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Coupling TPACK Instructional Model with Computing Artificial Intelligence Techniques to Determine Technical and Vocational Education Teacher's Computer and ICT Tools Competence

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Research Article

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ABSTRACT

Emerging technologies have changed workplaces through computers and ICT tools, which have revolutionized teaching and learning environments differently. Although computers and ICT tools have become instrumental in teaching and learning, most educators cannot incorporate them into their teaching and learning. Subsequently, this results in students who are ill-equipped or lack some necessary skills in the work world, leading to low performance and poor handling of tools, and thus, low production. Therefore, we aimed to investigate the Technological Pedagogical Content Knowledge (TPACK) model, TVE teachers competence regarding computer and ICT tools for classroom teaching and learning and the competence level required by TVE teachers for computer related instructional technology for classroom teaching and learning. Three hundred (300) participant TVE teachers from six north-eastern state technical colleges of education in Nigeria were cluster selected, and questionnaires were administered to them. The results will be essential to educational institutions, the Ministry of Education, industries, and researchers. Traditional linear models, *viz*: Multi-Linear Regression (MLR) developed with SPSS software, and Artificial Intelligence (AI) models, specifically Artificial Neural Networks (ANN), Adaptive Neuro-Fuzzy Inference Systems (ANFIS) and Least Square Support Vector Machine (LS-SVM) developed with MATLAB 9.3, were used to analyze the data quantitatively. The results from our study indicate that TVE teachers are competent in computers and some instructional technology usage and show a high correlation between competence and teaching experience and a lower correlation between competence and gender. The goodness of fit leads to a good fit of the model. Future studies should examine the application of other linear and nonlinear AI techniques.

Keywords: Artificial intelligence; TPACK; Teachers; Competence; Computer; TVE

INTRODUCTION

Globalization fuels the need for training teachers of the present and future eras, specifically the establishment of modern culture, on an elementary level, of teachers work and the preparation of competent teachers and instructors, which is one of the most vital angles of the concept of instruction modernization. The rapid development of information and communication technologies has generated new knowledge and skills distinct from those of the previous century. As the world relies more on technology due to the pervasiveness of computers, ICT tools and the advanced web, there is a developing need to enable individuals to acquire this pre-requisite knowledge to meet the needed demand for training youth. Incorporating technology has now become a requirement in teaching and learning processes, necessitating high levels of ICT knowledge. The integration of computers to improve instructive learning in this modern period may be a significant issue for its integration into teaching and learning. Computers and other ICT tools have provided teachers with many opportunities to incorporate different curricular subjects and substantially accelerated teaching and to learn research. Materials, instructional content analysis and devices used by teachers are linked to constructivism, collaboration, investigation, and a pedagogical shift. According to studies conducted by Oladosu K, et al., in various developed and information-based countries around the world, computer technology will never be able to replace teachers. However, teachers will continue to be the key players in unlocking the true hidden potential of the learners through the use of computer technology in education. As a result, teachers must be literate in computers and ICT tools and be equipped to use them in classroom teaching and learning. Teacher training institutes should prepare teachers to incorporate and use technology and understand how technology can help learners acquire essential skills. A professional, competent teacher should establish conditions for developing new technologies and ideas that can be used to build a complex framework of interrelationships with the world. VTE programs have a crucial role in every country's social and economic growth and development by providing skilled human beings [1].

Today's concern is not so much about the worth and importance of VTE but how to ensure relevance, flexibility, and value in an era of globalization. In order to provide a quality workforce in the training industry, delivered courses and programs must comply with technological advancements at the manufacturing site. This scenario is improving steadily across disciplines. The best TVET systems are focused on coordinating their performance to be comparable to other specialized development areas. The recent shift aims to turn the skeptical views of TVET away from second-class schooling and toward developing skilled trade individuals. Utilizing computers in this domain is because it incorporates experimental learning, improves, and upgrades students accomplishments, offers genuine research materials, and encourages more prominent cooperation, individualization, autonomy from a singular data source, and global understanding. In a study conducted by Atman Uslu N, et al., it was found that information and communication technologies comprise apparatuses such as smartphones, iPhones, tablets, laptops, individual computerized associates, projectors and versatile DVD players, utilized by encouraging classroom teachers. As supported by Asenso-okyere K, et al., computers and other technologies are essential tools for innovative teaching and play a significant role in the interactions between teachers and students [2-9].

A study by Oladosu K, et al., opined that computer information and communication technologies, information technology or computer related technologies consist of electronic devices that reshape the world in all aspects of human endeavors. It is recognized that information and communication technologies through computers are vital skills for the present generation to meet the global standard, and these skills are necessary for modern education systems worldwide. TVET teacher training's most important role is to encourage teachers to obtain training to allow them to prepare their students not only for today but also for tomorrow's modern society and the world of work. Although there is a rapid increase in the adoption and usage of computers across the globe, the story is different in Nigeria and other West African countries, as the adoption and use of various computer technology based education systems in the region continue to fail. Previous studies conducted by Romeo G, et al., clarify the need to integrate technologically instructive and content learning with the pervasive development of these studies of nature and innovative technologies needed to investigate the effect of teachers competence in computers and other ICT tools. Traditional methods of instruction are beginning to lose viability as teachers and instructors are increasingly responsible for teaching with modern technologies. The fruitful utilization of ICT in schools requires an interest in the framework and progressions in the abilities of teachers and instructors to incorporate these new devices into teaching and learning. To set up methodical instruments to facilitate educators expert improvement. It is essential to show the skills required for utilizing ICT in schools and classrooms, which will reduce the poor performance among graduates in the work force resulting from teachers low competence during teaching and learning [10].

Despite the support of computers as teaching and learning tools, it has often been found that teachers in schools are generally reluctant to facilitate the use of computers in the curriculum. There are limited empirical studies about the TVET computers and ICT tool competencies. However, no study developed on the TVE teacher's competence, background, and information and communication technology profiles, mixed with the support they receive from the teachers training institute on computer-related technologies or ICT tool competencies. A definitive study defining a technical and vocational teacher's computer technology competence has not been attempted despite this assertion. This study contributes to the current novelty literature. Therefore, this study investigates TVE teacher's competence in computer and ICT tools and their demographic backgrounds. They get some ICT characteristics enshrined in the

support they get from teacher training institutions on ICT, supported by the emerging application of computing intelligence. The objective of this study is presented as follows: (i) to investigate the competencies required of technical education teachers in using computers and other ICT technology tools in the classroom. (ii) to investigate competencies needed by vocational teachers toward computer innovative ICT technology for classroom teaching; (iii) to evaluate whether there is a relationship between technical and vocational teachers computer technology competency levels with specific demographic backgrounds; and (iv) to employ the artificial intelligence (AI) models in the TVE area [11].

Research motivation

The exponential growth of technology and internet connectivity has created a modern world that has impacted all aspects of people's lives the complexities of labour advertising for scholastically discharged youthful graduates. The requirement for social relations between regions, and insufficient social implications, to name a few factors, have increased the risk of youth disengagement from occupations. Despite exceptionally considerable speculation, introducing computers and other ICT equipment into the classroom is a more significant part of specialized and professional instruction. Instructors are not leveraging such instructive advances. Education financial experts in various countries have used ICT to improve instructional performance and make strides in the quality and adequacy of educational teaching and learning. The National Center for Instruction Measurements (NCES) announced that 100 per cent of schools within the joined together states had access to computer technology by the end of 2005. It may be that such a guess is not being realized [12].

TVET teachers prepare themselves and their students for a constantly changing environment. Education is not simply confined to teaching students according to a suggested plan at a specific school level. It has many outside goals, destinations, and various thoughts. As a result, preparation is becoming an increasingly important tool in the fight against deprivation, poverty, and establishing a developed nation. The progression of information technology development in all spheres of life, including education, is a feature of modern society. In general, the new advancements have been viewed as significant in creating and improving educational and learning conditions. Technology is a growing part of any society today; the application of technology in education has become a cornerstone of any country's efforts to improve learners performance in higher institutions. Education influences almost every area of our daily lives and covers different specializations. Education is a process in which learners gain knowledge and skills. The spread of knowledge has become crucial in this process, opening its doors to every technology that affects learning.

Despite the widespread benefits of ICT innovation in instruction, a report demonstrated that in recent years some nations in the developing African region were appraised lower than the world regarding ICT reception take up in training. Most technical and vocational educators have consistently had to cope with the problem of working with innovative technologies that are in a steady state of change. Besides, vocational instructional teachers consistently had the duty of preparing students for a changing world of work. These concerns suggest to vocational educators that they don't have the luxury of resting on recently learned work abilities and information. Vocational instructors must educate themselves concerning recent improvements in their specialized professional expertise. Research centers around the viability of computer use and its contributions to the education of specialized and professional courses and technical and vocational teacher's caveats have been given insufficient consideration. Most African countries are experiencing low skilled labour shortages, hindering, and jeopardizing their further economic growth and development. To fill this gap and control this crucial issue, technical and vocational education teachers constitute the main key factor. Technical and vocational education teachers have consistently needed to adapt to the difficulty or dilemma of working with innovative technologies in a steady state of flux since they have the obligation and responsibility of preparing individuals for the ceaselessly developing world of work [13].

A limited number of studies have been conducted regarding TVET impressions of computer utilization in teaching and learning. To address this gap, this paper aims to investigate the competence needed by TVE teachers regarding computer and ICT tools for classroom teaching and learning. The anecdotal evidence about the quality of technical and vocational education graduates in the world of work sounds different today when discharging duties, especially related to recent technologies, which lead to inadequate performance, low efficiency, and limited production in companies. The computer and its related technology have become a powerful instrument used for teaching and learning in higher education. It's a single instructional technology instrument used in subjects like science, technology, or language. Indicated that, generally, technical, and vocational teachers in tertiary educational institutions in Nigeria don't have competence in computers and related technological advancements in their classrooms for teaching and learning [14].

Although technical and vocational education teachers are eager to advance in information development, discoveries show that they have not yet reached the ideal level. The fast convergence of computer innovations into technical and professional vocational classrooms has left numerous professional educators ill equipped to use these contemporary instructional innovative technologies adequately. Technical and vocational education teachers who lack competencies will lead to unproductive teaching and learning processes, which, in turn, might negatively impact the graduates quality. TVE teachers competence should be emphasized more to guarantee that the technical and vocational education and training graduates are highly calibres and ready to address the issues in production sectors. Along these lines, this study attempts to investigate and portray the present expert skills, knowledge, clarity, and

preparation needs for computer innovative technology competence among vocational and technical education teachers in Nigeria. However, the computational motivation of this study was carried out by reviewing a decade of reported literature from a renowned database. A bibliographic software was used to visualize over 2000 documents to assess the feasibility, occurrences, and interest in TVET combined with ICT based learning. Figure 1a indicates the popularity of this topic with TVET as the keyword, while Figure 1b shows the application of TVET with ICT based education. Considering Figure 1b, there is still a wide range of global gaps in the field of TVET with the Internet of Things (IoT) and machine learning applications [15].

Figure 1(a). The major keywords used over the literature on TVET (2005–2022) (2000 documents)

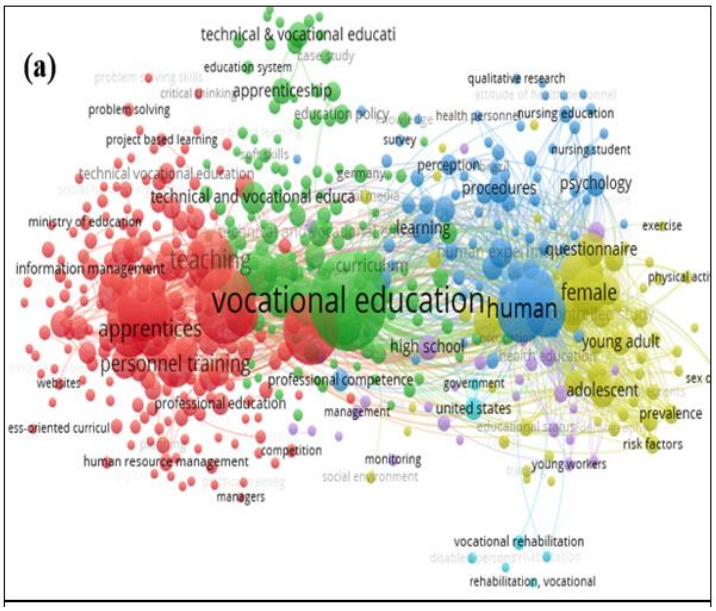
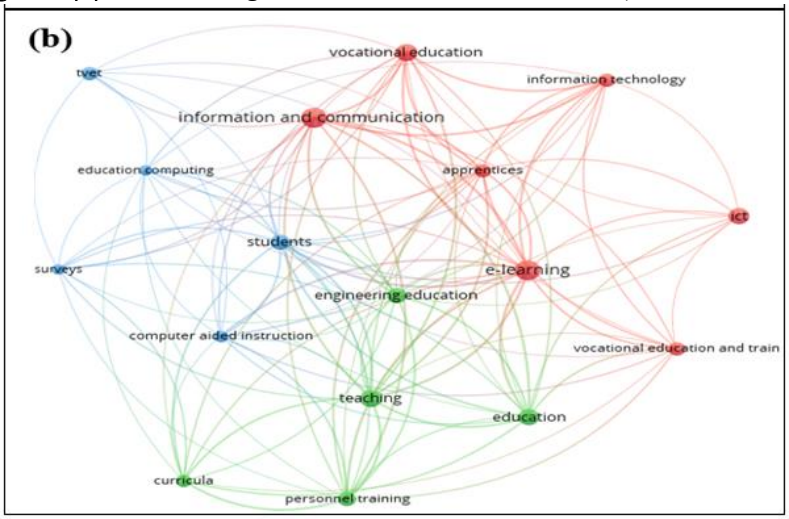


Figure 1(b). The investigated the research on TVET-ICT (50 documents).



Theoretical and conceptual frameworks

This study is backed by the theory of reasoned action, planned behaviour and a trying approach. The idea of Reasoned Action (TRA) was developed and proposed as an improvement over information integration theory, which is explicitly concerned with behaviour intention and persuasion. However, it recognizes the situation that limits the influence of attitude on behaviour. The approach also uses two elements, attitudes, and norms, to predict behavioural intent. The theory laments attitudes towards behaviours, subjective norms, and perceived behavioural control, which shape an individual's behavioural intentions and behaviours. The Theory of Planned Behaviour (TPB) has evolved from the rational action theory. The subjective norms (*i.e.*, social influences), perceived behavioural controls and aspects of attitudinal attitudes are explored by this model. It splits them down into exact dimensions of beliefs. The Trying Theory (TT) promoted by Bagozzi RP, et al., centers around the appraisal of attempting to act and focuses on the assessments of TVET. In other words, attitudes toward reasoned activity are supplanted by attitudes toward trying, and expectations are limited to goals and attempts (Figure 2).

Figure 2. Proposed conceptual frameworks.

Education is not just a medium for information exchange and technology on a global scale but also funding, a means of market struggle, and a solution to geopolitical, socio-cultural, and ethical problems. As the computerization of education is increasing rapidly, educators are considered competent when they have three elements of competence: Knowledge, skills, and attitudes. Competent employees have the skills, capabilities, and knowledge to carry out their duties efficiently and effectively, and competent teachers can change the progress of student learning. Thinking (knowledge, skills, attitudes) and application occur within the organization through behaviour elements of competence [16].

Concept competence

Historically, educational systems are the functional approach that has long prevailed and is predominant in many palaces. In the 1970's, there was a shift from the logic of content to a goal teaching process. Most school programs today agree on putting competence at the center of the curriculum. However, the notion of expertise is far from being fully stabilized. It is understood in many distinct ways and expressed in the curriculum across various variants. Competence derives from the Latin word "computer," which means "capable" and refers to a person's ability to have the desirable aptitudes, facts, frames of mind, attitudes, or lead to carry out a specific action. In this study, the word "competency" is used synonymously with the different term "mission." Competency is the core of knowledge or abilities required to deliver critical outputs. According to the Oxford advanced learner's dictionary, competence is the ability to achieve something efficiently, productively, or admirably [17].

Competence is the collection of demonstrable competencies, features, and abilities that empower the effectiveness or enactment of a job to be improved. According to the business dictionary, competence is a collection of related skills, commitments, experience, and abilities that enable a person (or an organization) to behave effectively in a job or situation. Competence as the "ability to adequately apply learning outcomes in a defined context (education, training, and job or career development)" is a qualification accomplished learning outcome. Competency refers to those measurements of conduct lying behind equipped execution. In light of the fact that they are proposed to depict how individuals carry on when doing their jobs, they are frequently referred to as "conduct abilities." According to Lee CJ, et al., competence is a set of related aptitudes, capacities, information, and conduct that can impact the achievement and quality of a laborer's activity. A person's competency is the capacity to apply their learning aptitudes and disposition to finish a given errand that can be assessed. Competency can be characterized as the capacity to use many abilities, information, and attitudes to effectively play out a given task or employment. Classifications have been described as an occupation's specific, critical work section. Within each order, a different number of progressively related abilities can be combined [18].

The American Society for Training and Development (ASTD) indicates that competencies are a sign of a genuine profession. As never before, the American Society for Training and Development (ASTD) is supporting its individuals and the field of learning and improvement with a model intended to form the profession's future. According to Mulder M, et al., competence is viewed as the conventional, coordinated, and disguised capacity to convey practical, compelling (commendable) execution (including critical thinking, realizing development, and making change) in a specific expert area, work, role, organizational setting, and task circumstance. Competence is "a perceptible or quantifiable capacity of an on screen character to perform the vital activity in an offered setting to accomplish explicit results." Workers should have cognitive skills (knowledge), interpersonal skills, and technical skills to achieve their work. In this study, there are three domains: Technical competency, pedagogical competency, and personnel competency. Technical competence is the ability of a vocational teacher to apply knowledge and skills in technical fields. Pedagogy competence is the ability of a teacher to teach and convey theoretical and practical subjects. However, personnel competence is the attitude that should be developed by vocational teachers. Research competence is the mix of noticeable and quantifiable learning, aptitudes, capacities, and individual ascribed traits that enhance employee execution performance and eventually bring about hierarchical achievement.

Competency is a critical factor in evaluating the standard of TVET teacher skills connected to talents, expertise, attitudes, beliefs, and appreciations that are considered vital elements of career growth. In content delivery, skill acquisition, and classroom management, TVET teachers need to be competent. They should also be able to manage teaching aids, evaluate and evaluate pupils, provide suitable teaching methodology, understand students learning styles, address the student's demands within the classroom, and, most importantly, be a role model for learners. TVET

teachers are facing numerous challenges in Nigeria and other parts of the world, especially in developing countries. TVET educators, for example, do not have adequate experience in the new technologies and pedagogy. This would undoubtedly impact the skills of TVET teachers and, in turn, jeopardize their career growth. Pragmatic action will be used to solve the problem.

Teachers interpret and teach using computer technology

According to Baturay MH, et al., computer competence is a broad term closely connected to computer know how, computer abilities, computer attainment, and computer knowledge. The concept of computer skills has evolved in line with changes and needs in the field of information technology. International Society for Educational Technology (ISTE) has developed criteria for teachers and computer competence among pre-service teachers for teaching technology integration. They included the efficient use of technology in teaching and the promotion of digital citizenship to boost students creativity. Research study on preservice teacher's use of information technology in education has mainly focused on measures of self-efficacy, attitude, epistemological and pedagogical beliefs and individual differences in ICT tools use [19].

Technical and Vocational Education and Training (TVET)

TVET is a separate program that provides instructional methods that are scientifically and distinct from other educational systems. The TVET education system is paired with special skills for individuals interested in the vocational sector. The learning processes are designed to be suitable for the manufacturing world, emphasizing practical skills and work related issues. TVET is a vital part of national improvement designs in industrialized countries because of its effect on profitability and monetary and economic modern progression. TVET, regarding this examination, embraced the federal republic of Nigeria's definition in the national policy on education. As a "thorough term alluding as the part of instructive educational procedure including broad training to general education, the study of advancements and most sciences procurement of practical skills, attitudes, approaches, comprehension and information identifying with occupations in areas of the economic and social life". TVET is generally accepted as a critical driving force for skills development. Global socio-economic growth and technological advancement to fulfil the goals and objectives of the consistency of the program needs to be strengthened and maintained by TVET in Nigeria. Technical and vocational education is any form of training, collection, programming, students, or individuals that prepares them for practical work as semi-skilled laborers or expert specialists in a specific occupation.

As indicated by Afeti G, et al, the goal of TVET is to develop a person's aptitudes, skills, and information to find work to live comfortably. One of the essential aspects of TVET is its emphasis on jobs, and the educational strategy also emphasizes acquiring skills for gainful employment. Secondary schools in developing countries have technical and vocational education organizations that prepare students for college. The primary goal of all TVET initiatives is to secure abilities and skills for practical work in a specific occupation or employment. Personal or paid jobs, as necessary for related planning and career, are the cornerstone of the majority of the most excellent practices and approaches clung. TVET arrangements are found to train the skilled laborer's that the country needs to generate wealth and leave deteriorated penury. One distinguishing feature of TVE is that it is usually delivered at varying difficulty levels. This implies that TVET will respond not only to the needs of various industries but also to various needs [20].

Technical and vocational education suggests qualifying instruction ways that pro-vide people with occupation explicit information and practical abilities, independent of the place, substance, and training provider (international center for technical and vocational education and training, 2015). TVET includes training, preparing and aptitudes advancement identifying with a broad scope of word related fields, generation, administrations, and employments. TVET, as a segment of lifelong learning, can happen at all levels of education and incorporates work based knowledge, preparation, and professional advancement, which may prompt capabilities. TVET includes a broad scope of abilities and advancement openings receptive to national and nearby settings. Figuring out how to learn, advancing proficiency and numeracy aptitudes, skills transversal abilities, and citizenship aptitudes are indispensable segments of TVET.

TVET has a variety of objectives that differ by region. In Nigeria, TVET is part of the formal education system, which has been integrated into the three tiers of education (primary, secondary, and tertiary) to meet the nation's need for skilled labour and improve individuals economic status and countries in general. Qualitatively TVET is widely recognized as the cornerstone of all growth. Therefore, continuous improvement of the process is necessary to achieve national TVET objectives, which will lead to the achievement of national goals for creating quality human resources for self-sustaining national development. In Nigeria, TVE at the post elementary school level is planned to prepare students with the information, aptitudes, and characteristics to make a living (either independently employed or a business of work or be employable.

In line with this statement, the FRN in NPE states that:

"TVET is utilized as a distant coming to term alluding to those perspectives of the teacher procedure counting regardless comprehensive broad preparing; the investigation of progress and related sciences and the securing of practical and common sense abilities, aptitudes, outlines of intellect, understanding, and information distinguishing with occupations completely different divisions of the economic and open action NPE".

The policy further states that the goals of TVET are:

- To give prepared Labin the applied science and business, particularly at craft, advanced art, and specialized technical and vocational levels.
- To give the specialized and professional abilities necessary for Agricultural, business, and monetary improvement.
- To give preparation and impart important abilities to the individual who will be self-reliant economically NPE.

Incompatibility with the expressed objectives, the national policy on education further expresses that: The trainees completing technical college programs shall have three alternatives:

- Secure work toward finishing the entire course or after completing a couple of modules of employable abilities.
- Set up their own business and become independently employed and be able to engage others.
- Pursue further training ahead of time to create/technical programs in specialized tertiary establishments, for example, science and technical schools, polytechnics or universities of education (technical) and universities NPE.

Competence to integrate computer in Technical and Vocational Education (TVE)

Competence in TVE is gained by completing tasks that assist a person in acquiring employable skills. Competent individuals can apply knowledge and skills and demonstrate attitudes related to expected job activities in the teaching and learning processes. This proliferation of emerging technology greatly impacts the regular lives of individuals. Indeed, concerning societal interaction, teachers view digital communication technologies as indispensable. Abilities to facilitate computer innovations and technology instruction can be portrayed differently. Various affiliations have outfitted structures with Computer capacities for teachers. In different computer innovation frameworks, for instance, modernized capability, ICT in education and ICT aptitude. Computer technologies capacities recommended the specific usage of computer technologies, which is conceptualized as the fused and valuable use of advanced information, aptitudes, and perspectives. According to Chee Sern L, et al., the meaning of computer technology competency shifts from a tight specialized abilities based concentration to a more extensive, progressively encompassing idea of structuring academic information about innovation, including both instructional and psychological devices to encourage students learning. This study is presented because the computer has the potential to increase teacher competence and student motivation. As a result, the school has been asked to use the computer as an instructional assistant.

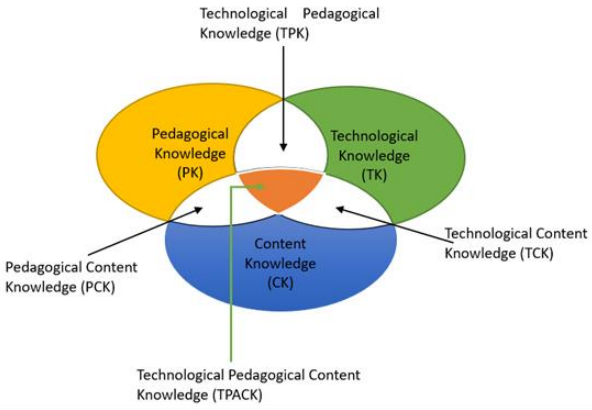
Technological Pedagogical Content Knowledge (TPACK) model

TPACK is the complex knowledge among technology, pedagogy, and content. TPACK is good primary teaching with technology. Pedagogic technic is the technology that uses constructively to teach the content. The knowledge of what makes that concept hard or easy to learn and how technology can overcome some problems. TPACK explains teachers abilities how to teach and learn from certain content through the pedagogy approach and technology in the curriculum because teaching and learning are found within the integration of computer application technology.

The rapid proliferation of ICT tools in the 21st century is through analysis of TPACK and teacher interaction capabilities. There are seven variables which influence TPACK namely (1) Technological Knowledge (TK) is the study about how to operate computer and relevant software, (2) Pedagogical Knowledge (PK) is the ability in learning management, (3) Content Knowledge (CK) is the subject matter such as science, mathematics, language and so on, (4) Technological Content Knowledge (TCK) is knowledge study about how the content can be examined or represent by technology such as using computer simulation to represent and study network topologies, (5) Pedagogical Content Knowledge (PCK) is knowledge how to represent and formulate subjects that make it understood by students, (6) Technological Pedagogical Knowledge (TPK) is knowledge about how technology can facilitate pedagogical approaches such as using game design to support practicum about Open Systems Interconnection (OSI) Layers computer networks, (7) Technological Pedagogical and Content Knowledge (TPACK) is knowledge about how to facilitate student learning from certain content through pedagogical and technological approaches (Figure 3).

Teaching is a dynamic cognitive task that allows teachers to draw on many forms of information. It is well understood. TPACK is a valuable conceptual tool for thinking, assessing, and reviewing what teachers need to know to incorporate technology into teaching. With suitable pedagogical approaches and selected technologies, TPACK can be viewed as an intuitive understanding of teachers for teaching subject specific content. Still, ultimately it needs to be used as a framework for how teachers can better develop this integrated knowledge.

Figure 3. The TPACK framework.



Technological Knowledge (TK)

TK is the basics of technology that can be used to support learning. For this reason, teachers need mastery of information processing and communicating with ICTs in education. Furthermore, mastering this technology is the demand of the 21st century, knowledge about various traditional and new technologies.

Pedagogical Knowledge (PK)

PK describes knowledge in depth related to the theory and practice of teaching and learning, including goals, processes, assessment learning methods, strategies, and others. Pedagogical knowledge needs consideration of cognitive, affective, and social aspects and the development of learning theory and how it can be applied in the learning process. "Understanding of how specific subjects, issues, or problems are structured, addressed, and adapted to the diverse interests and skills of learners;" and the "most valuable ways of representation of these concepts, most effective analogies, diagrams. Awareness of educational methods, ideas, and techniques for the management of classrooms and the coordination of subject matter was by several researchers.

Content Knowledge (CK)

CK communicates the information instructors get to instruct almost in their field. The perception within an area of research of knowledge systems, concepts, theories and skills. Domain specific knowledge about the subject matter that teachers are supposed to teach.

Technological Content Knowledge (TCK)

In formulating instructional goals, there is often misconception and scientific ego. For example, people who are experts in ICT are positioned as people who are only in the ICT field. ICT experts are needed as a catalyst, which is to facilitate understanding of the subject matter. Awareness of technical material recognizes technology in a particular topic or discipline; it reflects technology. TCK is included in understanding innovation and subject matter that can assist and impact other components.

Pedagogical Content Knowledge (PCK)

PCK includes the interaction and occurrence of intersection between Pedagogy (P) and subject matter (C). This consists of the learning process related to the subject matter being studied and the learning participant assessment system. The learning model is expected to make learning participants effectively. According to Hulya G, et al., PCK is the category of educational fabric mindfulness incorporates the central regularly instructed concepts in one's subject range, the foremost useful shapes of representation of those thoughts, the foremost compelling analogies, charts, examinations, depictions, and exhibits, in a word, ways of speaking to these thoughts.

Technological Pedagogical Knowledge (TPK)

TPK is a series of understanding how learning changes occur by utilizing the technology used to support active learning and can assist and simplify the concepts of the subject matter. In fact, with the presence of ICTs in learning optimally to open insights, participants learn to understand the subject matter that is microscopic, abstract, and complex. This is the role of ICT tools can be interpreted as a source of learning. As opined by Hulya G, et al., Technological pedagogical knowledge gets it how innovation can shape the ways of education.

MATERIALS AND METHODS

Complete research method

The research aimed to investigate TVET computer and some ICT tools competence, the relationship between computer and ICT technologies competencies (dependent variables) through the TPACK design model and different independent variables with teacher's demographic background. In the study, the TPACK design model was used to train the teachers and then later obtain the data from the TVET through the distribution of sixty (300) questionnaires to the institutions. Bauchi and Gombe state that Nigeria was chosen for the research study because six (6) higher educational institutions offer technical and vocational courses. Such as Abubakar Tafawa Balewa University Bauchi (ATBU), Aminu Saleh College of Education (ASCOE) Azare, and Abubakar Tatari Ali Polytechnic (ATAP). Institutions in Gombe include the Gombe State University (GESU), the Federal College of Education technical (FCE) Gombe, and the Gombe state polytechnic Bajoga. The two states were chosen because they share the same cultures and traditions. Bauchi state was established in 1976 when the former northeastern state was divided, and it originally included the region now known as Gombe state, which became a distinct state in 1997 created out of Bauchi. Only technical education institutions that have been in operation for more than seven years will be included in this report claim that it will take about seven to thirty years for an organization/institution to enter maturity level. Matured organization/ institution will be involved in this study for several reasons:

- All programs are functioning well and recognized in the community.
- Larger and more culturally diverse and specialized staff.
- Efficient and standardized operations.

Research sample

Agreeing to Liu Y, et al., population alludes to the total number of individuals or objects that can be included in investigating the subject. It might also be indicated as comprising the entire set of people that the researcher is curious about and to whom the investigation's discoveries can be generalized. This non-experimental consideration gives a numeric description or opinions of a population by considering a test of that populace. The sample of this investigation study were instructors who epitomized a better level of education in specialized and professional instruction in these states. Ten questionnaires were distributed to each institution. According to Ranjit kumar, et al., Cluster sampling is typically used when the population is substantial, such as when sampling a region, state, or nation. The sampling population is divided into clusters, and elements are selected from each group. The justification for the choice of cluster sampling in this study is that the people surveyed are spread across two (2); therefore, to save cost, time and transportation, cluster sampling was utilized for the study.

Research instrument

The study data were collected through structured questionnaires; the study survey comprises three parts. The primary portion one (1) contained the study consent form, which introduces the study to the members, highlights the reason for the research, and what is required from the teachers concerning the survey. It also states the benefits and risks associated with participating in the study, which is voluntary cooperation. Whereas the second portion of the survey contained respondents demographic information such as age, gender, years of teaching experiences, and level of education with forty four (44) questions from the three constructs: computer operation skills, perception of computer technology, and attitudes towards computer technology usage, using 5-point Likert scale 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree. Seven (7) experts validated the questionnaire, including a language expert from the educational sciences Near East university Nicosia, Cyprus and two subject experts from Abubakar Tafawa Balewa university Bauchi Nigeria and Aminu Saleh college of education Azare Cronbach alpha of 0.83 was obtained. The statistical analyses between the variables are presented in Table 1. Statistical analysis is, for the most part, utilized to get the science of the information to explore the common issues that can lead to erroneous comes about as well as a legitimate choice making based on the crude information.

Table 1. The statistical analysis between the variables.

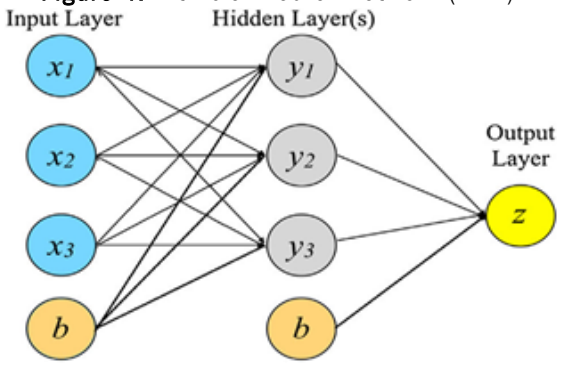
Variables	Mean	Median	mode	SD	Minimum	Maximum
N-INST.	3.42	3	2	1.7	1	6
A	2.67	3	3	1.08	1	4
G	1.15	1	1	0.35	1	2
LE	2.81	3	3	0.86	1	4
YTE	2.31	2	2	1.15	1	5
C	58.13	60	61	11.14	31	89
Note: N-INST: Name of Institution; LE: level of Education; G: Gender; A: Age; YTE: Years of Teaching Experience; and C: Competence						

Content validity ratios: Content validation refers to a process that aims to provide assurance that an instrument (checklist, questionnaire, or scale) measures the content area it is expected to measure.
Tally the number of "essential" ratings for the object or person in question.
Use the following formula, using the total number of experts (N) and the number who rated the object as essential (E):
CVR=[(E−(N/2))/(N/2)]
As an example, say you assembled a team of seven (7) experts, five (5) of whom rated the product essential:
CVR=[(5−(7/2))/(7/2)] CVR=[(5−3.5)/3.5] CVR=1.5/3.5 CVR=0.43
Interpret the results. CVR can measure between -1.0 and 1.0. The closer to 1.0 the CVR is, the more essential the object is. Conversely, the closer to −1.0 the CVR is, the more non-essential it is.
In this study, the CVR was 0.43. While that number is positive, it does show doubt in the product. Had six or seven experts agreed that the item was useful, the result would be 0.80 or 1.0, respectively, which is much better. Conversely, if only one expert thought the item was useful, then the CVR would have been −0.80, which shows the item is not very essential.

Artificial Intelligence (AI) and regression models

Artificial Neural Network (ANN): Artificial Neural Network (ANN) is the foremost standard utilized discovery model because of its promising ability and capacity to anticipate, predict, and illuminate highly complicated or complex input-output relationships. ANN is a framework structured subordinate to computational investigation to mimic and imitate the human brain's strategy to handle the information. It involves different neurons as processing units associated with customizable weight and inclinations. Back Propagation Neural Network (BPNN) is among the comprehensively used ANNs. In BPNN, the learning setting is alluded to as a ceaseless method through which the tendencies and the affiliation loads are adjusted till the yield is acquired. This procedure may be managed or even unsupervised. Supervised learning is commonly utilized to limit the between the figured and the ideal worth. Learning rates expect a tremendous activity by portraying the organization's knowledge through joining the organization framework system and in this manner restricted the issues of close by least. The fundamental purpose of the BPNN is to decrease the blunder altogether for the framework to get comfortable with the readiness data. Sigmoid and the Lave berg Marquardt (LM) were utilized separately as actuation restrain and calculation, as presented in Figure 4.

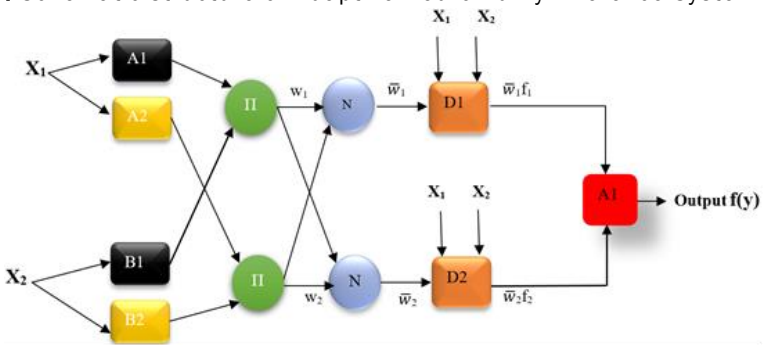
Figure 4. Artificial Neural Network (ANN).



Adaptive Neuro-Fuzzy Inference System (ANFIS)

Adaptive Neuro-Fuzzy Inference System (ANFIS) or Neuro-Fuzzy (NF) or non-direct model filled in as one staggering displaying device because of the way wherein NN's learning capacity and Fuzzy Logic (FL) are both used to make a steady half breed frame work structure. ANFIS has been filled in as the general approximate that mixes NN and FL's capacity to create a system fit for managing complex, non-straight associations be-tween a great deal of information and yield. Generally, Tsumoto, Sugeno, and Mamdani are three sorts of ANFIS, to be explicit Tsumoto, Sugeno, and Mamdani, whereby the surgeon's framework structure has more broad applications. There are various kinds of interest work, for instance, three sided, sigmoid, Gaussian, and trapezoidal. The overall design of ANFIS is showed up in Figure 5. FL was shown to hand questionable wonders participated in any methodology and incorporates the change of data into fluffy characteristics through cooperation limits. Hubs that fill in as participation capacities (MFs) essentially grant the appearance between the relations of the commitment with the surrender. There are different sorts of intrigued restrain, for instance, three sided, sigmoid, Gaussian, and trapezoidal. Below is the architecture of ANFIS.

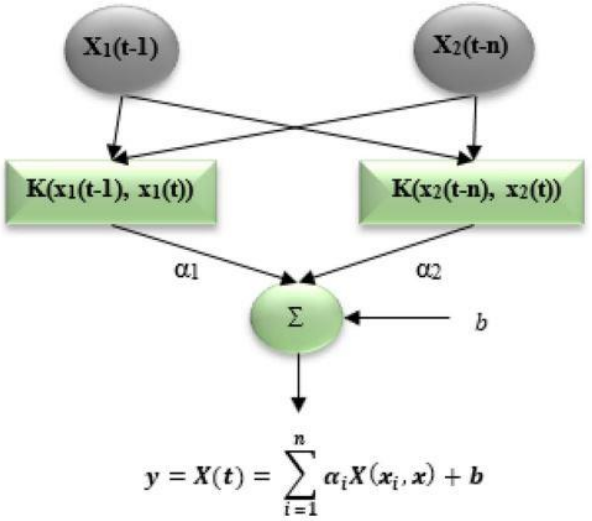
Figure 5. Schematic structure of Adaptive Neuro-Fuzzy Inference System (ANFIS).



Least Square Support Vector Machine (LSSVM)

The Least Squares Support Vector Machine (LS-SVM) algorithm is an improved algorithm of the standard SVM, which provides a computational advantage (reduces the computational burden) over the standard SVM by converting the quadratic optimization problem into a system of linear equations. In the LS-SVM algorithm, a solution is obtained by solving a linear set of equations instead of solving a quadratic programming problem involving the standard SVM. The LS-SVM can be used for both classification and regression problems. Refer to the studies of Ghorbani, et al. and Zhou, et al., for more information about the LSSVM model (Figure 6).

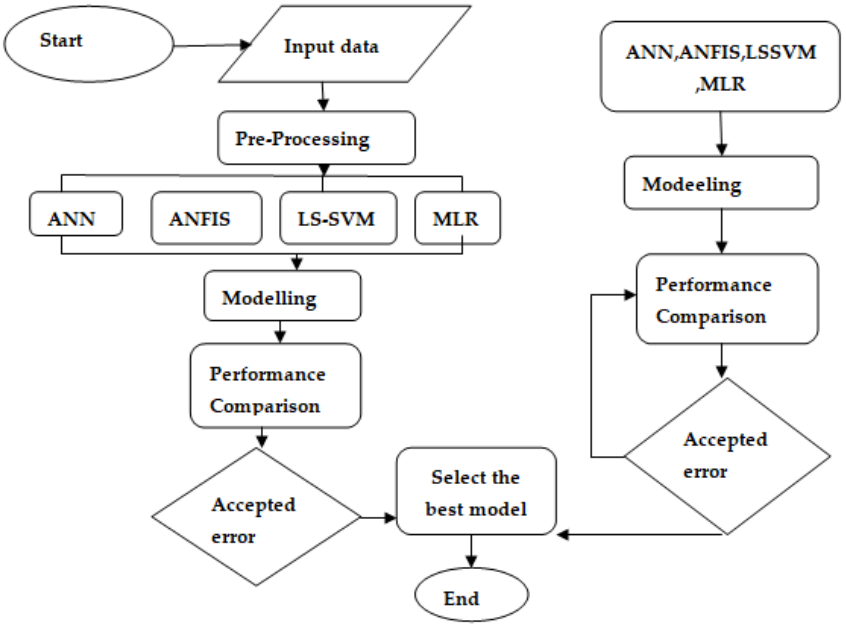
Figure 6. Least Square Support Vector Machine (LS-SVM).



Multilinear Regression (MLR)

Regression models are generally used to predict the extent of the correlation between the parameters of inputs and outputs. Linear regressions are usually fitted using the least square approach. However, other methods can be used equally, such as limiting the “lack of fit” in some of the standards or reducing the penalized variant loss of the least square function as for the ridge regression. Linear regression is primarily separately categorized into two major product divisions and simple linear regression. Linear regression is considered easy if a single input variable predicts the association between a single output. However, the purpose is to calculate the relationship among two or more input variables in order to evaluate a model. The variables of the unit criterion are known as multilinear regression. MLR, in which each input parameter value is associated with the output variable value, is the most commonly used form of linear regression in various fields of study. It is known that MLR shows a straight line correlation in terms of excellent estimates of all data points concerning both the output and the target variables. As per, the MLR model is the broadly utilized sort of linear regression that includes an investigation whereby each esteem from the independent factors is recognized with a dependent subordinate variable worth. Commonly, MLR incorporates the estimation of the degree of association that exists between a single reaction variable for illustration of the conditional and two or more indicators for illustration of free components (Figure 7).

Figure 7. General flowchart of the proposed methodology.



RESULTS

The results of the study parameters competence on Name of Institution (N-INST.), Age (A), Level of Education (LE), and Year of Teaching Experience (YTE) were presented. Three different AI based models (ANN, ANFIS and LSSVM) and one classical model (MLR) were employed to forecast/prediction of Competencies (C) using other input variables known as dependent variables. For any data driven techniques such as ANN, ANFIS, LS-SVM and MLR, data pre-processing is essential to determine the proper output as such correlation matrix between the observed data was carried out to evaluate the strength and relationship between the variables (Table 2). The raw data of both the input and output can be visualized in Figure 8.

Figure 8. The trends of the raw data used in this study.

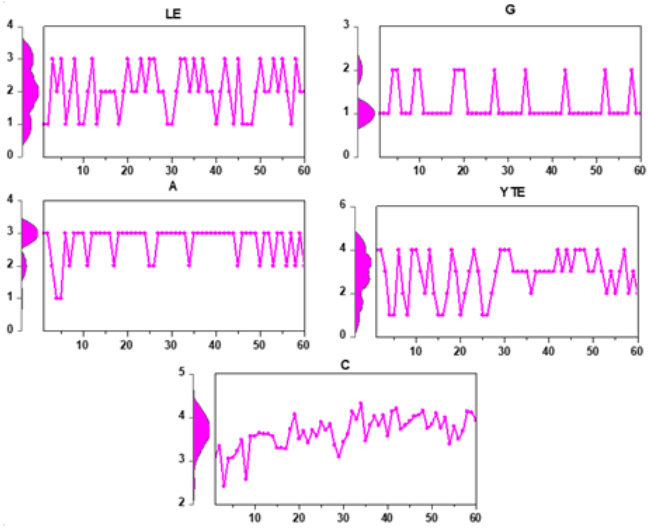


Table 2. Spearman Pearson correlation.

Variables	N-INST	LE	G	A	YTE	C
N-INST	1					
LE	0.14159	1				
G	0.026383	0.164416	1			
A	0.073422	0.093488	0.212289	1		
YTE	-0.00287	-0.19078	0.081641	0.685346	1	
C	0.028742	-0.02307	-0.07468	-0.05358	-0.034	1

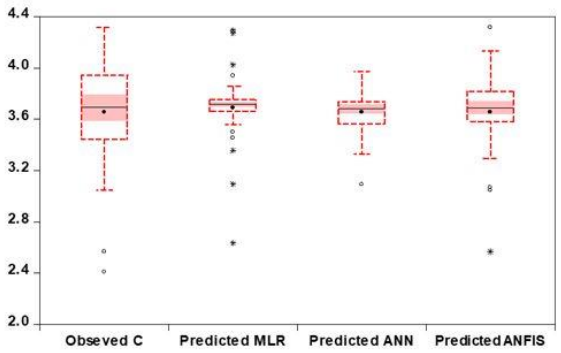
For the improvement of the models, MATLAB 9.3 was utilized within the ANN, ANFIS and LS-SVM models, whereas the classical linear MLR demonstration was created using the SPSS software. Finding suitable hidden nodes is the fundamental inclusion of any ANN has shown in arrange to side step overfitting problem. As has been detailed in several works of literature within the field of science and engineering, there's no exact standard strategy for determining the suitable number of hidden neurons. In this consideration, trial and mistake strategies were utilized to the assurance of covered up neurons. For the case of ANFIS demonstrate, various enrollment capacities (MFs) and epoch cycles were investigated utilizing trial and mistake to distinguish the leading structure. Table 3 appears the comes about the execution analysis for the used approaches.

Table 3. Performance efficiency of the models.

Training				Testing					
Model	Variables	R^2	RMSE	MSE	R	R^2	RMSE	MSE	R
MLR	N-IST+LE+G+A+YTE	0.0155	0.1936	0.0375	0.1245	0.0167	0.1827	3.34E-02	0.1294
ANN	N-IST+LE+G+A+YTE	0.9685	0.0345	0.0011	0.9841	0.9997	0.0028	8.16E-06	0.9987
ANFIS	N-IST+LE+G+A+YTE	0.2746	0.1662	0.0276	0.524	0.0787	0.1739	0.0302	0.2806
LS-SVM	N-IST+LE+G+A+YTE	0.0002	0.1951	0.038	0.0124	0.0261	0.1836	0.3372	0.1618

Table 3 shows the training and testing part by dividing the seventy five (75) percent of data for training and twenty five (25) percent of data for testing. The ANN model provides higher accuracy than the ANFIS, LS-SVM and MLR model for the prediction of C using N-IST, LE, A, G, and YTE. However, concerning goodness of fit (R^2), the performances of the four models are not satisfactory for the prediction of C. This is because of the low correlation coefficient between some variables and the target value. Even though the prediction results in terms of R^2 are very low, AI based models have shown promising capability and wider percentage differences about the traditional linear models. According to Table 3, it can be quantitatively concluded that the ANN model as universal approximate increased the prediction percentage over ANFIS, LS-SVM and MLR up to 11%, 12% and 19%, 21% for training and testing, respectively. This powerful nature of ANN is the ability and capacity to anticipate, predict, and illuminate highly complicated or complex input-output relationships. More comparisons of the results can be visualized using the box plot diagram shown in Figure 9. From the plots, it can be observed that the ANFIS model was spread with the agreement of the observed value (C). Finally, the extent of the far and near outliers are associated with MLR and ANN models. This justified the prediction performance of the ANFIS model.

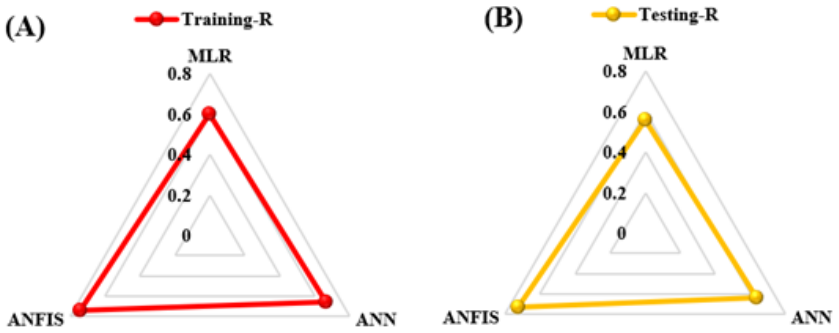
Figure 9. Boxplot between observed C and predicted model.



Furthermore, the predictive results can be described in terms of the correlation co-efficient. Generally, the higher the R, the better the prediction accuracy and vice versa. It was reported by Hadi SJ, et al., that the correlation value

greater than or equal to 0.7 is satisfactory. Hence, according to the results obtained from Table 3, ANFIS with R=0.7406 and 0.7262 for both the training and testing phase, respectively, emerged satisfactory. This conclusion can also present in a radar chart diagram, also called a spider chart (Figure 10).

Figure 10. Radar chart diagram of ANFIS, ANN and MLR models.



Regarding error differences, the three models were evaluated in terms of MSE, as shown in Table 3. The error graph is shown in Figure 10. From the figure, the ANFIS model outflanked the other two models and therefore proved merit. The prediction accuracy of the ANFIS model is quite promising because the ANFIS model reduced the prediction error by 2%, 1% and 7%, 4%, for ANN and MLR in both the training and testing phase. The incapability of MLR regression is associated with its linearity pattern of handling the data. The overall comparisons of the three models are presented in Figure 11. From the figure, it can observe that predicted values from both the three models are graphically demonstrated and visualized in respect of scatter plot and histogram to show the distribution and the unique R coefficient among the three models (Figure 12).

Figure 11. Error bar graph of three models in term of RMSE, and MSE.

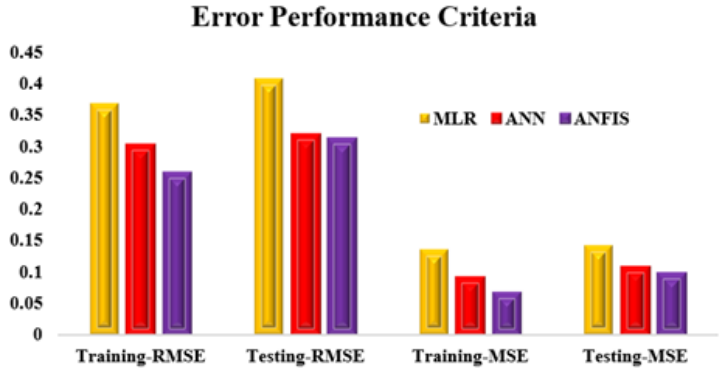
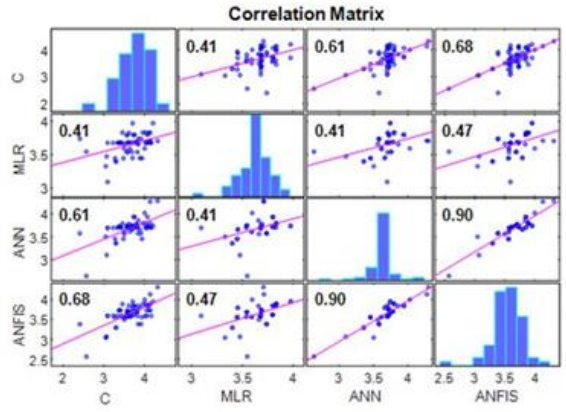


Figure 12. General comparison between three models in terms of scatter plot, histogram and Correlation coefficient.



DISCUSSION

Vividly, digital, and analogue technologies are likely to be extensively used for teaching and learning at all levels of education. Despite the limitations, the study contributes to the literature on TVE teacher's competence for computer

educational technology use in several ways. The study also examined the influence of computers and related ICT tools technologies among technical and vocational teachers competencies toward using these technologies in their classroom teaching. It explored the relationship between technological and vocational teacher's computer competencies with their demographic background and data collected in two states higher educational institutions for technical and vocational education teachers in northeastern Nigeria.

The testing and training data were done corroboration by two AI nonlinear models and one linear model. The outcome of both predicted and targeted output values for all the models was good, showing competence among the teachers in computer and ICT tools technology, as shown in Figure 6 boxplot between observed Competence (C) and predicted model; the result is like that of Alazam AO, et al. The basic ICT skills, particularly computer use as the main target of this study among TVET teachers. The results discovered that most teachers possessed the knowledge of using essential word processing functions. This indicates that when it comes to the word processing skills among the TVET teachers. The teachers had been found to have frequently used the internet and social media, mainly using their cellphones, and a few used their personal computers. Generally, the internet can be easy to access in Sudan from the teacher's side, but it is not free. It depends on the internet package, period, and price.

Table 3 appears the Spearman Pearson relationship between the dependent and independent factors. Spearman Pearson's relationship characterizes how well the relationship between the elements can be depicted by employing a straight work. The strength of the correlation isn't subordinate to the course or sign. A positive coefficient shows that an increment within the first parameter would compare to an increment within the second parameter. In contrast, a negative relationship demonstrates a converse relationship whereby one parameter increments and the second. Can be seen from Table 2 shows there is a high correlation between Competence (C) and Level of Education (LE), then Age (A), educational level and gender. The correlation between Competence (C) and Gender (G) is 0.04839, indicating less relationship between the two variables. At the same time, the strong relationship was demonstrated to be with the Level of Education (LE). There's a significant and positive relationship between computer competence, attitude towards Computer Aided Education (CAE), and deliberate innovation acknowledgement. Seen convenience and satisfaction have a positive relationship with attitude towards CAE. Although perceived ease of utilizes additionally has a significant positive relationship with the attitude towards CAE, it does not anticipate the attitude towards it.

Furthermore, the predictive results can be described using a correlation coefficient. Generally, the higher the R, the better the prediction accuracy. It was reported by Asnake Metekia W, et al., that the correlation value greater than or equal to 0.7 is satisfactory. Hence, according to the results obtained from Table 3, ANFIS with R=0.7406 and 0.7262 for both the training and testing phase, respectively, emerged satisfactory. This conclusion can also present in a radar chart diagram, also called a spider chart (Figure 7). Regarding error differences, the three models were evaluated in terms of MSE, as shown in Table 3. The error graph is presented in Figure 8. The ANFIS model outflanked the other two models from the figure and proved merit. The prediction accuracy of the ANFIS model is quite promising because the ANFIS model reduced the prediction error by 2%, 1% and 7%, 4%, for ANN and MLR in both training and testing phases. The incapability of MLR regression is associated with its linearity pattern of handling the data. The overall comparisons of the three models are presented in Figure 9. From the figure, it can observe that predicted values from both the three models are graphically demonstrated and visualized in respect of scatter plot and histogram to show the distribution and the unique R coefficient among the three models.

This finding is like those of competencies: those aptitudes, learning, mentalities, and qualities identified with educating and preparing inside the circle of TVE and training. Also, similar to the study conducted, according to the report, teachers ICT skills were mild, and the vastly more significant part of instructors who took part in this think about was direct users of computer ICT devices within the classroom. Teachers ICT skills differed significantly based on demographic factors such as gender, age, years of teaching experience, and type of ICT training. Furthermore, this study was consistent with that of Daramola FO, et al., that educators in Nigerian tertiary establishments have specialized aptitude in computers to empower them to show students computer technologies to be competent teachers. Similar to a study conducted by Koruroglu CH, et al., which emphasized that these days the utilization of innovation isn't a benefit but a commitment to make learning more retention and provide teachers competency. This finding is like, indicating that VTE teachers place themselves at a similar degree of digital competence, with a few differences across profiles in some of the sub-competences. Moreover, multiple regression analysis high lights the prominent role of attitude towards technology and digital tool use frequency among the personal factors that contribute to Teachers Digital Competence (TDC) development.

A similar study conducted by Buntat Y, et al., TVE teachers competency in Computer innovation is fundamental to the chance that they are to be successful instructional leaders as they use and move this competency to their students. A study by Gundogdu K, e al., demonstrated that educators in the two nations had a positive attitude toward using computers and other technology tools in schools. They regularly imagined that computers might create teachers inspiration, abilities, intrigue, and accomplishment if they were utilized successfully. They likewise imagine that the future will also be founded on knowledge, information and innovation. The result is in line with the study conducted by Markauskaite L, et al. Teachers should apply their computer teaching expertise and skills and use their business experience to contribute to a wider understanding of knowledge and teaching to establish successful strategies in TVE. Furthermore, to determine if there is any relationship between competencies in technical and vocational teachers with their demographic background, the study indicates a high correlation between competency and years of teaching experience flows by competency and age, competency and level of education and competency and gender.

The correlation between competency and years of teaching experience while the least is the correlation between competency and gender, about 0.04839. This result supports the study by Arif S, et al., to examine teachers attitudes and perceived competency toward computer and ICT tools. The result shows that most teachers with encouraging knowledge running between nine to fourteen years (9 years–14 years) have a positive attitude toward using computer technologies. According to Adodo SO, et al., his study demonstrated a considerable contrast between the male and female teachers toward Computer innovation aptitudes. The connection between attitude and competency was most minor but significant as the connection between gender and competency was noteworthy. The study's findings are like the survey conducted by Omar MK, et al., which showed that expertise, abilities, and characteristics played a significant role in ensuring the degree of competency of teachers.

CONCLUSION

Even though technology has always played a significant role in human life, it has only recently evolved into an integral part of our everyday lives. It was doubtful that education would not fall behind when technology was being absorbed so quickly. As evidenced by the continuous participation of computer ICT tools in teachers educational needs in OECD TALIS studies, expertise in technology has become a need rather than a need for educators. The fact of technology's incorporation into education has become an essential factor in the academic climate. It is not enough to make teachers competent in technical knowledge in an authentic way like education that must be considered in many aspects and has many affecting variables. Long term continuous teacher growth, knowledge sharing among trainers, partnerships and teacher engagement and encouragement from educators and leaders. Along with the results, the teacher's comprehension was found to be the most crucial factor in defining the competence of TVET teachers. The result is similar to a study conducted by Scherer R, et al., also found that teachers needed ongoing support and opportunities to gain trust in the use of ICT, and experiment with new technologies. Administrators were also significant factors affecting the willingness of teachers to integrate with their lectures, ICT. Based on the results of the current report, it is proposed that teachers computer knowledge and skills should be continually assessed to enhance their competency in using computers.

In addition, measures for mandatory implementation of computer based content delivery are recommended, including computerized pre and non-instructional practices. It is essential to consistently develop the level of computer skills through daily training sessions. The more trained teachers are in technology, pedagogy, and technology and pedagogy integration, the more computers are used in teaching and learning. Therefore, teacher competence in the use of computers may be an essential factor in deciding the use of computers. It is assumed that an awareness of different competencies related to the use of computers by teachers will empower policymakers and decision makers with helpful knowledge to support the formulation of strategies to implement the widespread adoption of computer use in the teaching and learning process. These variables should, therefore, be considered when educating. The authorities decided to encourage teachers to take full advantage of using ICT to improve the method of teaching learning. Leaders in the Nigerian ministry of education empower technical and professional vocational instructors to upgrade their computer and innovation related abilities to have the option to coordinate innovation in their classes. In conclusion, in case of innovations to be utilized as apparatus to bolster the instructive destinations. Such as aptitudes for discoveries and surveying data participation, communication, and issue understanding are crucial for students planning for the information within the society.

Furthermore, the results of this study contribute to the existing literature regarding teachers. Since TVE teachers in Nigerian tertiary institutions have competencies in using computer and ICT tools technology in their classroom and think about the gadgets as valuable for instructing, it's suitable to guarantee those good opportunities are available for Nigerian TVE teachers to use them and beyond. Recommendations for teachers and professional development: There is no barrier to computer technology training among all teachers, regardless of their levels and computer training experience. Further studies can be conducted using the same methodology but in different states and zones in Nigeria to generalize the results. This research is quantitative, but further research could be either qualitative or mixed method through interviews, observation, and questionnaires to get in depth information about computer technology competencies among TVE teachers.

Author Contributions

For research articles with several authors, the following statements should be used “conceptualization, Idris Adamu, Sezer Kanbul; methodology, Idris Adamu, A.G. Usman and S.I. Abba.; software, A.G. Usman and S.I. Abba.; validation, Idris Adamu, Sezer Kanbul, A.G. Usman and S.I. Abba; formal analysis, Idris Adamu, A.G. Usman and S.I. Abba.; investigation, Idris Adamu, Sezer Kanbul, A.G. Usman and S.I. Abba; resources, Idris Adamu, Sezer Kanbul, A.G. Usman and S.I. Abba.; data curation, Idris Adamu; writing original draft preparation, Idris Adamu.; writing review and editing, Idris Adamu, Sezer Kanbul, A.G. Usman and S.I. Abba.; visualization, A.G. Usman and S.I. Abba; supervision, Sezer Kanbul and S.I. Abba; project administration, Sezer Kanbul; funding acquisition, Idris Adamu and S.I. Abba. All authors have read and agreed to the published version of the manuscript.”

Institutional review board statement

Not applicable.

Informed consent statement
Not applicable.

Data availability statement
Data is available based on personal request.

Conflicts of interest
The authors declare no conflict of interest.

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