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Application of ICT-Based Facilities for Teaching Among Technology Education Lecturers in Nigerian Tertiary Institutions in North-East, Nigeria

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ABSTRACT
The use of electronic aids in teaching and learning has experienced a steady growth within the Nigerian education system, especially at the tertiary institution level. The practice has grown from using just the desktop PCs in the 1980s to improve examination materials production and results processing to the present wide variety of technology use for instructional purposes. A key component to the success of some of the institutions has been technology specialists who deliver ongoing professional developments. This study which adopted a questionnaire-based field survey was specifically set-out to study how technology education lecturers (as master trainers) are integrating technology in their teaching and learning, taking into account several related variables including Technology Adoption in Teaching and learning, Challenges to Technology Adoption, Technology Anxiety among Lecturers, Available Technology Training Opportunities, Effects of Age, Gender and Teaching Experience of the Lecturers on Technology Adoption and other technology education lecturers' characteristics that will contribute positively to the adoption of available technology-based instruction for improved quality of teaching and learning in Nigerian tertiary institutions. This study discovered that as perceived challenges and technology anxiety increase, technology adoption in instruction by technology education lecturers decreases; whereas as technology availability increases and as technology lecturers use colleagues as training sources, technology adoption increases. The study also discovered that challenges to technology integration, technology anxiety, and the use of colleagues as a training source combine to explain a large proportion of the variance in technology adoption for instruction among technology education lecturers in North-East, Nigeria.
KEY WORDS: Technology Application, ICT-based Facilities and Lecturers' Adaptation.

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INTRODUCTION

In the past two to three decades the use of electronic aids in teaching and learning has experienced a steady growth within the Nigerian education system, especially at the tertiary institution level. The practice has grown from using just the desktop PCs in the 1980s to improve examination materials production and results processing to the present wide variety of technology use for instructional purposes. Such uses include the Internet, laptop computers, podcasting, e-learning platforms (e.g., Moodle, Blackboards and LMS), interactive whiteboards with video-capture technology, streaming videos,

and the use of iPod as a digital notebook. We have also moving from a local classroom to a global classroom via distance learning technology.

In the area of technology adoption in teaching and learning several tertiary institutions especially, at the university level and a good number of private colleges and universities in Nigeria have shown good examples of a school system with a 21st century infrastructure. Some of these institutions are already at the cutting-edge of technology, such as the ABTI American University of Nigeria, Yola, Adamawa State Nigeria and Afe Babalola University of Nigeria, Ado-Ekiti (ABUAD) (Isaac, 2011). Examples of their use of technology in instruction include PDAs and interactive whiteboards, podcast lesson reviews via students' MP3 players, and broadcasts streamed via the internet.

A key component to the success of these institutions has been technology specialists who deliver ongoing professional development. At the national level, the National University Commission's (NUC) futuristic philosophy as contained in the Benchmark Minimum Academic Standards(BMAS), (Federal Government of Nigeria, FGN, 2011) emphasizes improvement in internet communication systems and collaboration among students, staff, parents, and the community. Unfortunately, this is not yet the norm, for most Nigerian tertiary institutions. Not all the levels of the school systems are operating with this innovative use of technology even though more than 70 per cent of full-time lecturers at the tertiary institution level have access to computers and/or internet services, (Olaniyi, 2006; Quadri, 2012).

It is also noticeable that although the relevant government agencies are spending huge amounts of money on education to encourage technology for instruction, the evidence on ground in these institutions does not appear to have kept pace with the use of technology in schools over the last two to three decades. This apparent lag in the adoption of technology use in teaching and learning may not be unrelated to the lack of adoption of innovations. In this direction Rogers (2003) had argued that "How quickly individuals adopt change is related to whether they value the new approach when compared to their existing approach. Furthermore Fullan (2001) argued that the adoption of technological change is usually accomplished in three stages: adoption, implementation, and continuation. By this assertion, Fullan believes that teachers need time to merge their improved knowledge into their instructional practice as a basis for the acceptance of innovations.

Variables of Interest in this Study

In this study several important variables related to technology adoption in teaching and learning formed the major areas of concern, namely, Challenges to Technology Adoption, Technology Anxiety among Lecturers, Available Technology Training Opportunities, Effects of Age, Gender and Teaching Experience of the Lecturers on Technology Adoption. A few related literature materials have been presented here to justify this variables selection. These include Brinkerhoff's (2006) study on "Variables Related to Technology Adoption Barriers" which found that teachers often failed to build on technology's instructional potential due to barriers such as institutional and administrative support, training and experience, attitudinal or personality factors, and resources. These barriers are considered in this study as "challenges" and are defined as "any factor that prevents or restricts teachers' use of technology in the classroom". In another development the British Educational Communications and Technology Agency(BECTA) in 2003 had reported that teacher-level barriers in technology adoption for teaching included lack of time, lack of necessary knowledge, and lack of self-confidence in using technology, BECTA (2003). In another study Redmann and Kotrlik (2004), and Mumtaz (2000) in their findings concluded that technology unavailability was an important factor inhibiting the use of technology by teachers. Other Administrative-level challenges considered in this study include access to equipment, technical support, availability of up-to-date software, and institutional support. All these and other additional identifiable challenges considered in this report include lack of knowledge and skills, unclear expectations, and insufficient feedback, a lack of a clear, shared vision as a primary challenges. Other challenges of interest in this study include gender as identified by Kotrlik, Redmann, Harrison, and Handley in their study in 2000, the effects of Teacher's Age and Teaching Experience as indentified by Waugh (2004) and Mumtaz (2000) in their separate studies

Scope and Significance of this Study

This study covered several technology adoption variables which include technology education lecturers' characteristics that will contribute positively to the adaptation of available technology-based instructional materials to improve the quality of teaching and learning of technology education courses in Nigerian Technical/Technology programmes. This study has also addressed technology education lecturers' status and challenges in the use of technology in their instruction. This study was also conscious of several other studies that have been conducted in other countries in the areas of career and technical education. There are also several other studies but mainly outside Nigeria, which are related to technology adoption in technical education that clearly indicate that career and technical education

teachers should adopt technology for use in instruction (Chapman, 2006; Redmann & Kotrlik, 2004; Womble, Adams, & Stitt-Gohdes, 2000). All these studies have provided the spring-board and guide to this present study.

The author believes that the findings of this study would significantly contributed to streamline and encourage the efforts of educators, tertiary institutions and other agencies advocating for the instructional use of technology in teaching and learning to achieve maximum possible impact for quality education while creating wider access to education in Nigeria.

Research Questions

To effectively address the concerns of this study the following six research questions were raised:

1. What are the commonly needed demographic and personal characteristics of technology education lecturers to adopt technology-based instruction?
2. What are the Common Technology facilities Available for the lecturers to adopt for use in their instruction?
3. To what extent have the lecturers adopted technology for use in their instruction?
4. What are the major existing challenges that may prevent lecturers from using technology in their teaching?
5. To what extent do technology education lecturers experience technology anxiety when attempting to employ technology in their instruction?
6. To what extent do selected variables explain significant proportion of the variance in the lecturers' technology adoption?

MATERIAL AND METHODS

The study adopted a questionnaire and telephone- (voice calls & SMS) based field survey approach to generate the relevant data to investigate the indentified variables of the study, which include the lecturers' technology anxiety level, perceived challenges to technology adoption, technology resources availability, training sources used, age, years of teaching experience, and gender.

The population for the study was made-up of all technology education lecturers in federal tertiary institutions in Adamawa, Gombe and Taraba, and Bauchi states. A sample of 103 technology education lecturers were randomly selected based on Cochran's formula (Snedecor & Cochran, 1989). The data collection was basically through the questionnaire which was personally distributed by the researcher(accompanied with a letter of introduction), with the help of one research assistant from each of the institutions for the return of the questionnaires. Telephone follow-up calls/SMS was put across to the respondents whose questionnaires were delayed. Sixty-seven out of the 103 lecturers returned their questionnaire fully completed (i. e. 64.05% response rate).

To determine if the responses were representative of the population and to control for non-response error, the inferential t-test statistics was used to compare the scaled means of the technology adoption, challenges to technology integration, and technology anxiety scales for those responses received during the phone follow-up to those received by hand as recommended by Gall, Gall, and Borg (2002). These scales are described in the instrumentation section below and these scales were selected for non-response analysis because they were the primary variables of interest in the study. No statistically significant differences were found between the means by response mode for these variables (see Table 1); therefore, the data were considered representative of the population. The personally collected questionnaires and phone follow-up responses were combined for main analysis of this study.

Instrumentation

The questionnaire which formed the basic data gathering instrument contained a total of 31 items in three major sections, namely, technology adoption for use in instruction (15 items), challenges to technology integration in instruction (7 items), and technology anxiety experienced while attempting to use technology in instruction (9 items). All items used in the instrument were developed by the researcher, based on the review of related literature materials (some of which have been mentioned in the earlier part of this report). Five technology education professors from five different Nigerian universities carried out the face and content validation of the instrument in addition to three doctoral technology education students at Modibbo Adama Federal University of Technology, Yola, Nigeria. The instrument was pilot tested with vocational and technology education teachers enrolled for their post-graduate programs in Vocational and Technology education in Modibbo Adama Federal University of Technology, Yola, Nigeria.

A Cronbach's alpha formula based reliability of the three major sections was computed and the results were as follows: technology adoption, $\alpha = 0.98$; challenges, $\alpha = 0.84$; and technology anxiety, $\alpha = 0.98$. This result shows that all the item sections possessed acceptable reliability index within recommended

standards for instrument reliability based on Cronbach's alpha Formulae, (Robinson, Shaver and Wrightsman, 1991).

RESULTS AND DISCUSSION

Table 1: Summary of the Analysis of Data on Responses Received from Technology Education Lecturers via Hand Collection versus Responses Received via Telephone Follow-up

S/N0	Item	Hand Collected Respondents	Telephone Follow-up Respondents	Levene's Test for Equality of Variance					Remarks
		m(n/sd)	*m(n/sd)*	*F*	*P*	*T*	*df*	*p*	
1	Technology Adoption[a]	3.68(44/1.13)	3.78[b](22/0.98)	.95	.33	-.39	47.45	.70	
2	Challenges to Technology Integration	2.03(42/0.67)	2.05[c](22/.61)	.65	.42	-.18	63	.84	
3	Technology Anxiety	1.91(42/1.01)	2.06[d](22/0.84)	.77	.37	-.65	63	.52	

Notes: [a] - Equal variances were not assumed for the t-test for technology adoption because the Levene's Test for Equality of Variances resulted in a statistically significant F value.
[b] - Technology Adoption Scale: 1 = Not Liked Me, 2 = Very Little Liked Me, 3 = Some Liked Me, 4 = Very Much Liked Me, 5 = Just Liked Me.
[c] - Challenges to Technology Integration Scale: 1 = Not a Challenge, 2 = Minor Challenge, 3 = Moderate Challenge, 4 = Major Challenge.
[d] - Technology Anxiety Scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety.

Data Presentation and Analysis

The data generated for Research Questions 1 – 4 were analyzed using the descriptive statistics, while multiple regression was used to analyze the data for Research Question 5. The effects of sizes on the correlation and multiple regression analyses were interpreted based on Cohen's guidelines, (Cohen, 1988).

Personal and Demographic Characteristics of the Respondents

Research Question 1: What are the commonly needed demographic and personal characteristics of technology education lecturers to adopt technology-based instruction?

The personal and demographic characteristics of the technology education lecturer studied include the ages of the lecturers, sex, years of teaching experience, main sources of technology training used by the lecturers. The data analysis as presented in Table 2 clearly shows that the lowest percentage of the lecturers (37.31%) studied have enjoyed one form of institutional technology training programme on technology adoption for instructional purposes, while a high percentage of them were trained through workshops/conferences(76.12%). On the other hand 67.16 per cent of the lecturers engaged their colleagues for their training, while an overriding 88.06 per cent adopted self-instruction approach for their technology adoption instruction training.

Table 2: Summary of Data Analysis on the Personal and Demographic Characteristics of the Respondents

S/N0	Item	Range	Mean	SD	Remarks
1	**Age of Lecturers**	29 – 65 years	48	8.73	Middle Age
		Sex	**X**	**%age**	**Ratio**
2	**Sex of the Lecturers**	Male	47	71.15	47/20
		Female	20	29.85	
		Range	**Mean**	**SD**	**Remarks**
3	**Teaching Experience**	2 – 35 years	21.15	9.72	Active
		Mode of Training	**X**	**%age**	**Range**
	Major Sources of	Self-Instruction	59	88.06	
4	**Technology Training for the lecturers**	Workshops/Conferences	51	76.12	
		Trained by Colleagues	45	67.16	
		Institutional Organized Courses	25	37.31	

Note: N = 67; The lecturers were asked to tick (√) against the response3 that best described their opinion/disposition

Available Technology and Level of Adoption by Technical/Technology Education Lecturers

Research Question 2: What are the common technology facilities available for the lecturers to adopt for use in their instruction?

A summary of the data analysis on the type of instruction-adoptable technologies available to the lecturers is presented in Table 3. The result of the data on the levels of availability of such identified technologies indicate that the possession of email accounts (97.01%) was the most commonly available technology, followed by lecturers connection to the internet at school(89.55%) and home(77.61%). This information further shows that there is a difference in level of internet availability to the lecturers at school and at home. This is clearly understandable because most of these institutions have Broad-band internet facilities on their campuses, whereas most of the lecturers are resident outside their college campuses and depend solely on relatively more expensive pre-paid internet modems.

The data on lecturers' possession of CD or DVD recorders shows a very high level of availability(86.56%) mainly because virtually all the lecturers' laptops have functional CD/DVD recorders and this makes it possible for the lecturers to record their instructional materials for the students with interactive DVDs or CDs(70.15%), as the need arise. On the other hand only 37.31 per cent of the lecturers have any form of laser disc players or standalone DVD or CD players (these are mainly as personal property). The data on this Table 3 clearly show that a very low percentage of the students(47.76%) have school email accounts because most of the institutions, as a matter of policy do not allow students to open school email accounts, even though the students are more internet active than their lecturers, (Thomas, Adams, Meghani, & Smith, 2002)

Table 3: Types of Technology Available to Technology lecturers for Use in Instruction

S/N0	Available technology for Teaching/learning	N	%age	Remarks
1	Laser disc player or standalone DVD or CD players[a]	25	37.31	Low
2	Lecturers have Video Cassette, CD, or DVD Recorder[a]	58	86.56	Very High
3	Lecturers have computer with Internet connection at school[a]	60	89.55	Very High
4	Possession of school email account by the Lecturers	65	97.01	Very High
5	Lecturers have computer with Internet connection at home[a]	52	77.61	Very High
6	Lecturers have access to enough computers in a classroom or lab for all students to work by themselves or with one other student	18	26.87	Very Low
7	Lecturers have Digital video Camera[a]	21	31.34	Low
8	Access to GPS (Global Positioning System)[a]	53	79.10	Very High
9	Students have a school email account	32	47.76	Low
10	Personal Digital Assistant(e.g. Palmtop, IPAD, Blackberry Phones)[a]	30	44.78	Very Low
11	Lecturers use of Interactive DVDs or CDs[a]	47	70.15	Very High

Notes: N - Total Number of Lecturers = 67.

[a] The lecturers were asked to tick (√) against each type of technology that was available for their use in instruction.

[a] The number of technologies available to each teacher ranging from 0 to 9 and was totaled to create an available technology score for use in the regression analysis for research question 5.

In item 11 of this Table 3 the information is clear that only a negligible percentage (11.94%) of the lecturers have personal digital assistance of any form. This also suggests that most of the available technologies for instruction adaptation are mainly owned by the lecturers. The dearth of computers(26.87%) for individual students use in the laboratories/classrooms (these are supposed to be provided by their institutions) is a clear confirmation of this fact.

Research Question 3: To what extent have the lecturers adopted technology for use in their instruction?

The data on the lecturers' adoption of technology for use in instruction was measured using a researcher developed Technology Adoption Scale. The variables were presented as 15 research items measured on a rating scale of 1-5 as follows: Not adopted by me at all = 1; Very slightly adopted by me = 2; Slightly adopted by me = 3; Highly adopted by me = 4;Very Highly adopted by me = 5. The Means and Standard Deviations for the items in the technology adoption scale are presented in Table 4.

The summary of the data analysis as presented in this Table 4 show explicitly that most of the technology adoption measures achieved by the lecturers are more of theoretical and students' encouragement

measures than real life practical adaptations. The data in this table is clear, that all the items that scored above 3.50 means (Items 1, 2, 9, 10, 13, and 15) are more of theoretical adjustment than practice, except for Items 3 and 14 which are more of students' learning activities than teacher activity. The result of the analysis for the other items that are practice related teacher-activity areas scored means between 2.50 and 3.49 which indicate a moderate position (slight adoption by the lecturers) on the extent of the lecturers' technology adoption of technology for teaching/learning attainments.
The data for Item 6 (I use technology based games or simulations on a regular basis in my classroom or laboratory), Item 11(I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students) and 12 (I incorporate technology in my.

Table 4: Summary of the Data Analysis on the Responses to the Items on the Technology Adoption Measures

S/N0	Items on Technology Adaptation Measures	Mean(M)	Standard Deviation (SD)
1	I expect my students to use technology so they can take on new challenges beyond traditional assignments and activities	3.97	1.28
2	I am more of a facilitator of learning than the source of all information because my students use technology.	3.59	1.36
3	I assign students to use the computer to do content related activities on a regular basis	3.57	1.32
4	I have made physical changes to accommodate technology in my classroom or laboratory	2.75	0.98
5	I emphasize the use of technology as a learning tool in my classroom or laboratory	3.06	1.10
6	I use technology based games or simulations on a regular basis in my classroom or laboratory	2.08	1.43
7	I regularly pursue innovative ways to incorporate technology into the learning process for my students	2.70	1.33
8	I use technology to encourage students to share the responsibility for their own learning	3.43	1.26
9	I expect my students to fully understand the unique role that technology plays in their education.	3.97	1.13
10	I expect students to use technology to such an extent that they develop projects that are of a higher quality level than would be possible without them using technology	3.81	1.22
11	I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students	2.07	1.33
12	I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process.	2.05	1.43
13	I discuss with students how they can use technology as a learning tool	3.88	0.90
14	I design learning activities that result in my students being comfortable using technology in their learning	3.81	1.30
15	I expect my students to use technology to enable them to be self-directed learners.	3.81	1.22

Notes: N= 67. Scale interpretation ranges for the scale means: 1 = Not Like Me at All (1.00-1.49), 2 = Very Little Like Me (1.50-2.49), 3 = Somewhat Like Me (2.50-3.49), 4 = Very Much Like Me (3.50-4.49), and 5 = Just Like Me (4.50-5.00). Scale M = 2.78 (SD = 1.43).

Teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process) which recorded mean scores of 2.08, 2.07 and 2.05 respectively, clearly shows that the level of practical technology adoption for instruction among technical/technology education lecturers in North-East, Nigeria is still very low.

Challenges to Integrating Technology in Instruction

Research Question 4: What are the major existing challenges that may prevent lecturers from using technology in their teaching?
To identify these major challenges to the Adoption of Technology in Teaching and learning by the lecturers, the researcher developed a simple 7-item instrument called "Challenges to Integrating Technology in Instruction Scale" which was administered on the lecturers to identify. The lecturers responded to the seven items based on the following scale: 1 = Not a Challenge; 2 = Minor Challenge; 3 =

Moderate Challenge; 4 = Major Challenge. The summary of the analysis is presented in Table 5 followed by the interpretation scale.

Table 5: Summary of Analysis on Technology Education Lecturers Responses to the Obstacles to the Integration of Technology in Instruction

S/N0	Major Challenges to Technology Adoption	Mean (M)	Standard Deviation(SD)	Remarks
1	Scheduling enough time for students to use the Internet, computers, or other Technology in the teaching/learning process	3.43	1.05	
2	Availability of effective instructional software for the courses I teach	3.37	0.97	
3	Lecturer's Ability to integrate technology in the teaching/learning process	2.09	0.87	
4	Availability of technology for the number of students in my classes.	3.64	1.14	
5	Availability of technical support to effectively use instructional technology in the teaching/ learning process	3.59	1.02	
6	Administrative support for integration of technology in the teaching/learning process.	1.83	1.01	
7	Enough time to develop lessons that use technology	2.45	1.13	
	SUMMARY	**3.04**	**0.64**	

Notes: N= 67. Scale interpretation ranges for the scale means: 1 = Not a Challenge (1.00-1.49); 2 = Minor Challenges (1.50-2.49); 3 = Moderate Challenges (2.50-3.49); 4 = Major Challenges (3.50-4.00). Summary Mean = 3.04 and SD = 0.64.

Taking the items on this table separately clearly shows that the lecturers were experiencing major challenges with the level of availability of technology for the number of students in their classes (Item 4 – Mean = 3.64, SD = 1.14) followed closely by availability of technical support to effectively use instructional technology in the teaching/learning process (Item 5: Mean = 3.59, SD = 1.02), and this in turn has contributed to make scheduling enough time for students to use these poorly available facilities (Internet, computers, or other Technology in the teaching/learning process) another challenge (Item 1: Mean = 3.43, SD = 1.05. But the lecturers were experiencing minor challenges with having enough time to develop lessons that use technology (Item 7; Mean = 2.45, SD = 1.13).

The result of the data analysis as presented on this table further demonstrates that the lecturers were having very minor challenges with their personal ability to integrate technology in their teaching/learning processes (Item 3: Mean = 2.09, SD = 0.87) and the least challenge with administrative support for the integration of technology in their teaching/learning process 9Item 6: Mean = 1.83; SD = 1.01). This is a clear indication of the preparedness of both the lecturers and their institutions to integrate technology for instruction in their colleges. In summary the combined standard deviations as shown in Column 4 of this Table 5 shows a very close cluster of opinions of the lecturers on the major challenges to technology adoption for instruction in North-East, Nigeria.

Lecturers Perceived Technology Anxiety

Research Question 5: To what extent do technology education lecturers experience technology anxiety when attempting to employ technology in their instruction?

Another researcher-developed scale, "The Technology Anxiety Scale", was used to determine the anxiety level experienced by technology education lecturers when they think about using technology in their instruction. The lecturers were also presented with a 12-item instrument based on a 5-point scale as follows: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety and 4 = High Anxiety, and 5 = Very High Anxiety. The summary of the analysis for these items are presented in Table 6.

The analysis of the data on Lecturers Perceived Technology Anxiety shows that lecturers exhibited low level of anxiety on almost all the items investigated. They data also show that the lecturers showed only moderate anxiety level with respect to Items 4, 5, 7, 8 and 12. From the data on this table, the lecturers exhibited low level of anxieties towards all the other remaining 7 items (1, 2, 3, 6, 9, 10 and 11) which have to do with their individual feelings towards using technology in instruction. Based on the data presented in this Table 6 it is clear that technology education lecturers were commonly experiencing low level of anxiety (Mean = 2.17, SD = 0.95) as they integrated technology in their instruction, and moderate anxiety in the areas of choice of available options (M=3.10, SD=0.99) and fear of making mistakes that cannot be corrected(Mean=3.03, SD=1.06).

Table 6: Technology Education Lecturers' Responses to Technology Anxiety the Scale

S/N0	Technology Anxiety Parameters	Mean (M)	Standard Deviation(SD)	Remarks
1	What is the level of your anxiety when you think about your technology skills compared to the skills of other teachers?	2.05	1.27	Low
2	What is the level of your anxiety when someone uses a technology term that you do not understand?	2.04	1.04	Low
3	What is the level of your anxiety when you think about using technology in instruction?	1.75	1.06	Low
4	What is the level of your anxiety when you fear you may break or damage the technology you are using?	2.76	1.10	Moderate
5	What is the level of your anxiety when you are not certain what the options on various technologies will do?	3.10	0.99	Moderate
6	What is the level of your anxiety when you cannot keep up with important Technological advances?	2.15	1.09	Low
7	What is the level of your anxiety when you are faced with using new technology?	2.98	1.06	Moderate
8	What is the level of your anxiety when you hesitate to use technology for fear of making mistakes you cannot correct?	3.03	1.06	Moderate
9	What is the level of your anxiety when you avoid using unfamiliar technology?	1.87	0.95	Low
10	What is the level of your anxiety when you try to understand new technology?	1.97	0.98	Low
11	What is the level of your anxiety when you try to learn technology related skills?	1.88	0.99	Low
12	What is the level of your anxiety when you try to use technology?	2.91	1.00	Moderate

Notes: N= 67. Interpretation of the Means of the scales ranges: 1 = No Anxiety (1.00-1.49), 2 = Low Anxiety (1.50-2.49), 3 = Moderate Anxiety (2.50-3.49), 4 = High Anxiety (3.50-4.00), 5 = Very High Anxiety (4.50-5.00). Scale M = 1.97 (SD = .95).

Correlations of Study Variables with Lecturers' Technology Adoption Performance

Research Question 6: To what extent do selected variables explain significant proportion of the variance in the lecturers' technology adoption?

At this stage this research went further to establish the level of correlation between the variables studied so far and the lecturer's level of technology adoption for their teaching/learning in North-East Nigeria. The Forward Multiple Regression statistics was adopted to further analyze the data generated in this correlation analysis, to determine if the selected variables explained a substantial proportion of the variance in the adoption of technology for use in instruction. The Technology Adoption Scale mean was the dependent variable in this analysis, while the six teacher demographic/personal variables already identified from literature served as the potential explanatory variables (i.e. age, gender, years of teaching experience, perceived challenges to integrating technology in instruction, technology anxiety, training sources used, and technology available for use in instruction).

The training sources used by the teachers as presented in Table 2, was adopted for this analysis also. The training sources score was calculated by assigning one point for each of the four training sources. The technology types included in the technology available for instruction variable are shown in Table 3. The score was computed by assigning one point for each of nine types of technology.

The correlations of the seven demographic and personal variables with the Technology Adoption Scale score are shown in Table 7. Due to the minimum number of observations needed per variable for the regression analysis, it had been determined a priori that only those variables that were significantly correlated with the adoption scale score would be utilized in the regression analysis.

The data in this Table 7 show that the adoption scale score is moderately correlated with four of the ten variables, namely, challenges to technology integration (r = -.32), technology anxiety (r = -.42, technology availability (r = .33), and the use of colleagues as a training source (r= -.31). Therefore, these four variables were utilized in the forward multiple regression analysis. The sample size was adequate for this analysis in line with Hair, Black, Babin, Anderson, and Tatham (2006), recommendation that a minimum of 5 observations per variable was required, but 15-20 observations for each potential explanatory variable were desirable in a forward regression analysis. The result of the Forward Multiple Regression Analysis is presented in Table 8.

Table 7: Correlations of Selected Variables with Teachers' Technology Adoption Measures

S/N0	Selected Variables	Correlation Co-efficient		Remarks
		r	*P*	
1	Age	.04[a]	0.793	The Population of 67 respondents was the same for all the variables
2	Gender	.06[a]	0.619	
3	Years of Teaching Experience	.02[a]	0.859	
4	Challenges to Technology Integration	-.32[b]	0.011	
5	Technology Anxiety	-.42[b]	<0.001	
6	Technology Available	.33[b]	0.006	
7	Training Sources:			
	Self-Instruction	-.02[a]	0.853	
	Workshops /Conferences	.19[a]	0.122	
	Trained by Colleagues	-.04[a]	0.751	
	Institutional Organized Courses	-.31[b]	0.012	

Notes: N =67; a. Negligible association according to Cohen (1988);b. Moderate association according to Cohen (1988).

In this Table 8 the three variables entered into the forward multiple regression analysis combined to explain 37 per cent of the variance (R2) in technology adoption in instruction. The variable "technology anxiety" entered the model first and accounted for 17 per cent of the variance, followed by "technology available for instruction" which accounted for an additional 13 per cent of the variance. Colleagues as a training source entered the model last, explaining an additional 7% of the variance. Technology adoption increased as technology available (Standardized b=.35) increases, as technology anxiety decreases (Standardized b= -.40), when teachers use colleagues as a training sources (Standardized b= -.27). A regression model that explains 37 per cent of the variance represents a large effect size (Cohen, 1988). "Challenges to technology integration" did not explain additional variance in technology adoption.

Table 8: Forward Regression Analysis Model Explaining Variance in Technology Adoption in Instruction Scale Mean

	S	**df**	**MS**	**F**	**p**
Regression	27.57	3	9.18	11.42	<.001
Residual	46.66	58	80		
Total	74.23	61			

Explanatory variables in the Model					**Change Statistics**		
	R	**R^2**	**Adjusted R^2**	**SE**	**R^2 Change**	**F Change**	**P of F Change**
Technology Anxiety	.41	.17	.15	1.02	.17	12.01	.001
Technology anxiety, technology availability	.55	.30	.28	.94	.13	11.13	.001
Technology anxiety-technology availability, training source: colleague	.61	.37	.34	.90	.07	6.68	.012

Excluded Variable				
Variables	**Beta In**	**T**	**p**	**Partial r**
Challenges to technology adoption	.02	.02	.843	.03

***Notes*:** i. N =67; Dependent Variable: technology adoption.

ii Technology Adoption Scale: 1 = Not Like Me at All, 2 = Very Little Like Me, 3 = Somewhat Like Me, 4 = Very Much Like Me, and 5 = Just Like Me.

iii. Technology Anxiety Scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety.

iv. Technology Available variable potentially ranged from 0 to 9 points, but the actual range was 0 to 8 points since none of the respondents had all nine types of technology.

v. Challenges to Integration Scale: 1 = Not a Challenge, 2 = Minor Challenge, 3 = Moderate Challenge, 4 = Major Challenge.

vi The combined variables included in the multiple regression model represent a large effect size according to Cohen (1988): $R^2 > .0196$ - small effect size; $R^2 > .13$ - moderate effect size, and $R^2 > .26$ - large effect size.

Multi-collinearity did not exist in the regression analysis (see Table 8). In this case Hair et al. (2006) explained that "The presence of high correlations (generally 0.90 and above) is the first indication of substantial collinearity" (Hair et al. 2006, p. 227). None of the independent variables had a high correlation with any other independent variable. Furthermore, Hair et al. (2006) stated that "The two most common measures for assessing both pairwise and multiple variable collinearity are tolerance and

its inverse, the variance inflation factor (VIF). ... Moreover, a multiple correlation of 0.90 between one independent variable and all others ...would result in a tolerance value of 0.19. Thus, any variables with tolerance values below 0.19 (or above a VIF of 5.3) would have a correlation of more than 0.90" (Hair et al., 2006, pp. 227, 230). None of the tolerance values observed was lower than 0.19 and none of the VIF values exceeded 5.3.

CONCLUSIONS

The data presented and analyzed in this study so far, clearly shows that more than half of technology education lecturers have enjoyed one form of their institutional courses or the other for their technology training purposes while most of them trained themselves through self-instruction, by colleagues and/or workshops/conferences as technology training sources. This very finding appears to be in agreement with what also obtains in other countries (Redmann & Kotrlik, 2004), except that in Redmann & Kotrlik's study technology education teachers utilized colleagues as a training source at a much lower level than the secondary career and technical education teachers.

Technology education lecturers within the zone of this study have reasonably adjusted themselves to adopted technology for use in instruction in a number of teaching/learning aspects, but they are not making the maximum use of these technologies in their teaching delivery as a result of facility inadequacies or the dearth of such needed technology adoption facilities. The dearth of adoption of technology for use in instruction at this level is clearly reflected as a continuing concern of the Academic Staff Union of Universities (ASUU) over the years for improved funding of Nigerian universities.

Based on the analysis of the data generated in this study the major findings are grouped into two as follows:

1. Technology Education Lecturers Demographic Related Variables

Technology education lecturers in the North-eastern Nigeria:

i. are experiencing major challenges with availability of technology-based facilities for technology integration in instruction;

ii. have some moderate level of technology anxiety as they strived to integrate technology in their instruction;

iii. have individually perceived challenges to technology integration and technology anxiety that have moderate negative associations with technology application to instruction and

iv. have technology availability related challenges and are using colleagues as a training source, both of which have a moderate positive relationship with technology application in instruction.

2. Technology Application in Instruction Related Variables

Technology application related variables were discovered to have combined effects on the application of technology in instruction by technology education lecturers in North-eastern, Nigeria as follows:

a. as perceived challenges and technology anxiety increase, technology application in instruction by technology education lecturers decreases;

b. as technology availability increases and as technology lecturers use colleagues as training sources, technology application increases;

c. only three of the variables, namely, challenges to technology integration, technology anxiety, and the use of colleagues as a training source combined to explain a large proportion of the variance in technology application;

c. technology adoption increases as challenges and technology anxiety decreases, and as technology education lecturers use colleagues as a training source;

RECOMMENDATION

Based on these findings this study, the researcher recommends that :

1. Efforts must be made to encourage and support technology education lecturers as they work to integrate technology in their teaching/learning processes;
2. The federal government through the Nigerian Universities Commission(NUC) and other relevant agencies, the state governments, and college/university faculties must continue to take responsibility for leading the efforts needed to implement these improvements successfully. This may involve developing a shared vision among these stakeholders.
3. Technology education lecturers must proactively embrace learning opportunities, including use of knowledgeable colleagues to assist them in developing the skills needed to integrate technology in their instruction and continue to use conferences, workshops, college courses, and

self-directed learning to stay current. These efforts on the part of the lecturers should result in increased technology adoption;

4. Major responsibility for leadership, training, technology, and technical support must be taken by all levels of Nigerian education systems as they work to reduce or eliminate challenges to technology integration in instruction and

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