic scientific knowledge for the growth and development of the country and the world in large. It was introduced in Nigeria with the aims

of giving technical knowledge, attitude, and skills for economic, agriculture, industrial and commercial development of the nation (Okoye & Michael, 2015).

TVET is the total education programme by which man learns about work. It could be referred as an aspect of education tailored towards enhanced productivity of the labor force (Aniah & Muhammed, 2021). It aims at becoming an instrument of self-employment to individuals who have been empowered not only by subject matter inhibition, but through experimental learning capable of providing real life solutions to problems such as poverty, unemployment, and other socioeconomic maladies. According to Diao et al (2021), TVET aims at serving social development and promoting employment, cultivating students' professional skill and spirit, enabling them to act correctly in different fields and assume personal and social responsibilities. FRN (2013) listed the goals of TVET to include among others: provision of trained manpower in the areas of applied sciences, technology, business, advanced craft as well as providing training and related skills for self-reliance and employment.

TVET is classified into three categories: informal, non-formal and formal, TVET. Formal TVET refers to vocational education programs provided within an approved public institution. Non-formal TVET is the type of vocational education and training which takes place outside the formal school system either on a regular or intermittent basis consequently. Informal TVET is the type of vocational education that is provided by craftsmen of different trades in the informal sector of the economy (Ogbunaya & Udoudo, 2015).

Many countries have enhanced their development by fostering well organized and linked TVET systems. Most TVET institutions in developing countries apply traditional methods in teaching and learning delivery where a learner must be physically present in class and the teacher is mostly the source of the content while the learner is only a recipient. The current dynamic education and

work environment necessitates a shift from the norm. The integration of ICT in TVET plays an important role in enhancing the students' outcome, as it helps students acquire 21st century skills such as problem solving and critical thinking (Akeem & Najeem 2020). The role of ICT in the growth and development of the developing economies cannot be underestimated, with ICT utilization effective TVET can help a country rapidly enhance its economic level by improving the capability of future young workforce. Many developing countries greatly rely on skilled labor to enhance their development agenda and as pointed out by many professionals: TVET is the master key to development, and ICT implemented TVET is the master key to rapid development.

Summarily, ICT expands access to education. ICT integration in the educational system provides a dynamic and proactive teaching-learning environment which can improve the quality and accessibility of the delivery of instructions to students (Altakhyneh & Abumusa 2020). Through ICT, learning can occur anytime and anywhere. Online course materials are accessible 24/7. With ICT, learning and teaching no longer relies exclusively on printed materials. Abundant resources are on the Internet, and knowledge can be acquired through video clips, audio sounds, and visual presentation and so on. This necessitates the urgent need for a full-fledged inclusion of ICT and emerging technologies in the implementation of TVET across the nation. Research has indicated that ICT assists in transforming a teaching environment into a learner-centered one (Castro Sánchez and Alemán 2019), as learners are actively involved in the learning processes in ICT classrooms. Therefore, the application of ICT in TVET provides both learners and instructors with more educational affordances and possibilities.

1.2. Statement of the Problem

Technical and Vocational Education and Training (TVET) has become critical to the up-skilling of mid-level manpower as they are the driving force required for sustained economic growth. For many, TVET still remains a second class education mostly in developing nations like Nigeria (Aniah & Muhammed, 2021). TVET system therefore, need to be modernized and simplified through the application of ICT. Study indicate that technological opportunities are considered to help teachers and students to enhance their effectiveness of teaching and learning process especially to perform new attitude, skills, knowledge and value.

Digital transformation leads to massive changes in the skill set needed for work and life. ICTs are essential for contemporary educational development of any nation (Madaki et al 2021), the conventional method of teaching finds it hard to cope with the abounding population of students in schools who are faced with limited facilities and poorly structured classroom, the increasing lack of learners motivation and engagement, it is therefore evident that traditional educational environment do not seem to be suitable for preparing learners to function or to be productive in the workplaces of today's society, hence the integration of the application of ICT in TVET programs. TVET institutions need to make best use of new technologies to provide adequate and quality education for its learners, teachers need to integrate technology seamlessly into the system instead of viewing it as an add-on, an afterthought or an event especially when it involves preparing learners for the world of work of the present and future.

With all the advantages that comes with the application of ICT in TVET programmes, the availability and the application of ICT in TVET is still lacking greatly, it is not certain if these technological opportunities are available for use and where available teachers and students are either resistant to change or incompetent in handling technological tools. As stated by Igwe et al

(2021), TVET sector in Nigeria is faced with acute shortage of certified personnel, equipment and infrastructure. It is in view of these, this study aims to find out the availability and the application of ICT for teaching and learning in Technical and Vocational Education and Training (TVET) programs in Technical Colleges in Niger State, Nigeria.

1.3 Purpose of the Study

The main purpose of the study was aimed at assessing the application of Information and Communication Technologies (ICTs) in TVET programs in Technical Colleges in Niger State, Nigeria.

Specifically the study sought to:

1. Assess the application of ICT in the teaching and learning process in TVET programs in Technical Colleges in Niger State.

2. Assess the utilization of ICT resources (hardware and software) for teaching and learning in TVET programs in Technical Colleges in Niger State.

3. Determine the level of TVET teacher's ICT competency for teaching and learning in TVET programs in Technical Colleges in Niger State.

1.4 Significance of the Study

The recommendations of this study if implemented would assist in improving the quality of education and training in technical and vocational programs and would be of immense benefit to the TVET teachers, students, TVET institutions and the Federal government.

TVET instructors/teachers would benefit from this study in that it allows access to a wide range of information in various formats, this helps the teacher to produce and modify resources quickly and easily while preparing for their teaching, provides feedback and it also allows for effective

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differentiation of instructional delivery approach. TVET instructors will be motivated to undertake workshops/refresher courses/programs on regular basis in order to be updated and up skilled on technological developments, through the use of ICT, instructors can effectively present abstract or difficult concepts in computer for students' easy understanding and comprehension which would make the teacher feel more competent in transferring knowledge to the students. Communication with students will also be effective and efficient.

The findings of this study would greatly benefit the students because when ICT is integrated into lessons, students becomes more engaged in their work, they're motivated to learn therefore, the class becomes more fun and enjoyable which enhances retention of knowledge. The teaching-learning process becomes student-centered and this will result in increased learning gains for students, creating and allowing for opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communication skills and other high-order thinking skills

The findings of this research will serve as a self-appraisal to TVET institutions and the educational system on the extent to which they employ ICT in TVET programs, they would be enlightened about necessary technological tools, resources, basic skills and competence needed to produce quality. This would therefore, bring to light the level at which ICT are employed in TVET programs by TVET institutions and therefore will serve as a guide to curriculum planners and policy makers in formulating/planning appropriate and adequate policies/curricula for improving the quality of TVET programs in Nigeria.

Furthermore, the findings of this study will provide a significant contribution to the literature of ICT especially in the Nigerian context. The overall educational systems would improve when technological innovations are utilized in the provision of valid and quality information and

attending to students' individual differences. The findings of the study on presentation as a conference material would also reveal the unavailability of ICT in the TVET institutions which will inform the Federal government to increase educational budget that will enable the institutions acquire them.

1.5 Scope of the Study

The study focuses on the determining the extent to which ICT is utilized in the teaching and learning of TVET programmes in the area of study, the application of ICT resources (hardware & software) in TVET programmes and also the level of TVET teachers ICT competency TVET programmes in Technical Colleges in Niger State.

1.6 Research Questions

In order to realize the goal of this research, the following research questions were asked to help achieve the purpose of this study.

1. To what extent is ICT applied in the teaching and learning process of TVET programmes in Technical Colleges in Niger State?

2. To what extent is ICT resources (hardware and software) utilized for teaching and learning in TVET programmes in Technical Colleges in Niger State?

3. What is the level of TVET teacher's ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State?

1.7 Hypothesis

The following null hypothesis will be used to test at 0.05 level of significance

H0₁ There will be no significant difference in the mean response of TVET teachers with 5-10 years' of experience and 11years and above experience on the utilization of ICT resources are (hardware and software) for teaching and learning in TVET programmes in Technical Colleges in Niger State.

H0₂ There will be no significant difference between the mean response of TVET teachers with 5-10 years' of experience and TVET teachers with 11 years and above experience on the level of ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State.

CHAPTER TWO

LITERATURE REVIEW

Review of related literature is done under the following sub-headings

- TVET's Pedagogy

- Utilization of ICT Resources in TVET Programmes

- ICT Competency of TVET Teachers in Technical Colleges

2.1 TVET'S PEDAGOGY

Pedagogy is concerned with the principles and methods of instruction (teaching and learning). It addresses how the content of a course is designed; identifies the learner's needs; and how the learning objectives will be achieved. Pedagogy is the development of educational process that helps learners gain knowledge, it stimulates the unique interaction between teachers and students "Pedagogy in Education" (2022). Successful pedagogy requires the teacher to understand how students learn then design and deliver course materials, and mentor students appropriately, so that knowledge and skills are passed on. Pedagogy should be the cornerstone to any educational technology. Without pedagogical principals, learning will be cumbered.

These principles of instruction are divided into the following:

a. Analysis of Content

Content refers to the subject matter within a domain of knowledge to which a lesson or course is devoted. It also refers to those disciplinary practices that guide the creation, use, and communication of subject-matter knowledge. The content presented within an ICT enabled unit course depends on the learning goals for that course. It simply is the totality of what is taught for a particular course.

Content analysis involves the identification of the content units that support learning and facilitate content reuse in other contexts and courses and a sequence of content units that serves learners' needs while respecting the integrity of the domain. It determines the presence of certain words, concepts, themes, phrases, characters or sentences within texts or set of texts and to quantify this presence in an objective manner. Not all content is suited for the electronic environment. As Singh and Reed (2001) state, "Some forms of content – for example, intense behavioral modification, complex physical skills – might only be effectively delivered in face-to-face formats" hence the need for content analysis. The content analysis process guides the selection of both presentation models and delivery media for course content.

Content best served by personal interactions should be taught face-to-face, while content suitable for online learning should be taught online. Depending on the situation, blended learning format can be introduced. Blended-learning, also known as hybrid learning is an approach to education that combines online educational materials and opportunities for interaction online with traditional classroom methods, it combines face-to-face teaching and online instruction ideally leveraging the strengths of both approach. Therefore, blended learning complements online learning.

  b. Analysis of Audience

Who are the recipients? We can learn about our audience and their specific characteristics by conducting an audience analysis. Audience analysis consist of assessing the audience to make sure that the information provided for them is at the appropriate level. A careful analysis of who the learners are will provide important information that can be used to design learning activities. Since ICT enabled learning is not bound by time and place, it can be delivered to anyone, anytime, and any place. Learners may come from culturally diverse background and they may differ in how they learn. Information about learners level of knowledge and skills, personal and social characteristics,

capabilities, preferred learning styles, needs, and interests are critical elements of audience analysis. To be able to understand learners and their needs better, one need to consider the learners' cultural backgrounds, interests, and educational levels. There's need to assess their familiarity with the various instructional methods and delivery systems being considered, determine how they will apply the knowledge gained in their everyday life, and note whether the class will consist of a broad mix of students or discrete subgroups with different characteristics. Data collection techniques such as interviews, surveys and observations, can be used to collect data relating to several learner characteristics, including (but not limited to) age, educational level, standardized test scores, cultural background, physical and learning disabilities, learners' interest, experience, personal goals and attitudes, learning preferences, motivation, writing skills, reading skills. The more information available, the better and easier it will be to understand the audience. Instructors can be able to bring together relevant and appropriate materials for their target audience.

c. Goal Analysis

Well defined and articulated learning goals are important as they provide students with a clear purpose on which to focus their learning effort and inform instructors on the selection of instructional contents and activities. Okarfor (2016) defined a goal as an expression of instructional purpose, while an objective identifies the performance standards that a student must meet to reach a goal. The audience analysis process help to identify the need of the student which in turn can help us determine appropriate learning goals. The goal analysis process helps to identify and clarify the aims of the course of study. Identifying clear goals can help learners achieve the greatest learning gains in the most cost-effective and meaningful manner.

d. Instructional strategies and methods.

Instructional Strategies A variety of instructional strategies can be used to facilitate learning and help students achieve their own learning goals and objectives in an ICT enhanced learning environment. The strategies used in are based in part on the philosophical approach of the course. However, learners' preferences for specific instructional methods are influenced by their learning styles. Using multiple instructional activities can facilitate learning, and the technical and structural attributes of the Internet and digital technologies can be used to support these activities (Khan et al 2012). Their use depend on the type of learning domain (well-defined or ill-defined), the goals and objectives of the course, and the philosophical orientation of the course designers. One can argue that debates may make more sense in social sciences than in chemistry. Many instructional strategies may work; that is, they may eventually result in the desired learning. In an open, flexible and distributed environment, it is critical to provide learning materials in ways that are accessible to learners with a variety of learning styles.

According to Faruq (2022), TVET is one of the recognized and effective means by which quality, up-to-date, well informed; literate and knowledgeable workers are prepared and trained. Adequate hand-on-experience to all the learners is the primary instructional strategy in TVET courses. Most of the teaching/instruction sessions in the ICT environment are done with computer sessions with supporting presentations/demonstrations. The presentations are interactive in nature and the learners are expected to actively participate in the discussions and learning by doing. All learners are expected to be provided with computers and the learning activities should involve: Interactive theme presentations; Experience sharing through learners' presentations; Field visits to industry and institutions; Seminar presentations; Hands-on-practices by learners following instruction and demonstration by the tutor/trainer; Project work based on practical display of skills. The teaching

of practical skills in TVET therefore requires the use of precise instructions to enable learners to follow the process and thereafter repeat the skill. Michele, Emily and Martin (2019) stated that virtual instructional environment will enable the instructor or tutor to present lessons through: Video, PowerPoint or Charting. The learners are able to engage in collaborative learning, sharing experiences and creative activities.

2.2 The Utilization of ICT in Instruction Delivery

Instruction delivery is the core of every lesson. Instruction delivery refers to the act of sending information and procedures to comprehend and adhere by the receiver. Instruction delivery is the process whereby the instructor carefully selects the method and technique for handing down learning experiences to learners through appropriate mediums of communication. It deals with the interaction of the teacher with the students in the classroom. Utilization of ICT resources has the capacity to enhance teaching skills and expand access to education and training in TVET Programs (Igwe 2022).

Ayoade and Raji (2006) when emphasizing on the importance of ICT asserted that ICT can be used in many ways and how it is integrated into educational settings depend largely on teachers' instructional goals and strategies. They further enumerated technologies that enable ICT activities in the classroom as Interactive White Board (IWB), Web-based Instructions (WBI) and Virtual Classroom (VC).

An interactive white board is a sensitive display that functions as a white board, a projector screen, an electronic copy of the board, a computer, and projector in which computer image is controlled by touching the surface of the panel instead of using a mouse or keyboard. Interactive white board are used as presentation devices and classroom motivation for students. The use of the IWB for instruction can serve as a catalyst for the change from traditional instructional methods to

interactive and constructivist methods. This technology helps teachers use instructional methods in more up to date ways, and utilizes various media such as text, voice, pictures, and movies that facilitate more effective learning, even in routine practice activities.

Web-based instruction is an approach for delivering instruction to a remote audience using the World Wide Web (WWW) as the instructional delivery system. Web-based learning environment use the resources of the web to create a context of learning. It has unique characteristics of cost effectiveness, convenience and flexibility of structure for the students. It provides a wealth of information that is not readily available in textbooks or instructors. Student can access information and resources from around the world simply by having a computer and an internet connection. With the use of the Internet teachers have access to the World Wide Web (WWW) server which provides a form of lecture presentation. Through the Internet teachers can access an e-mail list server which provides a form of a tutorial group discussion to complement lecture presentation.

A virtual classroom is an online teaching and learning environment where teachers and students can present course materials, engage and interact with other members of the virtual class and work together in groups. The key distinction of virtual classroom is that it takes place in a synchronous setting (learning in which all parties participate at the same time). The main systems are mediated by correspondence, audiovisual means (television) multimedia and internet.

2.2.1 Utilization of ICT in Self-learning

Learning is a process by which a learner acquires knowledge, skills, attitude, concepts, traditions, values and the ability to comprehend in the process which ultimately leads to his mental, social, spiritual and physical growth and development. It is a relatively permanent change in the behavior of the learner and is expressed in terms of knowledge, skills and attitudes. Learning is a change in human disposition or capability which persists over period of time, and which is not simply

ascribed to processes of growth. Self-learning is a new educational technology. It is based on well-designed computer based course ware that allows students to teach themselves. In today's education, learning strategies have changed. Students can now decide on what lo learn, when to learn, where to learn and how to learn. Learners can use either print-based illustrations of step-by-step procedures or video-based practical lessons.

2.2.2 Utilization of ICT in Assessing Learners

Online assessment is described as the use of electronic media to assess a learner's level of education in respect to an interest variable or desired learning outcome. Technology can be used for assessing student, help boost engagement, identify knowledge gaps and support deeper learning. Assessment involves measuring a person's ability, knowledge, and performance in a given domain. The use of ICT in assessment can be conducted either online or offline setting.

Some examples of assessment tools used in online setting given by Dawley (2007) include course survey, exams and testing tools. Internet assessment tools such as Hotpotatoes, Quia, ExamBuilder, rubric tools like Rubi Star and quiz creation tools such as QuizStar. These tools are used to create questions such as multiple choice, essay, true/false, matching, fill-in-the-blank and ordering types of questions in online testing. When students are to take the tests, the internet availability is necessary. For the offline setting, a set of questions can be designed using a software, such as Adobe Dreamweaver, which can make an offline version of the test as well as generating the score. The testing program can be accessed in a computer independent of an internet connection. The use of ICT can help teachers by storing and recording information about how students are developing understanding of the course content. Individual testing, participation in group discussions, questions, and portfolio development can all be used to evaluate students'

progress. There are other online assessment experimental activities, such as, role-play, debates, reviews, simulation and journals.

Some of the benefits of technology enhanced assessments include: improved authenticity and alignment with learning outcomes (the design flexibility allows the instructor to access a wide range of student's skills and competences beyond simple recall); helps to clarify marking criteria; spread the assessment load for instructors and students; improves student engagement and promotes deeper learning.

2.2.3 ICT as a Source of Information

The world is moving faster with its advanced technologies. Information is a very important resource. Information and Communication Technology is plays a significant role in shaping the world of education by making the communications process faster. ICT is a broader spectrum that includes all communication technologies, software, videoconferencing, social media and other digital media to use, store, transmit and manipulate information digitally (Yang et al., 2020). ICT has the potentiality to share and disseminate information in very faster rate. It empowers both teachers and students to send, receive and utilize information for their development. Sources through which information is received include mobile phones, television, radio, computer, internet and social media.

2.2.4 Hardware Technology

Hardware is a comprehensive term for all of the physical parts of a computer system. It refers to the computer's tangible components or delivery systems that store and run the written instructions provided by the software. Hardware may also mean the physical components or items of a computer system that individuals can see or touch. Computer hardware is divided into two main

categories: the system unit and peripherals. The system unit contains the electronic components used to process and temporarily store data and instructions. These components include the central processing unit (CPU), primary memory, and the system board. Peripheral devices are hardware used for input, auxiliary storage, display and communication (output). These are attached to the system unit through a hardware interface that carries digital data to and from main memory and processors such as web cameras, scanner, printer, keyboard, mouse, microphones, and removable storage devices among others.

Input devices are computer peripherals that allow data/information to be entered into the computer system. These devices enable users to input different kinds of data from text through to video into a computer. Examples of input devices are the keyboard, mouse, web camera, microphone, digital camera, scanner, light pen, tablet PC pen, game pad, touch screen, and so on. The input devices that are used for multimedia production and delivery.

Output devices are computer hardware components which converts information into a human-readable form. It can be text, graphics, audio and video. They display or allow computer users visualize, listen to audio or read on-screen texts. A computer can still function without an output device. However, without an output device there's no way to determine what the computer is doing. Examples of output devices are Visual Display Units or Monitors, Computer Speakers, multimedia projectors, printers, and so on. The output devices used for instructional delivery discussed in this study are the Visual Display Unit (VDU) or monitor, Printer, Multimedia Projectors and Interactive Whiteboards, and Computer Speakers.

Memory and storage devices are part of the multimedia hardware. These devices allow users store vast amount of information, including multimedia-based courseware. There are two types of

computer memory – the primary (or internal) memory and the secondary storage devices (or external backing store). The primary/internal memory units (usually referred to as primary memory or internal memory) are of two types - the Random Access Memory (RAM) and the Read Only Memory (ROM).

Modern computers operate with electricity. The CPU processes electrically and uses basic instructions wired in the arithmetic logic units (ALU) electronics. Therefore, data and instructions directly manipulated by the CPU must also be stored electronically. Primary memory is electronic storage that is directly addressed by the CPU. Random access memory (RAM) consists of addressable storage areas for data and instructions in electronic format. This storage is volatile. Once electricity is powered off, the contents are lost. While not suitable for long-term storage, RAM provides the fast, electronic access to data and instructions required for processing by the CPU.

A second form of primary memory is read-only memory (ROM). ROM is a special form of nonvolatile electronic storage that contains frequently used instructions for the CPU. The ROM stores the data the CPU needs when it is first turned on. These commands are hardwired or embedded in the chip by the manufacturer; they can be read, but not changed. The instructions perform essential system checks and load the operating system from disk storage into RAM. ROM is activated when the power is on. The embedded instructions do not disappear when the power is off, unlike RAM storage. The ROM data/instructions are normally system programs (operating system, language translators, and utility and service programs)

Computer systems are not complete without a means of storing data and instructions for future use. Random access memory is essential for the CPU to process data and instructions electronically, but RAM is volatile. Once the power is off, memory is cleared and data is lost.

Secondary storage is the media that holds data and instructions outside the system unit for long periods of time. It is also called external storage or auxiliary storage to distinguish it from primary electronic storage inside the system unit. Secondary storage now includes hard disks with gigabyte capacities, optical discs that deliver high-fidelity multimedia, and a wide array of portable storage ranging from memory cards to flash drives, as well as portable music players and smartphones. Secondary storage has several advantages over primary electronic storage. In addition to being nonvolatile, secondary storage is easily expandable and portable. If one disk fills with data, another disk is readily available.

System devices are the devices that are regarded as the essential components for a computer. These devices include microprocessor/Central Processing Unit (CPU), motherboard and memory USB flash disk drives are typically removable and rewritable. Microprocessor is basically the heart of the computer. Alexandrou (2018) defined CPU as the part of a computer that controls the interpretation and execution of instructions. The most important component of any electronic computer is the central processing unit. A CPU is a complex integration of millions of transistors that execute program instructions and manipulate data. The CPU has three essential sets of transistors that work together in processing digital data: a control unit, an arithmetic logic unit, and registers. The control unit directs the flow of data and instructions within the processor and electronic memory. The arithmetic logic unit (ALU) contains programmed transistors that perform mathematical and logical calculations on the data. The registers are special transistors that store data and instructions as they are being manipulated by the control unit and ALU. New microprocessors also have additional high-speed memory called cache, on the chip to store frequently used data and instructions. A microprocessor is a processor on a small microchip and could process multimedia data or elements that are fed into the computer through any of the input

units for the view of computer users through any of the output devices. The processor is capable of converting analog audio input into digital form and can as well enable online streaming videos to play on user's computer. According to Nunes and Gaible (2018), a good sound card, a good processor, and sufficient RAM (Random Access Memory) and storage capacity should be considered before undertaking any multimedia project, therefore TVET instructors should be able to select standard multimedia systems for developing and delivering computer- based multimedia courseware and applications

The motherboard, on the other hand, is a device in the computer that contains the computer's basic circuitry and other components. It holds and allows communication between many of the crucial electronic components of a system such as the CPU, memory, hard drives, optical drives, video and sound card and other ports and expansion cards and also provides connectors for other peripherals. Fisher (2018) refers to motherboard as the "back bone" of the computer.

Communication devices are devices that are used to connect a computer system to the internet, intranet or extranet. It is any type of hardware capable of transmitting data, instructions and information between a sending device and a receiving device. One type of communication device that connects a communication channel in a computer is a modem. A modulator-demodulator or simply a modem, is a computer hardware that converts data from a digital format suitable for an analog signal such as telephones. A modem transmits data by modulating one or more carrier wave signals to encode digital information, while the receiver demodulates the signal to recreate the original digital information. A modem is usually connected to a computer's USB port, when a modem is connected to a laptop or desktop, it connects the computer to the internet through a service provider, such as MTN, GLO, among others. Modem operates as a wireless technology, and therefore can be used in places within the range of the service provider's network service.

Other communication devices include: Bluetooth devices, Wi-Fi devices, network interface card among others.

2.2.5 Software Technology

Computer software is a program (set of instructions) that directs the operation of computer hardware. National Open University of Nigeria (2006) defines a computer software or just software as a collection of computer programs and related data that provide the instructions telling the computer what to do and how to do it. Software programs refer to a planned step-by-step instruction that turns a computer into useful electronic device, the software drives the hardware components of a computer system. Computer software is divided into three classes: system software, application software, and programming software. The above mentioned categories of software are discussed below

System Software is any program written to act as an interface between the application software, programming software and the computer hardware. This controls the common computing functions and provides the basic functions for computer usage and helps run the computer hardware and system (National Open University of Nigeria, 2006). System software is designed to provide a platform for other software. Examples of system software include; operating systems (OS) like Microsoft windows, android, MacOS, search engines

Application software refers to computer software designed by software development professionals (or software engineers), software companies or computer users, who are knowledgeable about computer programming, to perform specific tasks for people (users) who will use the software program. An application program (app) is a computer program designed to carry out specific task other than one relating to the operation of the computer itself. Application may be bundled with the computer and its system software or published separately. An application program allows users

to manipulate input data to generate meaningful information/solutions. National Open University of Nigeria (2006) refers to application software as a broad category, and encompasses software of many kinds, including the internet browser being used to display web pages. Applications software also includes word processors, electronic spreadsheets, databases, desktop publishers, and other kinds of application software. There are specialized software that are been developed specifically for the production and execution of computer-based learning. These multimedia applications include image editing software, audio editing applications, animation creation/design software, video editing and production applications, and authoring systems

Educational software is a term used for any computer software which is made for an educational purpose. These software helps make teaching and learning more effective and efficient. Educational software refers to any computer application that enhances learning. It includes classroom management software, student information systems, language software, reference software, and more. Schools are known to be slow to adopt new technology. But since digital transformation has impacted how every industry works, they too, haven't been left behind. Educational software makes learning more effective and efficient. Not only do these educational tools improve your learning experience, but they also facilitate communication and reduce inefficiencies. A few of this educational software are: Classroom Aids, Google Classrooms, Schoology, Socrative, Virtual Learning Environment, and Learning Management System among others.

2.3 ICT Competency of TVET Teachers in Technical Colleges

Worldwide, ICTs are radically transforming the way we live, penetrating into our work, study and personal life. Today's learners are growing up in a world characterized by technological change and innovations. The use of ICT in teaching has been found to create learning activities which lead to an improvement in the overall student's achievement. As stated by Yuk-Kwan et al (2022), TVET teachers play a vital role in providing learners with digital skills and competencies needed for the rapidly evolving technological world of learning. Teachers who integrate ICT in the classroom demonstrates some degree of confidence, collaboration and cooperation which brings about the best in students capacity for active learning (Abel et al 2022). However, the experience of introducing different ICTs into the educational systems suggests that the full realization of the potential educational benefits is not automatic.

In the framework of this educational landscape the role of the teacher is that of acting as guide and instrument to assure a comprehensive learning process via the modern age technologies and managing the student's learning process by the new instructional models set in newly created virtual environments. The teacher will have to develop competencies related to the learning contexts that changes in teaching and learning paradigms require. Authors such as Potter and Darbyshire (2005) and UNESCO (2004) are of the view that ICT competencies are concerned with the ability to:

- Know when to apply or develop a particular skill in using an ICT resource

- Be aware of the reasons for using ICT and its effect on both users and context, and

- Have a critical and confident attitude to learning with the technology

According to UNESCO (2008) ICT competency is defined as knowledge, skills and ability to take advantage of ICT for the purpose of gathering, processing and presenting information in support of activities among different groups of people. It is the knowledge, skill and ability of the teacher to use ICT tools effectively and efficiently in teaching and learning. Some of the trends of ICT competency as defined by Bert and Theo (2018), are teacher training, operating ICT devices, assessing information on the internet and creating information using ICT devices.

Computer competency is a major factor that influences the implementation and use of ICTs in education. For the effective integration and use of ICTs in pedagogy, the teachers should be competent enough in the application of ICT for class content delivery. Teachers with a high degree of ICT competency have been found to have a higher level of ICT application in teaching and learning, according to studies (Buabeng, 2018). ICT integration in TVET is quite complicated and challenging therefore, teachers need to be equipped with the competencies for teaching practices (Paudel 2021). Computer training enables teachers to acquire more knowledge which in turn makes them more confident and improves their competency on ICT use in teaching because without adequate skill and knowledge of how to perform basic tasks on the computer, using the computer will be difficult and frustrating (Bamigboye et al 2019).

Operating ICT devices takes various forms: booting a computer, taking photos using a digital camera, operating a smartphone and mounting SD card on smartphone. These operations enable a teacher to use ICT devices comfortably in class thereby leading to observable influence in students' achievements. Another ICT competency is creating information using ICT devices. This involves working with software such as MS word for typing, editing and formatting text. MS publisher, Photoshop and paint for creating photos and images, MS PowerPoint for presenting documents such as text, videos and animations. These skills enable a teacher to create and present the desired

and favorable content for students to learn better leading to an influence in their achievement. Briones (2018) on her studies in the Philippines found that teachers emphasized ICT facilities in teaching and learning since discussions became easier, teachers spent lesser efforts in explaining certain phenomena due to videos and simulations and there was lesser time spent in preparing lessons.

The other ICT competency is the ability to access information on the internet which involves the speed of access, downloading text, audio and video content and saving content for editing and presentation. This enables a teacher to search for relevant content on the internet and present the same to learners for their effective learning hence, influencing their achievement.

Teacher's competencies are the key predictor in ICT implementation in technical colleges, it is a vital capacity required to implement ICT in teaching and learning however, as stated by Diao et al (2021), the status quo of TVET teachers ICT competency is not commensurate with the demands of the digital era, there is an urgent need for TVET teachers ICT competency framework and standards in the information age. Therefore, for a successful implementation of ICT for teaching and learning into TVET programmes in Technical Colleges to be achieved, the need for teacher's ICT competency should be emphasized

2.4 Review of Empirical Studies

As stated by Dean (2002), the founder of Cognitive Arts, he believes that educational institutions must adopt a new way of teaching. He claims that students learn better through experiential and emotional learning rather than through memorizing names and dates and thus, educators must simulate real-world environments. ICTs can be used to facilitate these types of environments. An example of this is using flight simulators to train novice pilots, artisans, craftsmen, technicians and technologists' as well as several other vocational and technical instructors (Dean, 2002). The ICT

applications based on the networking and communications technologies are becoming the fundamental tools for both administrative institutional management of teaching and learning methodologies on which planning, designing, implementation, and operation of TVET systems are being done

According to, Yunus et al (2013), the use of ICT in teaching, supplies teaching and learning aid to teachers and learners. He also stated that the use of e-learning encourages cooperative learning, enhances teaching and learning process, and encourages communication though websites, blogs and social networks. There is a need for the use of ICT in teaching in Nigerian schools, for effective instructional delivery. According to Abdul-Reheem (2018) unavailability and insufficiency of instructional materials are the main causes of the non-productive nature of Nigerian school system and poor academic performances of students in Nigerian schools. Thus, use of ICT as an instructional delivery in Nigerian schools has the potentials to enhance teaching and learning.

According to (Onwuagboke, et al 2015), there is a vast belief that information and communication technology (ICT) has the ability to change teaching and learning processes from greatly teacher-centered to student-centered. According to Asubiojo & Ajayi (2019) the implementation and use of ICT in education will also improve Nigeria's education system, by enhancing teachers' instructional effectiveness. The most crucial benefit of utilizing ICT in the teaching and learning process is that it fosters greater communication and interaction between students and even teachers. Effective learning happens when learners are interactively engaged in a learning task. Learning using ICT is more than learning through memorization. It allows the learners to experience their learning process being interactive, enjoyable and fun filled with technology.

2.5 Summary of Literature Review

The literature review revealed that the application of Information and Communication Technology in TVET has revolutionized its programs, bringing about effectiveness and efficiency to the instructional delivery and overall educational experience for both teachers and learners alike. Teachers are able to attractively render educational services and learners at any level are able to learn at a pace that suits their differing educational needs.

With the application of relevant software and hardware resources, ICT can be applied to TVET programs in a way that sustains a lifelong, flexible and learner-centered process of knowledge acquisition. ICT offers a new paradigm of teaching to educators for the delivery of instructional materials and lessons, and learning for learners at different levels of their educational experiences.

Teachers ICT competency is of growing importance as it is a vital factor that influences the application of ICT in the teaching and learning process of technical colleges. Teachers' competencies are critical influencers on ICT implementation in technical college. Teachers ICT competency in the 21st century require a regular update on knowledge and skills to be in tandem with the technology dynamic to implement it in classroom instruction so as to empower students with the relevant skills needed in the 21st century. Therefore, there is a need for teachers to be updated, having relevant and adequate ICT knowledge and competency.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Design of Study

The research design used in carrying out this study is survey research design, which involves the collection of information from a sample of individuals through their response to questions using questionnaires (Check & Schuut, 2012). This research design is efficient in getting people's opinions, beliefs, and thoughts regarding a specific phenomenon. The survey research design was chosen as an appropriate method for this study as it seeks the views of respondents about the application of ICT for teaching and learning in TVET programmes in Technical Colleges in Niger State.

3.2   Area of the Study

The study will be conducted in Niger State which was created out of the defunct North-Western States with Minna as its capital city. Niger state shares its borders with the republic of Benin (west), Zamfara state (North), Kebbi state (North-west), Kogi (South), kwara (South-west), Kaduna (North-east) and FCT (South-east). The state comprises of 25 local government areas grouped into three (3) senatorial districts /zones namely; Zone A, B and Zone C. There are 7 technical colleges in Niger State, six (6) of which are State technical colleges and one Federal technical college; Government technical college Minna, Government technical college Eyagi-Bida, Government technical college Kontongora, Government technical college New-Bussa, Suleman Barau technical college Suleja, Mamman Kontangora technical college Pandogari and Federal technical college Shiroro. The research would be carried out in all the State technical colleges. Niger state

was chosen for this research due to its accessibility to the researcher and there is a reasonable number of technical colleges available to carry out the research.

3.3 Population of the Study

The population for the study is 122 TVET teachers currently teaching in the selected Niger State technical colleges in options related to TVET; Automobile option, Building option, Furniture making option, Welding and fabrication option and Electrical option. Minna 22, Eyagi-Bida 20, Kontangora 19, New-Bussa 20, Suleja 21 and Pandogari 20.

Table 3.1

S/N	Technical college	5-10yrs	11yrs & above
1.	Government Technical College, Minna	8	14
2.	Government Technical College, Kontangora	10	9
3.	Government Technical College, New-Bussa	7	13
4.	Government Technical College, Eyagi, Bida	8	12
5.	Suleman Barau Technical College, Suleja	10	11
6.	Mamman Kontangora Technical College, Pandogari	8	12
	TOTAL	**51**	**71**
		122	

Source: Exam office, Science and Technical School Board Minna, Niger State. (2022)

3.4 Sample and Sampling Techniques

The entire population will be studied as it is too small to be sampled.

3.5 Instrument for Data Collection

The instrument to be used for data collection is a well-designed questionnaire developed by the researcher for the purpose of this study. Questionnaire is a widely used and useful instrument for collecting survey information, providing structures data, able to be administered without the presence of the researcher and comparatively straightforward to analyze (Cohen et al 2018). The questionnaire developed is divided into two (2) parts, namely Part A, and Part B. Part A contains the personal information of the respondent while Part B is further divided into three (3) sections.

Section I: this consists of 10 items which deals with the application of ICT in the teaching and learning process in TVET programs in Technical Colleges in Niger State.

Section II: this consists of 15 items that deals with the utilization of ICT resources (hardware and software) for teaching and learning in TVET programs in Technical Colleges in Niger State.

Section III: this consists of 10 items which deals with determining the level of TVET teachers ICT competency for teaching and learning in TVET programs in Technical Colleges in Niger State.

3.6 Validation of Instrument

The questionnaire for this study was validated by three lecturers in the Department of Industrial and Technology Education (ITE), Federal University of Technology Minna, Niger State. The essence of this is to assess the clarity and the appropriateness of the questionnaire items. Their comments and suggestions were used to modify and restructure the instrument for the final draft.

3.7 Administration of the Instrument

The questionnaire was administered by the researcher with the help of two research assistants. The research assistants were educated on the contents of the instrument. Concepts were explained and

the standards of responses discussed. A total of 122 copies of the questionnaire were distributed and 108 copies (88%) were duly returned after two weeks and used for analysis.

3.8 Method of Data Collection

Data was collected using structured questionnaires with closed-ended questions using a four-point rating scale. The distribution and collection was done by two research assistant under the directive of the researcher.

3.9 Method of Data Analysis

The data collected by the researcher was analyzed using mean, standard deviation and t-test as statistical tools. A four-point rating scale was employed with the following response. Research questions 1 and 2 were responded to using the following rating scale

Alternative value	Abbreviation	Rating
Low Extent	LE	1
Moderate Extent	ME	2
High Extent	HE	3
Very High Extent	VHE	4

Research question 3 was responded to using the following rating scale

Alternative value		Abbreviation	Rating
Strongly Agree	=	"SA"	4
Agree	=	"A"	3
Disagree	=	"D"	2

Strongly Disagree   =   "SD"   1

$$\frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$$

The mean response of each item was obtained by using the following formula

$$\overline{X}_1 \frac{\Sigma FX}{N}$$

Where

£ = Summation of

X = normal value of option (mean)

N = number of response of an item

F = frequency of response of each option

$\overline{X}_2$ = Grand mean of each item

Decision Rule

To determine the level of acceptance, mean response. 2.50 And above was considered agreed or

accepted. While mean response of 2.49 and below was equally considered disagreed or rejected.

For testing hypothesis ± 1.67 will be the critical value, any item that has its t- value equal or less

than t- critical was considered not significant, and any item that has its calculated t- value above t-

critical was considered significant.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter deals with the presentation and analysis of data with respect to the research questions formulated for this study, the result of this data analysis for the research questions are presented first, followed by those of the hypotheses tested for the study.

4.1 Research Question One

To what extent is ICT applied in the teaching and learning process of TVET programmes in Technical Colleges in Niger State?

Table 4.1: Mean response on the application of ICT in teaching and learning process of TVET programmes in technical colleges in Niger State. N1=46, N2=62.

S/N	ITEMS	X_1	X_2	X_t	Remark
1	Audio clips are used for teaching and learning	2.4	2.1	2.3	Unutilized
2	Video clips for teaching and learning	1.6	1.8	1.7	Unutilized
3	Digital library for teaching and learning	1.4	1 9	1.7	Unutilized
4	Internet search engines (Google) to achieve self-directed learning	3.3	2.9	3.1	Utilized
5	Online group discussions/ forums	2.3	2.2	2.3	Unutilized
6	Online tutorial for self- learning	2 3	1.5	1.9	Unutilized
7	Online dictionary (Wikipedia) for teaching and learning	2.1	1.8	2.0	Unutilized
8	Computer simulation (simulating real world phenomenon in 3-D to demonstrate difficult, complex concepts) for teaching and learning	1.2	1.7	1.4	Unutilized
9	Educational games/video games in the classroom to improve manipulating skills and creative thinking	2.0	1.5	1.8	Unutilized
10	Online drill and practice session for mastery	1.8	1.6	1.4	Unutilized

KEY: X_1= average mean responses of TVET teachers with 5-10 years' experience in technical colleges, X_2= average mean responses of TVET teachers with 11 years and above experience in technical colleges, N1= number of TVET teachers with 5-10 years' experience

in technical colleges, N2= number of TVET teachers with 11 years and above experience in technical colleges.

Table 4.1 reveals that the respondents agreed with item 4 with a mean score above 2.50 as being utilized. While items 1, 2,3,5,6,7,8,9 and 10 disagreed with a mean score below 2.50 as being unutilized, which implies that item 4 is being utilized in the teaching and learning process of TVET programmes in technical colleges in Niger State. While items 1, 2,3,5,6,7,8,9 and 10 unutilized. Meaning that the application of ICT in the teaching and learning process of TVET programmes is low and grossly inadequate.

4.2 Research Question Two

To what extent is ICT resources (hardware and software) for teaching and learning utilized in TVET programmes in Technical Colleges in Niger State?

Table 4.2: Mean response on the utilization of ICT resources (hardware and software) for teaching and learning in TVET programmes in technical colleges in Niger State. N1=46, N2=62.

S/N	ITEMS	X_1	X_2	X_t	Remark
1	Desktop computer	3.1	2.9	3.0	Utilized
2	Voice amplifiers (microphones)	1.7	1.8	1.8	Unutilized
3	Digital camera for recording information	1 2	1.9	1.6	Unutilized
4	Multimedia projectors	1.6	1.4	1.5	Unutilized
5	Printers	3.1	2.9	3.0	Utilized
6	Flash drive for storing materials	2.0	1.9	2.0	Unutilized
7	CD/DVD for storing information	1.1	1.8	1.5	Unutilized
8	Microsoft word	1.9	2.1	2.0	Unutilized
9	Microsoft PowerPoint to create presentations	1.2	1.5	1.4	Unutilized
10	Microsoft Excel	1.3	1.7	1.5	Unutilized
11	Social network platforms for discussions (WhatsApp, Facebook among others)	2.3	1.8	2.1	Unutilized

S/N	ITEMS				Remark
12	Zoom	1.4	1.6	1.5	Unutilized
13	Graphic software (Photoshop)	1.6	1.9	1.8	Unutilized

KEY: X_1= average mean responses of TVET teachers with 5-10 years' experience in technical colleges, X_2= average mean responses of TVET teachers with 11 years and above experience in technical colleges, N1= number of TVET teachers with 5-10 years' experience in technical colleges, N2= number of TVET teachers with 11 years and above experience in technical colleges.

Table 4.2 reveals that the respondents agreed with item 1 and 5 with a mean score above 2.50 respectively as being utilized. While items 2,3,4,6,7,8,9,10,11,12 and 13 disagreed with a mean score below 2.50 as being unutilized, which implies that item 1 and 5 are being utilized as ICT resources (hardware and software) for teaching and learning in TVET programmes in technical colleges in Niger State. While items 2,3,4,6,7,8,9,10,11,12 and 13 unutilized. Meaning that the utilization of ICT resources in TVET programmes is grossly insufficient.

4.3 Research Question Three

What is the level of TVET Teachers ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State?

Table 4.3: Mean response on the level of TVET teachers ICT competency for teaching and learning in TVET programmes in technical colleges in Niger State. N1=46, N2=62.

S/N	ITEMS	X_1	X_2	X_t	Remark
1	I know how to download and view PDF file	3.2	3.0	3.1	Agreed
2	I know how to create document using Microsoft word	2.7	2.9	2.8	Agreed
3	I can save documents in the desired location on the desktop	1.5	1.8	1.7	Disagreed
4	I know how to retrieve documents from the place of storage on the desktop.	1.2	1.5	1.4	Disagreed
5	I know how to use web browsers to get access to information (Google, chrome, Opera mini among others)	3.6	2.8	3.2	Agreed

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6	I can use Microsoft PowerPoint to present data	1.6	1.9	1.8	Disagreed
7	I know how to use spreadsheet software (Microsoft Excel)	1.2	1.8	1.5	Disagreed
8	I know to use a printer to print materials by myself	1.6	1.9	1.8	Disagreed
9	I know how to access educational materials from online libraries	1.4	1.5	1.5	Disagreed
10	I know how to send E-mails	3.6	3.0	3.3	Agreed

KEY: X_1= average mean responses of TVET teachers with 5-10 years' experience in technical colleges, X_2= average mean responses of TVET teachers with 11 years and above experience in technical colleges, N1= number of TVET teachers with 5-10 experience in technical colleges, N2= number of TVET teachers with 11 years and above experience in technical colleges.

Table 4.3 reveals that the respondents agreed with item 1, 2, 5 and 10 with a mean score above 2.50 respectively. While item 3, 4,6,7,8 and 9 disagreed with a mean score below 2.50, which implies that items 1, 2, 5 and 10 agreed to the level of TVET teachers' ICT competency for teaching and learning in TVET programmes in technical colleges in Niger State. While item 3, 4,6,7,8 and 9 disagreed. Meaning that TVET teachers ICT competency is low in the application of ICT in TVET.

4.4 Hypotheses One

There will be no significant difference in the mean response of teachers with 5-10 years' experience and teachers with 11 years and above experience on the utilization of ICT resources (hardware and software) for teaching and learning in TVET programmes in Technical Colleges in Niger State

Table 4.4: t-test analysis of the utilization of ICT resources (hardware and software) for teaching and learning in TVET programmes in Technical Colleges in Niger State

S/N	ITEMS	SD$_1$	SD$_2$	t-test	Remark
1	Desktop computer	0.38	0.82	1.69	NA
2	Voice amplifiers (microphones)	0.93	0.90	-0.56	A
3	Digital camera for recording information	0.44	0.93	-5.19	NA
4	Multimedia projectors	0.58	0.64	1.70	NA
5	Printers	0.67	0.90	1.32	A
6	Flash drive for storing materials	0.93	0.98	0.54	A
7	CD/DVD for storing information	0.50	0.67	-6.22	NA
8	Microsoft word	0.85	0.92	-1.17	A
9	Microsoft PowerPoint to create presentations	0.57	1.72	-1.28	A
10	Microsoft Excel	0.62	0.80	-2.93	NA
11	Social network platforms for discussions (WhatsApp, Facebook among others)	1.05	0.87	2.63	NA
12	Zoom	0.75	0.99	-1.94	NA
13	Graphic software (Photoshop)	0.93	0.99	-1.61	A

Key

SD$_1$= Standard deviation of TVET teachers with 5-10 years' experience in technical colleges

SD$_2$= Standard deviation of TVET teachers 11 years and above experience in technical colleges

A= Accepted

NA= Not Accepted

The result shown in table 4.4 indicates the comparism between the teachers with 5-10 years' experience and teachers 11 years and above experience in technical colleges. Data revealed that items 2,5,6,8,9 and 13 has a calculated t-value less than the t-critical value of ±1.66, hence hypothesis for these items were upheld at 0.05 level of significance. Expect for item 1, 3,4,7,10,11 and 12 which has a t-calculated value above the t-critical value ±1.66, thus HO was not accepted for this items.

4.5 Hypothesis Two

There will be no significant difference in the mean response of TVET teachers with 5-10 years' experience and TVET teachers with 11 years and above experience on the level of ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State

Table 4.5: t-test analysis of the respondents on the level of TVET teachers' ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State

S/N	ITEMS	SD_1	SD_2	t-test	Remark
1	I know how to download and view PDF file	0.92	0.85	1.15	A
2	I know how to create document using Microsoft word	1.10	0.92	-1.00	A
3	I can save documents in the desired location on the desktop	0.75	0.80	-1.99	NA
4	I know how to retrieve documents from the place of storage on the desktop.	0.51	0.74	-2.49	NA
5	I know how to use web browsers to get access to information (Google, Chrome, Opera mini among others)	0.75	0.95	4.89	NA
6	I can use Microsoft PowerPoint to present data	0.83	1.11	-1.61	A
7	I know how to use spreadsheet software (Microsoft Excel)	0.42	0.74	-5.33	NA
8	I know to use a printer to print materials by myself	0.91	1.51	-1.51	A
9	I know how to access educational materials from online libraries	0.80	0.57	-0.72	A
10	I know how to send E-mails	0.88	0.69	3.83	NA

Key

SD1= Standard deviation of TVET teachers with 5-10 years' experience in technical colleges

SD2= Standard deviation of TVET teachers with 11 years and above experience in technical colleges

A= Accepted

NA= Not Accepted

The result shown in table 4.5 above indicates the comparism between the teachers with 5-10 years' experience and teachers with 11 years and above experience in technical colleges. Data revealed

that items 1,2,6,8 and 9 has a calculated t-value less than the t-critical value of ±1.66, hence hypothesis for these items were upheld at 0.05 level of significance. Expect for item 3,4,5,7 and 10 which has a t-calculated value above the t-critical value ±1.66, thus HO was not accepted for this items.

4.6 Findings of the Study

The following are the major finding of the study, they are organized based on the research questions.

The findings related to the extent to which ICT is applied in the teaching and learning process of TVET programmes in technical colleges in Niger State.

1. Most of the process of applying ICT in the teaching and learning of TVET programmes is just through internet search engines such as google. Audio clips, video clips, digital library, online tutorials, online forums, computer simulations, educational games, online drill and practice are not applied which indicates that the application of ICT in the teaching and learning process of TVET programmes is very low

The findings related to the extent to which ICT resources (hardware and software) for teaching and learning are utilized in TVET programmes in technical colleges Niger State.

1. Desktop computer and

2. Printers are the only ICT resources utilized in TVET programmes in Niger State which tells us that voice amplifiers, multimedia projectors, graphic softwares, Microsoft word, Microsoft PowerPoint are not utilized

The findings related to the level of TVET teachers' ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State Niger State.

The findings reveals that the TVET teachers ICT competency is very low and inadequate as they don't know how to

1. Save documents in a desired location

2. Retrieve saved documents

3. Use Microsoft PowerPoint to present data

4. Use Microsoft excel

5. Access educational materials from online libraries

6. Print materials by themselves.

4.7 Discussion of the Findings

Findings of the study revealed that the application of ICT in Technical and Vocational Education and Training (TVET) Colleges in Niger State very low. The equipment and ICT resources are grossly inadequate and the TVET teachers lack relevant competencies for using them where they are available which greatly affects the full capacity of TVET programmes in these colleges. A study done by Offia and Prince (2020), noted the need for government at all level to provide adequate funding, training facilities and qualified teachers for all TVET programmes to boost effectiveness and efficiency which supports Ezenwanfor et al (2014) who also stated that ICT resources in TVET programmes are utilized at a low extent because ICT infrastructure and equipment are highly inadequate and TVET teachers lack competency in utilizing them. He went further to state based on his findings that the government and management of educational institutions are still playing lip service to TVET without practically appreciating its relevance. This clearly indicates that there has been no quantifiable improvement in the application of ICT in TVET programmes because as reported by Igwe et al (2021), TVET sector in Nigeria is still faced with an acute shortage of competent teachers, resources and infrastructure. TVET is one of the

main areas of education that ICT integration can enhance its productivity because TVET is an important pathway for students' skills development (Simin &Shi, 2021).

The findings shows that the TVET teachers ICT competency level is very low and insufficient, the status quo of TVET teachers ICT competency is not commensurate with the demands of the digital era. Majority don't see the need to develop competencies related to the learning contexts that the changes in teaching and learning paradigms require seeing as these ICT resources are not made adequately available in the schools and where teachers are open to learn, there are no training programmes put in place by the government or school managements to teach them.

A study done by Abel et al (2022), showed that teachers who integrate ICT in the classroom demonstrates some degree of confidence, collaboration and cooperation which brings about the best in students capacity for active learning. Teachers therefore play a vital role in providing students with digital skills and competencies needed for the rapidly evolving technological advancing world of learning but this is unachievable when TVET teachers are not equipped with the relevant ICT competencies for teaching practices

Liverpool and Oti (2011) on the benefits of the application of ICT in education stated that ICT in education increases access to instruction by improving the pedagogy and strategies of instructional delivery and facilitates meaningful interaction among learners, Amin (2013) also stated that ICT use in the classroom revitalizes both the teachers and students thereby providing an interactive and lively learning environment. Igwe (2022) added also that the utilization of ICT resources has the capacity to enhance and expand access to education and training in TVET, however benefits cannot be seen when there are no working systems for the application of ICT in TVET programmes in place.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Study

The focal point of this study was to assess the application of Information and Communication Technologies (ICTs) for teaching and learning in TVET Programmes in Technical Colleges in Niger State. Three research questions guided the study

1. To what extent is ICT applied in the teaching and learning process of TVET programmes in Technical Colleges in Niger State?

2. To what extent is ICT resources (hardware and software) for teaching and learning utilized in TVET programmes in Technical Colleges in Niger State?

3. What is the level of TVET teacher's ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State?

Based on the data collected and analyzed for these research questions, the following findings were made;

1. ICT is not applied in the teaching and learning process of TVET programmes in Technical Colleges in Niger State.

2. ICT resources (hardware and software) for teaching and learning are somewhat utilized in TVET programmes in Technical Colleges in Niger State.

3. TVET teachers are somewhat competent in the use of ICT for teaching and learning in TVET programmes in Technical Colleges in Niger State.

This tells us that the availability of modern teaching and learning technologies is still lacking greatly. ICT resources and infrastructure are grossly inadequate and TVET teachers lack relevant ICT competency. There is a lack of adequate funding which is an indication that the government

and policy makers pay little attention to TVET programmes in Technical Colleges in Niger State which is a crucial aspect of the Nigerian educational system.

5.2 Implication of the Study

The finding of this study is of immense benefits to TVET teachers and students, TVET institutions, Federal government and the overall education system. The findings of this study is a self-appraisal to TVET institutions on the extent to which they employ ICT resources in TVET programmes, they would be enlightened about the necessary resources, technological tools and basic skills needed to produce quality which is a guide to curriculum planners and policy makers in formulating adequate curricula for improving the quality of TVET programmes in Nigeria.

The findings of this study reveals the need for the Federal government to equip Technical Colleges with ICT resources or increase the educational budget that will enable TVET institutions acquire them. The findings of this study further revealed the need for TVET teachers to undertake training and re-training, workshop, courses/ programmes on regular basis in order to be updated and up-skilled on the use of ICT. TVET teachers through the use of ICT resources can effectively present abstract or difficult concepts for student's easy understanding and comprehension. TVET teachers would also benefit from this study when they are presented in workshops, seminars and conferences.

The findings further revealed that overall educational systems would improve when technological innovations are utilized in the provision of valid and quality information and attending to students individual learning differences. Not only TVET programmes but other departments will see the need to adopt ICT into teaching and learning process for capacity training of teachers and students.

5.3 Contribution to Knowledge

1. TVET teachers should pursue learning how to use ICT resources by participating in workshops and training programmes to increase effectiveness.

2. The government should make sure there are enough funding available for TVET programmes to build the ICT infrastructure they need for the teaching and learning process.

3. According to the demands of the 21st century, government and policy makers should train TVET teachers in ICT skills both before and during employment.

5.4 Conclusion

Conclusively, the application of ICT in TVET is the integration of ICT resources in the teaching and learning process of TVET programmes. The use of ICT in education has become a non-negotiable constant for effective teaching and learning. It is therefore not surprising to see a growing demand for the application of ICT into TVET programmes around the world. ICT resources are vital tools for enriching and facilitating observations, enhancing memory retention resulting in effective teaching and learning. ICT does not only reinforce learning but also supplement teachers' effort to put knowledge and skills transfer across. With ICT teaching and learning in TVET programmes would be interesting rather than laborious and stressful. The recognition of the application of ICT calls for its adoption by every TVET institution as compulsory.

Based on the findings of this study, it is concluded that ICT resources and facilities should be provided to meet a high standard of availability to facilitate effective teaching and learning process. Teachers ICT competency level is very low which indicates that ICT training programme should be well plan to improve their basic computer literacy. Overall, ICT enablement in TVET

programmes is very low, TVET policy maker, training providers, donors and funding agencies need to focus on this because for TVET programmes to remain relevant and attractive, they need to identify and introduce digital skills and competencies for the changing world of work and to utilize the opportunities provided by digitization.

5.5 Recommendations

Bases on the findings of this study and conclusion drawn, the following recommendations were made;

1. TVET teachers should pursue acquisition of skills in using ICT resources by attending workshops, training programmes, and seminars for enhanced effectiveness.

2. Government and policy makers should train TVET teachers pre-service and in-service on ICT skills based on the 21st century requirements.

3. Government should ensure adequacy of funds that will enable TVET programmes put in place necessary ICT resources and infrastructure for the teaching and learning process.

5.6 Suggestion for Further Studies

1. A study should be carried out to determine the extent to which TVET programmes in Technical Colleges in Niger State are funded for effective implementation of ICT in TVET programmes.

2. A study should be carried out to determine strategies for effective implementation of ICT in TVET programmes in Technical Colleges in Niger State.

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REQUEST LETTER TO VALIDATE

Industrial and Technology Education Department
Federal University of Technology,
P.M.B. 65,
Minna,
11th January, 2022.

Dear Sir,

REQUEST FOR FACE VALIDATION OF INSTRUMENT FOR ASSESSING THE APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) FOR TEACHING AND LEARNING IN TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) PROGRAMS IN TECHNICAL COLLEGES IN NIGER STATE, NIGERIA

I am an undergraduate student of the above named address currently undertaking a study on the topic: ASSESSING THE APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) FOR TEACHING AND LEARNING IN TECHNICAL AND VOACTIONAL EDUCATION AND TRAINING (TVET) PROGRAMS IN TECHNICAL COLLEGES IN NIGER STATE, NIGERIA.

Attached is the draft copy of the instrument. As an expert in this area, your assistance is hereby solicited to enable me accomplish this task. Kindly go through the item to verify their clarity, relevance and appropriateness in the use of language. In addition to this you can also make further suggestions that will improve the status and quality of the instrument. Your contribution to this work is highly appreciated.

Thanks

Yours faithfully,

AYANDOKUN, JANET
2016/1/63719TI

Department of Industrial and Technology
Education,
Federal University of Technology,
P.M.B. 65,
Minna,
14th April, 2022.

Dear Respondent,

REQUEST FOR RESPONSE TO QUESTIONNAIRE

I am a final year student of the above mentioned institution, undertaking a study titled:
"Assessment of the Application of ICT for Teaching and Learning in TVET Programmes in Technical Colleges in Niger State, Nigeria". Your objective responses are highly needed in ascertaining the facts under investigation. Please feel free and open to share your mind objectively, for your responses have great impact on the findings. All collected responses will be used only for this research and treated with confidentiality.

Thank you

Yours faithfully

Ayandokun, Janet

2016/1/63719TI

PART A

QUESTIONNAIRE: on assessment of the application of ICT for Teaching and Learning in Technical and Vocational Education and Training (TVET) in Technical Colleges in Niger State, Nigeria.

INTRODUCTION: Please complete this questionnaire objectively and sincerely by checking the column that represent your opinion or perception about the above topic

Personal Data

Name of College _____

Years of experience

a). 5-10 years   ☐

b). 11years and above   ☐

PART B

RESEARCH QUESTION 1

To what extent is ICT applied in the teaching and learning process of TVET programmes in Technical Colleges in Niger State?

Use the rating scale to indicate the item that best describe your level of agreement

1. Low Extent (LE)
2. Moderate Extent (ME)
3. High Extent (HE)
4. Very High Extent (VHE)

S/N	ITEMS STATEMENT	LE	ME	HE	VHE
1	Audio clips are used for teaching and learning				
2	Video clips for teaching and learning				
3	Digital library for teaching and learning				
4	Internet search engines (Google, Chrome) to achieve self-directed learning				
5	Online group discussions/ forums				
6	Online tutorial for self- learning				
7	Online dictionary (Wikipedia) for teaching and learning				
8	Computer simulation (simulating real world phenomenon in 3-D to demonstrate difficult, complex concepts) for teaching and learning				
9	Educational games/video games in the classroom to improve manipulating skills and creative thinking				
10	Online drill and practice session for mastery				

RESEARCH QUESTION 2

To what extent is ICT resources (hardware and software) for teaching and learning utilized in TVET programmes in Technical Colleges in Niger State?

Use the rating scale to indicate the item that best describe your level of agreement

1. Low Extent (LE)
2. Moderate Extent (ME)
3. High Extent (HE)
4. Very High Extent (VHE)

S/N	ITEMS STATEMENT	LE	ME	HE	VHE
1	Desktop computer				
2	Voice amplifiers (microphones)				
3	Digital camera for recording information				
4	Multimedia projectors				
5	Printers				
6	Flash drive for storing materials				
7	CD/DVD for storing information				
8	Microsoft word				
9	Microsoft PowerPoint to create presentations				
10	Microsoft Excel				
11	Social network platforms for discussions (WhatsApp, Facebook among others)				
12	Zoom				
13	Graphic software (Photoshop)				

RESEARCH QUESTION 3

What is the level of TVET teachers ICT competency for teaching and learning in TVET programmes in Technical Colleges in Niger State?

Use the rating scale to indicate the item that best describe your level of agreement.

1. Strongly Disagree (SD)
2. Disagree (D)
3. Agree (A)
4. Strongly Agree (SA)

S/N	ITEMS STATEMENT	SD	D	A	SA
1	I know how to download and view PDF file				
2	I know how to create document using Microsoft word				
3	I can save documents in the desired location on the desktop				
4	I know how to retrieve documents from the place of storage on the desktop.				
5	I know how to use web browsers to get access to information (Google, Chrome, Opera mini among others)				
6	I can use Microsoft PowerPoint to present data				
7	I know how to use spreadsheet software (Microsoft Excel)				
8	I know to use a printer to print materials by myself				
9	I know how to access educational materials from online libraries				
10	I know how to send E-mails				