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Technical and vocational education teachers computer competencies using artificial intelligence

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Abstract

Aim: This article investigates the knowledge and skills required by teachers of Technical and Vocational Education (TVE) to effectively implement computers and related technologies in the classroom.
Method: The survey used a structured questionnaire with 44 items about the participant's knowledge, opinions, and feelings regarding computer operation. TVE instructors at six different northern Nigerian tertiary technical institutions were each given one of sixty questionnaires to administer to their teachers (Bauchi and Gombe). Multilinear Regression (MLR) and Artificial Intelligence (AI) techniques, such as Artificial Neural Networks (ANN) and an Adaptive Neuro-fuzzy Inference System (ANFIS), were used to analyze the data (ANFIS). While the ANN and ANFIS models were developed using MATLAB 9.3 (R2019a), the classical linear MLR model was created in SPSS.
Findings: The results show that teachers in technical and vocational fields are highly proficient in using digital tools, with a strong relationship between competence and teaching experience and a weaker relationship between competence and gender.
Implications/Novel Contribution: This will help scholars, administrators, and teachers in Nigeria, as well as the Nigerian Ministry of Education.

Keywords: Teachers, Competency, TVE, AI

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INTRODUCTION

As the world becomes increasingly reliant on technology, rapid advances in information and communication technologies have led to the development of new skills that were unheard of a century ago. The 21st century has seen a proliferation of groundbreaking innovations, many of which are finding their way into today's progressive classrooms. As teachers, you must have a firm grasp on the reasons behind this shift so that you can use them to your advantage in implementing novel approaches to teaching and learning. There is no denying the central role that cutting-edge computer technology has come to play in the classroom.

Computers have been used successfully in education and learning since the 1960s. (Aydin, 2013; Meidrina, Mawaddah, Siahaan, & Widyasari, 2017) say that this is because computers allow for experimental learning, inspiration, improved student achievement, authentic research materials, better teamwork, personalization, independence from a single source of information, and a better understanding of the world.

Information and communication technology's role in the formation of skills appropriate to the twenty-first century is substantial. In this specific circumstance, the motive behind ICT utilization ought to be unequivocal in deciding the nature of the instructor's and learner's ICT use, as opposed to the time, frequency, or decent variety of innovation. (Atman Uslu & Usluel, 2019) found that information and communication technologies

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comprise apparatuses such as advanced cell phones, tablets, laptops, individual computerized associates, projectors, and versatile DVD players, which can be utilized to encourage classroom teachers. Consistent with the views of (Asenso-Okyere, Mekonnen, et al., 2012; Taher, Shrestha, Rahman, & Khalid, 2016). According to (Mueller, 2017; Oladosu, 2012), students and teachers benefit significantly from using computer technology in the classroom. Information and communication technologies, also known as computer-related technologies, are widely held to be a collection of electronic gadgets instrumental in fundamentally altering the landscape upon which humanity operates. Understanding how to use computers for information and communication is a crucial skill for today's youth to acquire to compete globally. It is also a requirement of the global education system of today.

Based on the results of prior research by Romeo, Lloyd, and Downes (2013) Sweeney and Drummond (2013), respectively. This study of nature and innovative technologies is essential for clarifying the need to integrate technological instructive and content learning and examining the growth of teachers' or instructors' competencies related to innovative computer technology.

Traditional teaching methods are becoming less effective as teachers are given more responsibility for students' education, as reported by Goldman and Martin (2016). Locals in their twenties and thirties grew up with computers, PDAs, workstations or laptops, and the internet as integral parts of their daily lives. Many countries have spent vast sums on school technology like computer labs and communication networks over the past few decades. However, investments in infrastructure and advancements in teachers' abilities to integrate these new devices into learning and teaching are required for the effective use of ICT in schools. Poor performance among graduates in the set employment caused by teachers' ill competency in teaching and learning can be remedied by demonstrating the skills needed for utilizing ICT in schools and classrooms as part of a systematic support instrument for teacher's expert development. Preliminary empirical studies compare the level of support provided by a teachers' training institute for ICT competencies to the teachers' levels of computer competency, background, and information and communication technology profile. This study aims to understand better the demographics of teachers in technical and vocational education, as well as the characteristics of and teachers available to them through information and communication technology (ICT) in teacher education.

Problem Statement

Anecdotal evidence suggests that graduates of TVE programs may need to be up to snuff when handling tasks related to modern technologies, which can negatively impact a company's performance, efficiency, and output. More numbers of trained workers threaten Africa's ability to advance economically. The role of TVE teachers in managing this critical issue is crucial. Teachers in technical and vocational fields, who are tasked with preparing students for a labor market that is rapidly evolving, have long faced the challenge of adjusting their lessons to keep up with the ever-changing nature of the technologies they use in the classroom. Technical and vocational teachers are reminded by this problem that they need to rely on their prior experience in the field.

As a single instructional technology instrument, the computer and its related technology have become an important tool for teaching and learning across all higher education systems in fields as diverse as science, technology, and language. According to Dauda (2015) and Isiyaku, Ayub, and AbdulKadir (2018), technical and vocational teachers in Nigerian universities often need more specialized knowledge to integrate Computers and related innovations into their curricula effectively.

Technical and vocational education teachers are eager to advance their knowledge of information technologies, but findings show that the field still needs to reach its full potential (Şad, 2012). Despite the rapid uptake of computer-based innovations in technical and professional vocational classrooms, many experienced teachers need the necessary skills to effectively implement these tools into their curricula. With the proper training, TVE teachers can effectively instruct their students, which could positively affect the quality of their graduates. To ensure that TVET graduates are of high quality and prepared to address the issues of the production sectors, it is important to emphasize the competence of TVE teachers. Because of this, the purpose of this research is to inquire into and portray the current expertise skills, the apparent vastness, and the preparation requirements regarding Computer imaginative, innovative technology among Nigeria's vocational and technical educators/teachers.

Background of Study

Teachers in Technical and Vocational Education (TVET) has a double responsibility: they must prepare their students and themselves for a dynamic and unpredictable world. Teaching students to follow a set curriculum designed for a given grade level is only one aspect of education. It's full of out-of-the-way places to go and ideas to ponder. Therefore, preparation is becoming an increasingly crucial instrument in the fight against homelessness and poverty and in establishing a rocketed-ahead nation. Recent years have seen rapid IT developments across all societal sectors, including academia. As a whole, the new developments have been seen to anticipate a considerable amount of action in creating and bettering educational and learning environments. Today, innovation is an integral part of any culture. Incorporating technological advances into classroom instruction has become a cornerstone of any nation's strategy to raise the bar for its college students. Education is a process through which students acquire knowledge and abilities; it has far-reaching effects and encompasses many fields of study. This process makes disseminating knowledge critically important, and it has thus welcomed every technological development that can affect it. Despite the widespread benefits of ICT innovation in education, a recent report showed that most countries in Sahel Africa were evaluated as inadequate globally regarding ICT reception take-up in education Tondeur, Aesaert, Prestridge, and Consuegra (2018). Most technical and vocational education teachers have faced the challenge of adapting to the ever-evolving nature of cutting-edge technological tools. Further, it has always been the responsibility of vocational teachers to ready their students for a dynamic labor market. These worries should serve as a warning to vocational teachers that they can't afford to rest on their laurels regarding student's newly acquired work skills and knowledge.

Teachers in the field of vocational education should always be learning more about what's new in their field. Despite the growing body of evidence supporting the efficacy of using computers in the classroom, the needs of technical and vocational teachers have received scant attention in the research. Only a small and carefully selected number of studies have been done on how technical instructors feel about using computers in the classroom.

Objectives of Study

The present study plans to inspect the TVE teacher's Computer innovation technology skills and competencies required in their classroom teaching.

1. To investigate competencies needed by technical education teachers towards computers and related innovative technology for classrooms instructions.
2. To investigate competencies needed by vocational teachers towards innovative computer technology for classroom teaching.
3. To evaluate whether there is a relationship between technical and vocational teacher's computer technologies competency levels with the specific demographic background.

Research Questions

1. What is the impression of technical education teachers competencies in computer technologies?
2. What are the competencies needed by vocational education teachers in computer technologies?
3. Is there any relationship between competencies in technical and vocational teachers with their demographic background?

Theoretical Framework

The research used the theories of reasoned action, planned behavior, and the trying approach.

The theory of rational action reasoned by (Bagozzi & Warsaw, 1990). While this is an improvement over previous work on integrating information, it still acknowledges that attitudes can only have so much of an impact on actions. The theory also utilizes attitudes and societal norms to foretell future behavior.

A theory that takes into account both an individual's beliefs and actions is the Theory of Planned Behaviour (TPB). According to the theory, an individual's behavioral aims and practices are determined by their attitudes toward behaviors, emotional standards, and perception of their degree of control over their behavior.

This is the Trying Theory (TT) popularised by (Bagozzi & Warsaw, 1990). Focuses on the evaluations of

attempted action. Furthermore, an attitude of trying replaces a perspective of reasoned activity, and all that can be expected is an attempt (Carsrud, Brännback, Elfving, & Brandt, 2017).

Conceptual Framework

The conceptual framework for this study.

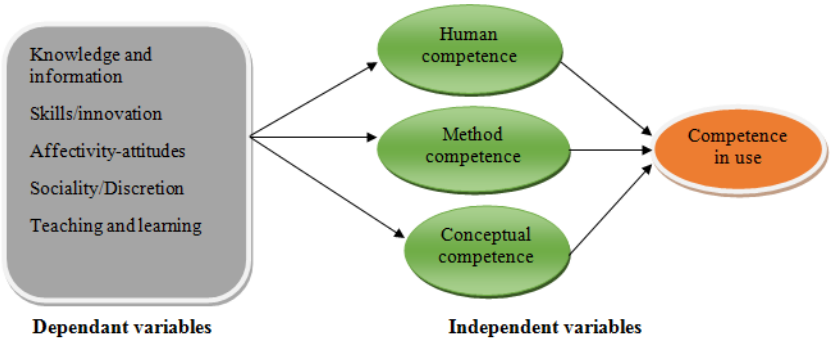

Figure 1. Conceptual framework for TVE competencies (Ellstrom & Kock, 2008)

LITERATURE REVIEW

teachers were considered competent when he or she has three element of competence viz knowledge, skills, and attitudes. Competent employees have the skills, capabilities, and competencies in carrying out their duties efficiently and effectively and competent teachers can affect the progress of student learning (Khuzainey, 2019).

Competency

Competency originates from the Latin word "competere," meaning "to be able to," and refers to a person possessing the desirable skills, knowledge, mindset, and direction necessary to carry out a given task successfully. In this research, "competency" is synonymous with the more general term "task" (Michael & John, 2002). Competency is defined as an essential set of skills and knowledge needed to produce valuable results. Tried to tell the difference between competence and competency:

- Competence: is the fitness portrays what individuals should have the option to do to play out a vocation well; the accentuation is on doing maybe in terms of accomplishing the ideal yield?
- Competency: is characterized as the measurements of conduct of relaying on equipped execution, frequently known as conduct abilities, because they are proposed to depict how individuals carry on when they do their employments.

Lee (2014) claims that Competency is defined as the knowledge, skills, abilities, and attitudes that affect the success and quality of a worker's performance in a given context. Competency is also defined as the ability to put learned knowledge into practice. In sum, Competency is the ability to effectively perform a given task or employment through applying a wide range of skills, knowledge, and attitude (Sern, Hamisu, & Salleh, 2018). It has been said that classifications represent a distinct and essential part of any given profession. Within each gender, you can find various combinations of progressively related skills (Abirafeh, 2009).

"Competence" is defined as "the ability to achieve something adequately or beneficially" and "the ability to achieve something splendidly" in the Oxford Advanced Learner's Dictionary.

The American Society for Training and Development (ASTD) has identified competencies as the sign of a genuine profession. The organization is now more than ever providing its members and the field of learning and improvement with a model that will shape the profession's future.

Competency is defined as abilities, learning capacities, and behavior that affect the core of specialized work Lee (2014). Competence can be defined as one's "ability to apply the learning aptitudes and disposition to complete the given errand that can be assessed" (Chee, 2018). Competence, as defined by Martin (2014), is the "conventional, coordinated, and disguised capacity to convey practical compelling (commendable) execution" (including critical thinking, realizing development, and effecting change) in one's field of expertise line of work, role within an

organization, and task context. Competency defined by (Chee, 2018) as: Perceivable and Measurable Learning, Aptitudes, Limits, and Individual Attributes that Contribute to Enhanced Employee Execution Performance and, Ultimately, Hierarchical Achievement.

Competency is characterized as "a perceptible or quantifiable capacity of an on-screen character to perform the vital activity in an offered setting to accomplish explicit results".

To do their jobs well, employees need to have a combination of cognitive (or knowledge-based) abilities, interpersonal (or people-oriented), and technical (or procedural). This research focuses on three areas of expertise: technology, education, and human resources. A vocational teacher's technical competence is the extent to which they can exhibit expertise in their respective specialized fields. Effective teachers will have the pedagogical skills to convey conceptual and procedural knowledge to their students. Vocational teachers should instill an attitude of competence in their students, as stated by the (Miadlikowska et al., 2014).

TVE

Because of its impact on profits, finances, and economic development, TVE is a crucial component of national improvement plans in developed nations (Glowacki, McGlone, & Bell, 2016) and Dike (2009). Concerning this study, TVE adhered to the Federal Republic of Nigeria's definition of TVE in the National Policy on Education Federal Republic of Nigeria 2004 as a "comprehensive term alluding as the part of the instructive educational procedure including, notwithstanding broad training to general education, the study of advancements and most sciences procurement of practical skills, attitudes, mentalities, comprehension, and information identifying with occupations in areas of telecommunications, broadcasting, and related media." Afeti (2007) TVE is a diverse range of training that prepares people for useful work as semi-skilled laborers or gifted specialists. The term "vocational technical education" (TVE) refers to the type of schooling that equips students with the theoretical and practical know-how necessary to enter the workforce, either as employees or as self-employed professionals.

The Value of Education (TVE) emphasizes developing skills and knowledge necessary for successful employment and independent living. TVE programs in middle schools in developed nations prepare students for careers in manufacturing and other service industries. All TVE programs should have as their primary goal the acquisition of knowledge and abilities useful in a specific occupation. The basis of related preparation and business, whether at home or for a living, is the foundation of the entire most incredible training and ways adhered to generally. Work is emphasized heavily, and students are encouraged to acquire the skills they'll need to find employment as part of the TVE curriculum. Successful TVE programs are found to produce the skilled workers a country needs to develop its economy and escape its dreary state of poverty. TVE is notable for having varying levels of complexity in its delivery. This suggests that TVE is less able to meet the needs of various types of factories than it is to meet the needs of students from a wide range of economic and instructional backgrounds who are looking for gainful employment and a decent standard of living. TVE is crucial for obtaining the proper specialized and innovative labor force (Afeti, 2009). Workers' ability could be an essential requirement that serves as a facility for mechanical and monetary improvement (Interntaional Center for Technical and Vocational Education and Training, 2017). TVE recommends various methods for delivering the knowledge and skills necessary to succeed in a given profession regardless of location, subject matter, or training provider. Training, preparing, and developing skills in various technical, vocational, and industry-related fields, products, services, and occupations are all part of TVET.

Lifelong learning, which includes TVET, can take place at any stage of a person's education and encompasses understanding on the job and ongoing training and professional development that can lead to new skills. Additionally, TVET incorporates various skills development opportunities adaptable to national and local contexts. The ability to learn, the development of literacy and numeracy skills, the acquisition of transferable skills, and the acquisition of citizenship skills are all crucial components of TVET (Tondeur et al., 2018).

In Nigeria, TVE at post-elementary school is designed to prepare students with the information, aptitudes, and characteristics for independent workers or a business of work or labor (Onyene, Olusanya, Salisu, & Johnson, 2007).

Based on the above postulate, FRN in NPE explain that: TVE is utilized as a distant coming to term alluding to those perspectives of the teacher procedure counting regardless wide broad preparing, the investigation of signs

of progress and related sciences and the securing of practical and commonsense abilities, aptitudes, outlines of intellect, understanding and information distinguishing with occupations completely different divisions of the economic and open action (Federal Republic of Nigeria, 2004).

The goals of TVE are

i To give prepared labor in applied science and business, particularly at craft, advanced art, and specialized technical levels.

ii To give specialized and professional abilities important for farming, business, and monetary improvement; iii To prepare important abilities for individuals who will be self-reliant economically (Federal Republic of Nigeria, 2004).

In compatibility of the expressed objectives, the NPE expresses that: Anybody who finishes a technical college program has three choices:

i Secure work toward finishing the entire course or after a few modules of employable abilities.

ii Set up their own business and become freely utilized and have the option to utilize others

iii Seek after additional preparation early make/specialized program and in tertiary specialized technical establishments, for instance, science and technical schools, polytechnics, universities and colleges of education (technical) (Federal Republic of Nigeria, 2004).

Competencies Needed to Integrate Computer in TVE

There are various ways that a person can portray one's ability to facilitate Computer Innovations in Technology instruction. As a result of the efforts of many groups, teachers now have computer access to various frameworks for Computer innovation, such as updated capability, ICT in education, and ICT aptitude. Computer Technology skills suggested the targeted application of Computer Technology, conceived of as the integrated and beneficial utilization of cutting-edge knowledge, skills, and insights Markauskaite (2007). According to Tesolowski and Howard (2015), the meaning of Computer Technology competency expands from a narrow focus on specialized skills to an all-encompassing concept of organizing academic data on innovation, which now includes both technological and psychological means of motivating students to study.

METHODOLOGY

This study aims to learn more about the technical knowledge and expertise of TVE teachers and the correlation between these abilities and the teachers' demographic backgrounds.

Abubakar Tafawa Balewa University Bauchi (ATBU), Aminu Saleh College of Education (COE) Azare, and Abubakar Tatari Ali Polytechnic (ATAP) are all in the state of Bauchi, where the research was conducted, along with two other universities in Gombe state, both of which offer technical and vocational programs. Gombe State University (GESU), Federal College of Education Technical (FCE) Gombe, and Gombe State Polytechnic (Bajoga) are the three institutions that makeup Gombe.

Bauchi was formed in 1976 when the former northeastern state was divided, and it originally encompassed the area now known as Gombe state, which was formed in 1997, also from Bauchi. The two states also share similar cultural norms and customs.

Only colleges and universities offering technical degrees will be considered for this research. It's been hypothesized that it takes anywhere from seven to thirty years for a company or institution to reach full maturity Simon and Donovan (2001). For several reasons, we've decided to include a developed institution in our research:

(i) All programs are functioning well and recognized in the community

(ii) Larger and more culturally diverse and specialized staff

(iii) Efficient and standardized operations.

Research Sample

The population is the total number of people or things used in a study, as given by Mathews and Ross (2014). It could also include everyone in whom the expert has a vested interest and upon whom the study's findings can be extrapolated. This non-experimental study, by studying a subset of the population, provides a numerical description of their opinions (Creswell & Creswell, 2017). Teachers in these states who were selected because

they exemplified excellent TVE teaching practices were studied. According to Kumar (2018), Cluster sampling is usually carried out when the population is very large; in the case of a city, state or country, the sampling population is divided into groups called clusters, and elements are selected within each cluster. The justification for the choice of cluster sampling in this study is that the study population is spread across two; therefore, to save cost, time, and transportation, cluster sampling was utilized for the study (Kumar, 2018).

Research Instrument

The study data were collected through the use of structured questionnaires, comprised of demographics information and 44 items questions for competencies from the three constructs: computer operation skills, perception of computer technology, and attitudes towards computer technology usage, using 5 points Likert scale 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

The questionnaire was validated by five experts, three including language/vocabulary experts from the Educational Sciences Near East University Nicosia Cyprus and two subject experts from Abubakar Tafawa Balewa University Bauchi Nigeria. A Cronbarch alpha of 0.89 was obtained. The statistical analyses between the variables are presented in Table 1. The measurable analysis is commonly used to comprehend the study of the data to explore the common issues that can prompt inaccurate results outcomes just as an appropriate decision dependent on the raw data.

Table 1: The statistical analysis between the variables

Variables	Mean	Standard Error	Median	Mode	Standard Deviation	Minimum	Maximum
LE	2.0500	0.0963	2.0000	2.0000	0.7462	1.0000	3.0000
G	1.2000	0.0521	1.0000	1.0000	0.4034	1.0000	2.0000
A	2.7167	0.0676	3.0000	3.0000	0.5237	1.0000	3.0000
YTE	2.8500	0.1298	3.0000	3.0000	1.0055	1.0000	4.0000
C	3.6564	0.0494	3.6932	3.5682	0.3828	2.4091	4.3182

LE = level of Education, G = gender, A = age, YTE = Years of Teaching Experience, and C = Competencies.

Proposed AI and Regression Models

ANN

Since ANN has the potential to foresee or predict and shed light on highly complicated or complex input-output relationships, it is the most commonly used discovery model. ANN is a framework dependent on computational research that attempts to replicate how a human brain processes data (S. I. Abba & Elkiran, 2017). It uses different types of neurons as processing units, each linked to a set of preferences like size and lean. A backpropagation neural network is one of the most common artificial neural network (ANN) types. Learning in BPNN is described as a continuous process in which the tendencies and affiliation loads are adjusted until the desired output is achieved. This process can be supervised or left unattended. To reduce the discrepancy between the calculated and the excellent value, supervised learning is frequently employed (Hamed, Khalafallah, & Hassanien, 2004). By showcasing the organization's knowledge by integrating the organization's framework system, we can drastically increase the learning rate and minimize the problems in the immediate vicinity. For the framework to feel at ease with the readiness data, reducing the error rate is BPNN's primary objective. The Sigmoid function and the Lavenberg-Marquardt (LM) were employed individually for the activation limit and the calculation.

ANFIS

Neuro-Fuzzy (NF) or a non-direct model such as ANFIS is a mind-blowing visualization tool thanks to ANN's prodigious propensity for learning and Fuzzy Logic's (FL) steady half-breed framework structure. It has been determined that ANFIS is the general approximator that combines the strengths of ANN and FL to create a system suitable for managing complex non-straight associations between a large amount of information and producing (Pearce, Andersson, & Zimmermann, 2013). Tsumoto, Sugeno, and Mamdani are all types of ANFIS, with the latter two being more specific, but the Surgeon's framework structure is more general. Three-sided, sigmoid, Gaussian, and trapezoidal are some of the many shapes used in interest calculations. You can see ANFIS's overall structure in Figure 2. Cooperation limits are a key part of FL, allowing data transformation into ephemeral

qualities. FL has been demonstrated to produce doubtful wonders in any methodology. Coordination nodes act as participation capacities (MFs) in the same way that awards do, illustrating the commitment-yield relationship. Three-sided, sigmoid, Gaussian, and trapezoidal are examples of the many shapes used for interest limits (S. Abba, Nourani, & Elkiran, 2019).

MLR

Simple classifications may be used to calculate a single indicator in the traditional classical regression analysis, along with a solitary rule variable. Many regressions may provide estimates of multiple indicators, all while utilizing the same solitary rule variable. The ultimate purpose of this research was to conduct various linear regression analyses. According to Chen, Lin, and Liu (2015), MLR models are the most popular type of linear regression because they allow researchers to examine how each independent variable is linked to the value of the dependent variable. In most cases, MLR involves calculating the correlation between a single response variable (like the dependent) and a set of indicators (like the free factors). The MLR is expressible.

RESULTS AND DISCUSSION

Competencies (C) were predicted from a variety of independent variables using two artificial intelligence (AI) based models (ANN and ANFIS) and one classical model (MLR), as described above. Data preprocessing is crucial for determining the correct output of data-driven techniques like ANN, ANFIS, and MLR. A correlation matrix was constructed from the observed data to assess the reliability and closeness of the associations between the variables. The Spearman Pearson correlation between the dependent and independent variables is displayed in Table 2. The strength of a linear representation of the relationship between the variables is measured by the Spearman-Pearson correlation. The direction and sign have no bearing on the relationship's quality. When the coefficient is positive, it indicates that an increase in the first parameter corresponds to the rise in the second parameter; when it is negative, it indicates the reverse, that is, that an increase in one boundary corresponds to a decrease in the second parameter. C and YTE flow by A, LE, and finally, G have a strong correlation, as shown in Table 2. The low value of 0.04839 for the correlation between C and G suggests a weak connection even though YTE was implied to be the center of the close relationship.

Table 2: Spearman pearson correlation

Variables	LE	G	A	YTE	C
LE	1				
G	-0.03379	1			
A	-0.35347	-0.20859	1		
YTE	-0.57719	-0.13372	0.465081	1	
C	0.058458	0.048393	0.161418	0.222111	1

ANN and ANFIS models were developed in MATLAB 9.3 (R2019a), while the classical linear MLR model was built in SPSS. To avoid the fitting problem, the central feature of any ANN model is the ability to find suitable hidden nodes. Although it has been addressed in a few scientific and engineering literature pieces, there is yet to be a universal method for determining the correct number of hidden neurons. The identification of covert neurons in this research was accomplished through a trial-and-error approach. Experiments were conducted to determine the optimal structure for the ANFIS model, which involved exploring a variety of Membership Functions (MFs) and an age cycle. The performance evaluation outcomes of the utilized methods are displayed in Table 3.

Table 3: Performance efficiency of the models

		Training				Training			
Model	Variables	R^2	RMSE	MSE	R	R^2	RMSE	MSE	R
MLR	LE+G+A+YTE	0.3574	0.3696	0.1366	0.5978	0.3141	0.4096	0.1439	0.5604
ANN	LE+G+A+YTE	0.4376	0.3033	0.0920	0.6615	0.4035	0.3198	0.1089	0.6352
ANFIS	LE+G+A+YTE	0.5485	0.2580	0.0666	0.7406	0.5274	0.3140	0.0986	0.7262

From Table 3, its clear that the ANFIS model provides higher accuracy than the ANN and MLR model for the prediction of C using LE, A, G, and YTE. However, based on goodness-of-fit (R^2), the performances of the three models are not satisfactory for the prediction of C. This is because of the low correlation coefficient attained between the variables and the target value. Even though the prediction results in terms of R^2 is very low, AI-based models have shown promising capability and wider percentage differences concerning the traditional linear models. According to the results from Table 3, it can be quantitatively concluded that the ANFIS model as a universal approximate increased the prediction percentage over ANN and MLR over up to 11%, 12% and 19%, 21% for training and testing, respectively. This powerful nature of ANFIS could be attributed to the hybrid nature of its algorithm; that is to say, ANFIS consist of the knowledge of ANN and fuzzy logic. More comparisons of the results can be visualized using the box-plot diagram shown in Figure 2. The plots show that the ANFIS model was spread with the agreement of the observed value (C). On the other hand, the extent of the far and near outliers is associated with MLR and ANN models. This justified the prediction performance of the ANFIS model.

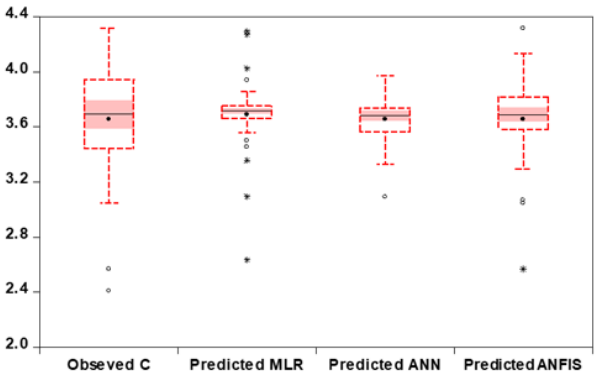

Figure 2. ANFIS model

Predictive results can also be expressed in the correlation coefficient, R, with a higher R indicating a more reliable prediction. According to S. I. Abba and Elkiran (2017)., a correlation coefficient of 0.7 or higher is considered optimal. Table 3 shows that ANFIS performed satisfactorily during the training and testing phases with a value of $R = 0.7406$. A radar chart, also known as a spider chart (Figure 3), can also be used to illustrate this conclusion.

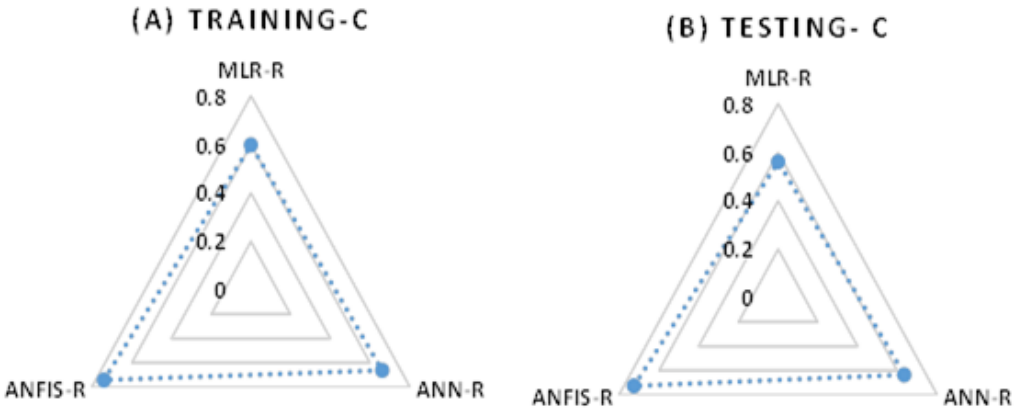

Figure 3. Training and Testing

Regarding error differences, the three models were evaluated in terms of MSE, as shown in Table 3. The error graph is presented in Figure 4; from the figure, it can be seen that the ANFIS model outperformed the other two models are therefore proved merit. The exact prediction of the ANFIS model is quite promising since 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 5. From Figure 5, it can be observed that predicted values from 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.

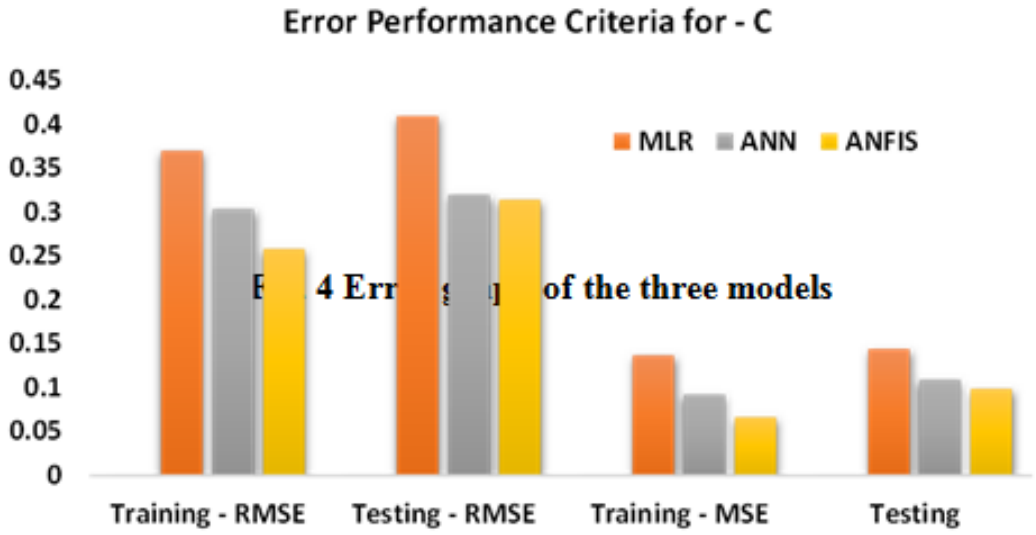

Figure 4. Error performance criteria for-C

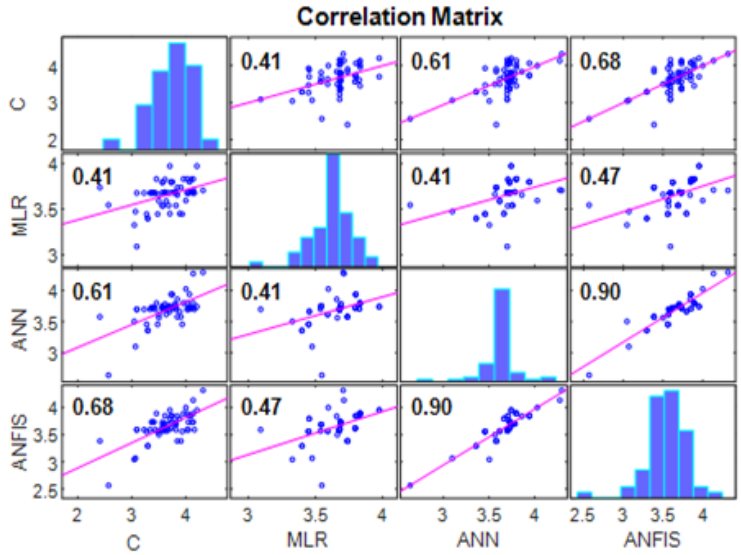

Figure 5. General comparison between the three models in term of scatter lot, histogram and R

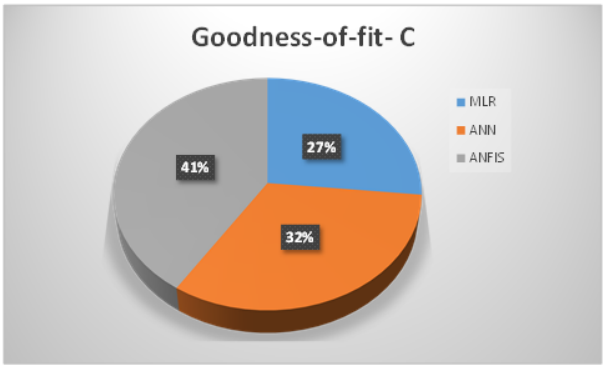

Figure 6. Goodness-of-fit C (competency)

CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

The research provided several important contributions to the literature on teachers' (TVE) competency for the use of computer-based educational technology in light of the widespread adoption of such tools for teaching and learning at all levels of education worldwide. This research looks at the competency levels of technical and vocational teachers with regard to the use of computers and related technologies in the classroom.

The researchers surveyed and gathered demographic information from TVE teachers in two states' higher institutions in the north-eastern region of Nigeria to better understand the connection between TVE teachers' computer competence and their personal histories. The quantitative portion of the study found that teachers in technical and vocational fields had high levels of competence regarding using computers in the classroom. This one corroborates the results of (Andersson & Köpsén, 2015). Competencies refer to skills, knowledge, attitudes, and character traits associated with teaching and preparing within the context of TVE and education. This research also corroborated previous findings by (Daramola, Yusuf, & Oyelekan, 2015) that professors at Nigerian universities possess the requisite computer-related expertise to equip their students with the knowledge they need to succeed in the digital age. This is in line with research by Daramola et al. (2015), which concluded that incorporating new methods into the classroom isn't a bonus but a necessity for improving students' ability to retain information and teachers' ability to impart it. Reference to a study by Dike (2009). The ability of TVE teachers to master new technologies and pass that knowledge on to their students is crucial if they want to be seen as effective teachers. Glowacki et al. (2016) conducted the research. Showed that teachers in both countries viewed the integration of attitudes favorably. They frequently speculated that, if used properly, computers could boost students' motivation, skills, interest, and success. They, too, believe that competence, knowledge, and originality will be the bedrock of the future.

Moreover, the research 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, suggesting a relationship between competencies in technical and vocational teachers and their demographic background.

Competency has a moderate correlation with years of teaching experience and a weaker correlation with gender (about 0.04839). These findings corroborate the research by Arif and Sidek (2015). Examining teachers attitudes and perceived competency towards computer technology shows that teachers with encouraging knowledge between nine to fourteen years (9-14ys) have a positive attitude toward using computer technologies. This research showed that male and female teachers have very different perspectives on the importance of computer-based innovation skills; the correlation between attitude and competence was weak but still significant, while the correlation between gender and competence was strong Adodo (2012).

As a result, the study's findings add to the literature about teachers. It is appropriate to ensure that adequate opportunities exist for Nigerian TVE instructors/teachers to utilize them and beyond, given that TVE teachers in Nigerian tertiary institutions have skills in using computer technology in the classroom and view the gadget as valuable for instructing. Therefore, when technical and vocational teacher's instructors deliberately infuse innovation throughout the instructors' training, plan of teaching, or curriculum, teachers will have a real chance to

develop the abilities necessary to educate with creativity.

There is no barrier to computer technology training among teachers of all levels and experiences, according to recommendations for teachers and professional development. It would be helpful to replicate this study in a larger sample size and across multiple states and regions in Nigeria.

In-depth information about TVE teachers' comfort with and use of digital tools could be gleaned from interviews, observations, and questionnaires in addition to the quantitative data gathered in this study.

The Nigerian government's education ministry encourages its technical and professional vocational teachers to improve their computer and innovation-related skills to coordinate the use of new technologies in the classroom.

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