ASSESSING TECHNICAL TEACHERS' PROFESSIONAL DEVELOPMENT IN INFORMATION AND COMMUNICATION TECHNOLOGY FOR TEACHING IN POLYTECHNICS IN THE NORTH EASTERN STATES OF NIGERIA

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Abstract
　　This study was designed to assess the level of preparedness of technical teachers to use information and communication technology facilities for teaching in Polytechnics in the North Eastern States of Nigeria. The study adopted descriptive survey research design to collect opinions of technical teachers on their professional development in information and communication technology and their exposure to information and communication technology facilities used for teaching. A 5-point researcher made questionnaire was used for data collection. The instrument was validated by two experts in information and communication technology and it was also pilot tested on nine polytechnic teachers after which a reliability coefficient of 0.98 was estimated. Two research questions were raised and one hypothesis propounded. The study revealed that technical teachers teaching in polytechnics in the North Eastern States of Nigeria possess moderate professional development and exposure to information and communication technology facilities. This implies that the teachers need further training on information and communication technology facilities used in the classroom. It was then recommended that employers of the teachers should send them on in-service training in information and communication technology and to also put in place adequate information and communication technology facilities for instructional purpose. The study suggested further studies to investigate the teachers' level of competency in using information and communication technology in the classroom.

Keywords: Technical Teachers, Professional Development, Exposure to ICT, Polytechnic, Teaching

Introduction

The National Policy on Information Technology, Federal Republic of Nigeria (FRN, 2000) acknowledges that information and communications technology (ICT) forms the bedrock for a nation's survival and development in a rapidly changing global environment, and hence challenged all and sundry to devise courageous initiatives to address issues relating to infrastructure, man power and open government. Specifically, the issues to be addressed revolve around the development and sustenance of ICT manpower requirement of the nation and tertiary institutions in particular. Technologically advanced countries of the world have integrated ICT into their education system, thereby making their education delivery more efficient and more qualitative

Information and Communication Technology (ICT) is a diverse set of technological tools and resources used to create, disseminate, store and manage information (George, 2012). ICT facilities have been identified to be very useful element in education, dating as far back as the 1920s (Alter,Tiough & Nevkar, 2006). While access to relatively newer forms of ICTs (personal computers, mobile telephony, internet, etc) is important, access to the "older" technologies such as transistor radios or analogue television cannot be ignored. In many developing countries these old technologies still play a vital role such as providing access to education in remote areas (UNESCO, 2006). However, Haddad and Jurich (2002) are of the view that when ICT is used in education, the teacher plays more of the role of a facilitator, mentor or coach.

A consensus opinion of educationists, has it that for any teacher to function effectively, teacher preparation is of paramount importance (Jen, 2002; Olele & Ozuru, 2007; Alonge, 2008). Educational preparation of a teacher, according to Okonkwo and Okonkwo (2008) deal with the training of teachers to enable them acquire knowledge, skills and competencies in order to practice effectively as certified and professional teachers.

The Federal Government of Nigeria recognizes the role being played by ICT in education and also acknowledges the problems hindering its effective use in education as the Nigerian Minister of Education stated that the present state of ICT in education must be remedied (Rufa'i, 2013). The Digital Bridge Institute of the National Communications Commission trains teachers of tertiary institutions across the country in the use and applications of ICT facilities. This is in line with the recommendation of Alkawaldeh (n.d.) who called for more technical training in ICT for teachers to remove barriers to utilization of ICT in education. These barriers according to

Ololube, Eke, Uzorka, Ekpenyong and Nte (2009) are among others; poor ICT penetration and usage among Nigerian higher education practitioners, insufficient electricity to power ICT materials and lack of acquisition of basic communication gadgets by most middle income earners, which results into teachers and students inability to own computer related telecommunication facilities. Consequently, accessibility to computers and other internet facilities has remained a serious problem for many schools in Nigeria (Aliyu, 2007). Limited integration of ICT into education posses a great challenge to Nigeria's global competiveness. Most importantly, how skilled and experienced the teachers are in using ICT facilities determines the success of achieving the objective of using ICT in education.

A Polytechnic is a tertiary educational institution whose statutory function is primarily to train middle level manpower for the nation, but current legislation is trying to empower a few of them to train high level manpower too. Teachers, as agents of change must be technically and pedagogically skilled and experienced to support students' academic achievement. It is against this background and the fact that teacher preparation, follow-up, staff development, and technical assistance are critical prerequisites for effective technology application (Cradler and Bridgforth, 2011) that the researchers undertook a survey of technical teacher's perceived professional development in ICT and their exposure to ICT facilities used for teaching in Polytechnics in North Eastern States of Nigeria, in order to obtain empirical data to guide ICT development and usage in the institutions.

Statement of the Problem

The Federal Government of Nigeria has emphasized the use of ICT in education in Nigerian schools, but the integration of ICT in education is also not without problems as confirmed by Nigerian Minister of Education that ICT in education in Nigeria needs remediation. The 3248Mw of electricity which is being generated and distributed in Nigeria is far below what is required to power the nation. Electricity consumers including ICT users have their gadget out of service most of the time due to lack of electricity to power them. National Communications Commission has been training teachers in tertiary institutions across the country in ICT because the teachers were found deficient in that area. With all these barriers to ICT use by teachers and the efforts put in place to limit them, how prepared are technical teachers in the Polytechnics in using ICT facilities for teaching? This and other related questions led the researchers to undertake a survey of technical teachers' opinion on the level of their professional development and exposure to ICT facilities for teaching in Polytechnics in North Eastern States of Nigeria.

Operational Definitions of Key Terms

Technical Teachers: Science, technology or engineering teachers teaching in Polytechnics in the study area.

ICT Certified Technical Teachers: Technical Teachers who have received formal training in Information and Communication Technology in colleges, polytechnics or universities.

ICT Uncertified Technical Teachers: Technical Teachers who have received informal training in Information and Communication Technology through conferences, seminars, workshop or self study.

Purpose of the Study

The purpose of the study is to find out the level of preparedness of technical teachers in the application of ICT in teaching in Polytechnics in the North Eastern States of Nigeria. Specifically, the study sought to:

1. Ascertain the perceived level of professional development of technical teachers in ICT for using ICT facilities to teach in polytechnics.
2. Ascertain the level of perceived exposure of technical teachers to ICT facilities used for teaching in polytechnics.

Research Questions

The study was guided by the following research questions:

1. What is the perceived level of professional development of technical teachers in ICT for using ICT facilities to teach in polytechnics?
2. What is the perceived level of exposure of technical teachers to ICT facilities used for teaching in Polytechnics?

Hypothesis (Ho)

There is no significant difference between the mean scores of certified and uncertified technical teachers on their level of professional development in ICT for using ICT facilities to teach in polytechnics.

Delimitation of the Study

The study was delimited to polytechnics and the technical teachers teaching in the Polytechnics in the North Eastern States of Nigeria.

Theoretical Framework

Professional development of teachers may be considered from the perspective of a few theories. At a theoretical level, social learning theory appears to offer a useful framework for describing and explaining professional learning (Watson 2013). Activity theory provides a useful

framework for negotiating the form that sustainable e-learning might take, describe how activity theory might be used and draws conclusions related to professional development of staff in educational organizations (Robertson, 2008). Benthum, Gulikers, Jong and Mulder (2011) concluded that motivation for their study was the often experienced lack of a theory of improvement in teachers' professional development and that the theory of improvement underpins professional development program. Considering the various views on professional development of teachers, this study is based on the constructivist perspective of readiness and development theory. The Theory of constructivism was advanced by theorists like Jeab Piaget, Maria Montessouri and Lev Vygotsky who believed that learning and development take place when learners interact with the environment and people (Song, 2007). Therefore, constructivism as a theory of learning and development is rooted in the "belief that knowledge is constructed out of personal sets of meanings or conceptual frameworks based on experiences encountered in relevant environment" (Newhouse, 2002:8).

Vosniadou (1994) was of the view that constructivism in ICT use has the tendency to determine the type of computer software that can be used in classrooms and as well as the manner in which computer is integrated into the curriculum and implemented in classroom instruction. This position was supported by Yowun (1996) who found out that teachers with a more constructivist orientation were more likely to select open-ended software over behaviorist. When necessary ICT training is given to a teacher, he/she serves as an agent for creating the constructivist environment in which he/she assumes new role of a facilitator.

Literature Review

Teachers and schools need to keep up with the recent developments in the field of teacher education and training in order to be able to improve their programs and the quality of teaching and learning process. In order to support this, we need to look at the recent research conducted in the field (Doyran, 2012). ICT is only one of the tools and sub-systems that make up the whole and teaching is only one of the many activities that take place there (Kirkup & Kirkwood, 2005). There is no firm agreement on the definition of ICT, as these technologies evolve almost daily; here we assume that ICT includes, but is not limited to, personal computers, laptops, printers, LCD operators, palm devices, ipods, fax machines, cell phones, internet and intranet (Zhang & Martinovic, 2008). Hine (2011) noted that the successful integration of ICT into the classroom depends on the ability of teachers to structure the learning environment in new ways, to merge new technology with a new pedagogy, to encourage co-operative interaction and group work.

Howard, McGee, Schwartz and Purcell (as cited in Karami, Karami,

& Attaran, 2013) reported that after a group of teachers received training in employing constructivist teaching strategies and using technology they (teachers) were found to have developed a more constructivist view towards education as a result of the training. Buttressing this point, Mikre (2011) concluded that regardless of all the limitations characterizing ICT, it benefits education system to provide quality education in alignment with constructivism, which is a contemporary paradigm of learning. Constructivism, therefore emphasizes learner centered approach in education under the active mentorship of the teacher.

The skill and attitude of the teacher determine to a large extent the effectiveness of ICT integration in teaching (Bitner & Bitner, 2002). Professional development of technical teachers on the use of ICT leads to effective use of ICT in schools. Lack of professional development of teachers constitutes a major barrier to effective use of ICT in teaching (Gulbahar & Guven, 2008). Professional development promotes the perception of self-efficacy among teachers (Kwache, 2007). Programmes of ICT professional development for teachers are most effective if they are designed to address the ICT needs of teachers for classroom instruction. Gaible and Burns (2005) stated that:

> Professional development is much more than training, though technology training may be one part of teacher professional development (TPD). Professional development–including the ongoing workshops, follow-up, study, reflections, observations and assessment that comprise TPD – accommodates teachers as learners, recognizes the long–term nature of learning, and utilizes methods that are likely to lead teachers to improve their practice as professionals (P. 6).

ICT professional development of teachers focuses on developing the competencies of teachers to effectively apply ICT to teaching.

Access to ICT facilities is a precondition for teacher professional development in ICT. Effective adoption and integration of ICT into teaching in schools depends on the availability and accessibility of ICT resources, such as hardware, software, etc; and obviously if teachers cannot access ICT resources, they will not use them (Buabeng-Andoh, 2012). However, having access to ICT is not the same as using or mastering that technology (Organisation for Economic Co-operation and Development, 2009a). But, access to technology encourages student-centered technology learning.

Obodoegbulam (2007) commented that for effective performance of teachers, a good knowledge of the principles and practice of education is essential. That was why Biggs, Hindon and Duncan (1996), argued that contemporary approaches to education demand that teachers develop new methods suitable to their roles as collaborators and facilitators of learning.

Consequently, they need to demonstrate some level of confidence in their work. To do this, Mbachu (2008) stated that teacher's training and education require reappraisal from time to time because no education system can rise above the quality of its teachers.

Methodology

Descriptive survey research design was adopted for this study. According to Akuezuilo and Agu (2003), descriptive survey research is used to collect detailed description of existing phenomena with the intent of employing data to justify current conditions and practices, or to make more intelligent plan for improving them. This study involves collection of opinion of Polytechnic technical teachers on their professional development in ICT and their level of exposure to ICT facilities. This is to reveal the teachers readiness or otherwise to use ICT in the classroom. The term readiness according to Werner (2009) connotes a state of being psychologically and behaviorally prepared to take action.

The instrument employed for data collection were two sets of researcher made five-point rating scale questionnaires designed to gather the participants' opinion on their perceived possessed professional development in ICT and their perceived level of exposure to ICT facilities. The researchers distributed copies of the questionnaires to the participants, who were required to rate the perceived level of their professional development in ICT and their level of exposure to ICT facilities. After seven days, the researchers collected back the questionnaires. The research questions and the null hypothesis were analyzed using mean and student t-test respectively. Statistical Package for Social Sciences version 17 was used for the analysis.

Area of the Study

The study was conducted in the six North Eastern States of Nigeria, namely; Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe.

Participants

All technical teachers engaged in full time teaching in Polytechnics in the study area were selected as the research population. The population was comprised of 100 certified teachers and 114 uncertified teachers. The total population was 214 participants. The participants comprise of both female and male teachers who hold qualifications ranging from Bachelor, Masters or Doctorate Degrees with an average of 11 years post qualification experience.

Validation and Reliability of the Instrument

Two experts in ICT and two in educational technology validated the instrument. The experts assessed the appropriateness and adequacy of the

content of the instrument. To measure the reliability of the test instrument, a single pilot test was carried out on nine technical teachers. Cronbarch's alpha co-efficient formula was used to obtain the co-efficient of internal consistency i.e. the reliability of the instrument. The reliability coefficient of the instrument is 0.98.

Results
Technical teachers in both groups completed the questionnaires. The data generated from the questionnaire were analyzed. Table 1 and Table 2 contain the mean scores and standard deviation for their professional development in ICT and their level of exposure to ICT facilities respectively. Table 3 contains the t-test of significance on their level of ICT professional development.

Research Question 1
What is the perceived level of professional development in ICT of technical teachers teaching in Polytechnics?

Table 1: Mean and Standard Deviation of Respondents on the Perceived Level of Professional Development of Technical Teachers in ICT

		RESPONDENTS			
		Certified Technical Teachers N = 100		Un-Certified Technical Teachers N = 114	
S/No	ITEM	$\overline{X}_c$	SDc	Xu	$\overline{SD}u$
1.	Audio-Tape Recordings	3.20	1.07	3.24	1.20
2.	Over-head transparencies	3.16	1.20	3.17	1.10
3.	Slide Series and Film Strips	3.04	1.10	3.17	1.20
4.	Multimedia	2.91	1.00	2.97	0.98
5.	Video and Motion Picture Film	3.08	1.08	3.98	1.40
6.	Power Point	3.34	0.94	3.30	1.10
7.	Teaching with Clickers	2.73	1.08	2.97	1.30
8.	On Line Conferencing/Discussion	2.75	1.10	2.95	1.10
9.	Teleconferencing	2.83	1.06	2.96	1.00
10.	E-mail	2.69	1.25	2.81	1.17
	Grand Mean	$\overline{\overline{x}}_c$=2.97		$\overline{\overline{x}}_u$ =3.15	

Table 1 contains the mean scores and standard deviations for the certified and uncertified technical teachers teaching in Polytechnics on their level of perceived professional development in ICT. The certified and un-certified technical teachers have grand means of $\overline{X}_u$=2.97 and X_c=3.15 respectively. The two groups of teachers, irrespective of their mode of training, agreed that they are moderately trained to handle ICT facilities in the classroom.

Research Question 2

What is the perceived level of exposure of technical teachers to ICT facilities used for teaching in Polytechnics?

Table 2: Mean and Standard Deviation of Respondents on their Perceived Level of Exposure to ICT Facilities used for Teaching in Polytechnics?

		RESPONDENTS			
		Certified Technical Teachers N=114		Un-Certified Technical Teachers	
S/No	ITEM N=100	$\overline{X}c$	SDc	Xu	$\overline{\,}$SDu
1.	Laptop	3.83	0.99	3.50	0.94
2.	Desktop computer	2.79	1.22	2.72	1.17
3.	Telephone	3.75	1.10	3.59	1.18
4.	Video Camera	3.02	1.15	2.86	1.10
5.	Microphone	3.11	1.16	2.99	1.15
6	Headphone	3.06	1.21	3.00	1.21
7.	Power Point Projector	3.47	1.20	3.36	1.12
8.	Printer	3.65	1.10	3.51	1.02
9.	Television for education purpose	3.21	1.30	3.52	1.21
10.	Fax machine	2.40	1.20	2.72	1.17
11.	Clickers	2.94	1.25	2.95	1.27
12.	satellite receiver	3.64	1.10	3.49	1.10
13.	Radio for education purpose	3.50	1.10	3.71	1.15
14.	Scanner	3.13	1.00	2.88	1.21
15.	Video player	3.21	1.10	3.00	1.17
16.	Overhead Projector (motion)	2.63	1.20	2.42	1.08
17.	Multimedia Equipment	2.87	1.20	2.69	1.21
18.	CD-ROM Packaged Software	3.38	1.20	3.14	1.18
19.	Flash Memory	3.58	1.20	3.51	1.25
20.	Modem (GSM)	3.64	1.17	3.33	1.18
	Grand Mean ($\overline{\overline{x}}$) =	3.24		3.14	

Table 2 presents 20 items on the level of exposure of technical teachers to ICT facilities used for teaching in Polytechnics. The grand mean score of Certified Technical Teachers (x_c=3.24) is slightly higher than that of Un-Certified Technical Teachers (x_{uc}=3.14), meaning Certified Technical Teachers are more accessible to ICT facilities than Un-Certified Technical Teachers. The grand means of the two groups of teachers show that they are moderately exposed to ICT facilities. This indicates occasional use of ICT facilities by the teachers for instructional purposes.

Hypothesis (Ho): There is no significant difference between the mean scores of certified and uncertified technical teachers on their level of professional development in ICT for using ICT facilities to teach in polytechnics.

Table 3: A t-test of Significance Between the Mean Scores of Certified and Un-Certified Technical Teachers on their Level of Professional Development in ICT.

Respondents	Mean	SD	N	df	Standard Error	t-cal	t-table	Decision
Certified Technical Teachers	2.97	0.22	100					
				18	0.64	1.38	2.10	Accept
Un-Certified Technical Teachers	3.15	0.33	114					

A student t-test was used to investigate the difference between the opinions of certified and un-certified technical teachers on their level of professional development in ICT for teaching in polytechnics. Table 3 presents the result of the test of the hypothesis at a degree of freedom of 18 and an α level of 0.05. The result shows that there is no significant difference (p>0.05) between the level of professional development attained by the two groups of teachers in the application of ICT facilities to teaching.

Findings
The findings of this study are among others:
1. Technical teachers in polytechnics perceived their professional development in the use of old ICT facilities ($\bar{X}>3.00$) as high and in the use of recent computer based facilities ($\bar{X}<3.00$) as low.
2. Power Point Presentation is the ICT facility on which the teachers perceived to have had high professional development ($\bar{X}=3.20$) and teaching with classroom response system (clicker) as the facility on which they perceived to have low professional development ($\bar{X}=2.73$).
3. Table 2 shows that the teachers are highly exposed to old ICT facilities (telephone, radio, television and over head projector) and moderately exposed to later ICT facilities (Laptop, CD-ROM packaged software, flash memory, GSM modems).
4. The teachers perceived Laptop computer as the ICT facility to which they are most exposed ($\bar{X}=3.84$) and fax machine as the facility to which they are least exposed ($\bar{X}=2.40$).
5. The t-test statistics on Table 3 revealed that both groups of the teachers do not differ significantly on their level of professional development in ICT.

Discussion
The theory of constructivist perspective of readiness and development theory which addressed the framework of teacher in-service development prompted the investigation into perceived professional

development and exposure of technical teachers to effectively use ICT in education in the face of problems militating against the integration of ICT in teaching/learning process in the polytechnics. The result of this study revealed that the teachers are moderately competent and moderately exposed to ICT facilities. This means that the teachers need further professional development in ICT and they need to familiarize themselves more with ICT facilities. This finding is supported by the work of Santos and Pedro (2012) who concluded from their research that ICT training presents significant effects on teachers' beliefs and perception of own professional practices.

That the teachers perceived their exposure and professional development in computer based ICT facilities moderate, means there is a low usage of ICT in the classroom by the teachers. The low usage of computer based ICT facilities by the teachers result more from the teachers not well prepared to use the equipment. This finding is not peculiar to Polytechnics in the North Eastern States of Nigeria as Boakey and Banimu (2008) found out that 71% of teachers in Ghana does not use ICT in the classroom, 19% use ICT to prepare lesson notes and 10% has some knowledge of web browsing. Also, Jude and Dankaro (2012) found out from the study they conducted on teacher educators in College of education (COE), Katsina-Ala, Nigeria that 87.5% of the samples were not supplied laptops/computers by COE Katsina-Ala; 95.0% had personal laptops/computers; 80.0% of the laptops/computers were not connected to the internet; 82.5% of internet services provided by the college are not available in lecturers' offices and 67.5% could not access the internet using personal mobile devices. The finding of this study and those of Boakey and Banimu (2008) and Jude and Dankaro (2012) revealled low application of computer based ICT to teaching in the study areas, which in the 21st century should not be.

This study revealed that certified and uncertified teachers do not differ significantly on their level of professional development in ICT. The teachers are found to be proficient in, and accessible to old ICT facilities. This finding is contrary to the wide spread integration of new ICT facilities in classroom. The uncertified teachers received their training through workshops, conferences and seminars, but the Organisation for Economic Co-operation and Development (2009b) report that isolated workshops or conferences are not enough to establish a real change concerning the integration of ICT in the classroom.

Conclusion/Recommendation

Teacher professional development has become a common trend in teacher education, and the need for it by technical teachers is more pronounced because their competencies and skills must move together with advances in technology. Recent ICT facilities in the classroom place new

demands on teachers to update their knowledge and skills in using ICT to facilitate teaching/learning process. Finding of this study from Table 1 shows that technical teachers perceived using old ICT facilities (Radio, television and over head projectors) more than recent ICT facilities in education. These are indications that computer based ICTS are yet to be fully accessible to most of the teachers, and where they are moderately available, the teachers are not competent enough to make maximum use of them in the classroom. It is therefore concluded that the teachers professional development and exposure to use ICT in the classroom is limited. This study therefore recommends that:

1. Technical teachers in polytechnics in the North-East Region of Nigeria should be sent by their employers on in-service training to upgrade their skills in ICT, particularly in the area of integrating ICT into the courses they teach.
2. The Polytechnics should make ICT facilities sufficient enough to expose their lecturers to current and emerging ICT facilities meant for teaching and learning purposes.

Further Study

Further empirical study should be carried out to ascertain the level of the teachers' competency in using computer based ICT facilities in the classroom and for research.

Implication

The implication of the finding of this study is that the low usage of computer based ICT facilities by teachers for teaching constitutes barriers to effective classroom communication, and as Seiler, Schuelke and Lieb-Brilhart (1984) pointed out, the future of education has been and will continue to be affected by the computer. Alter, et al (2006) explained that teachers encourage instructional capacities by linking learners to information sources, helping learners visualize problems and solutions, tracking learner progress and linking learner to learning tools. All these are computer based learning, which are global best practices in education for schools to adopt.

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APPENDIX 1
TECHNICAL TEACHERS' ICT PROFESSIONAL DEVELOPMENT FOR TEACHING
Instruction: Please, indicate by ticking (√) the option, which shows your perceived level of professional development on each of the ICT facilities listed.
Key: VH=Very High, HG=High, MD=Moderate, LW=Low, VL= Very Low

S/No	ITEMS	RESPONSE OPTIONS				
		VH	HG	MD	LW	VL
1	Audio-Tape Recordings					
2	Over-head transparencies					
3	Slide Series and Film Strips					
4	Multimedia					
5	Video and Motion Picture Film					
6	Power Point					
7	Teaching with Clickers					
8	On Line Conferencing/Discussion					
9	Teleconferencing					
10	e-mail					

APPENDIX 2
TECHNICAL TEACHERS' EXPOSURE TO ICT FACILITIES USED FOR TEACHING
Instruction: Please, indicate by ticking (√) the option, which shows your perceived level of exposure to the ICT facilities listed.
Key: VH=Very High, HG=High, MD=Moderate, LW=Low, VL= Very Low

S/No	ITEMS	RESPONSE OPTIONS				
		VH	HG	MD	LW	VL
1	Laptop					
2	Desktop Computer					
3	Telephone					
4	Video Camera					
5	Microphone					
6	Headphone					
7	Power Point Projector					
8	Printer					
9	Television for Education Purpose					
10	Fax Machine					
11	Clickers					
12	Satellite Receiver					
13	Radio for Education Purpose					
14	Scanner					
15	Video Player					
16	Overhead Projector (motion)					
17	Multimedia Equipment					
18	CD-ROM Packaged Software					
19	Flash Memory					
20	Modem (GSM)					