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PHYSICS STUDENTS' USE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN UNIVERSITY OF JOS, NIGERIA

By

Macmillan Mafulul Josiah
Department of Science and Technology Education
University of Jos, Jos
Email: mac1jo@yahoo.co.uk

Mohammed Gwamna Umaru
Department of Physics
College of Education, Akwanga
Email: mohdgwamna@yahoo.com

Yohanna Iliya Mallo
Department of Physics
Federal College of Education, Pankshin
Email: malloyohanna@yahoo.com

&

Uwem Sunday Inyang
Air Force Military School, Jos
Email: uwemiyang@gmail.com

Abstract
This study investigated the extent of physics students' use of information and communication technology in the University of Jos. The study employed the cross-sectional descriptive survey research design. The population was 227 physics students. A sample of 100 was selected using probability proportionate to size (PPS) technique. The instrument for the study was a Physics Students use of ICT Questionnaire (PSICTQ), developed by the researchers, and rated on the Likert scale. The face and construct validations of PSICTQ were ascertained by experts in the University of Jos. The PSICTQ had a reliability coefficient of 0.84, obtained using Cronbach's Coefficient Alpha method. Four research questions were raised and answered and three hypotheses were formulated and tested at 0.05 level of significance. The mean, standard deviation, Spearman Rank Order Correlation and t-test statistics were used as statistical tools to analyze data obtained. Findings revealed that ICT resources were available in the University, even though e-Library, interactive whiteboard and software were limited. Further findings revealed that physics students used ICT resources. The findings also revealed that limited ICT infrastructure and unstable power supply are some challenges physics students faced with the use of ICT resources. The study established that there was a significant positive relationship between the availability of ICT resources and students use of the resources, as $p < 0.05$. It was also found that no significant difference existed between the challenges faced by male and female physics students in the use of ICT resources, since $p > 0.05$. The study concluded that physics students use ICT resources for learning courses and recommended, among others, that the federal government and stakeholders should provide adequate ICT resources such as e-Library and interactive white boards for students' use.

Keywords: Physics Students, Information and Communication Technology (ICT), ICT Resources, Availability of ICT, Use of ICT

Introduction

The importance of physics in a nation's economic, scientific and technological development cannot be overemphasized (American Physics Society, 2008). Thus, there is the need for the sustenance of teaching and learning of physics in our institutions of learning. However, Mankilik and Usman (2009) observed that students do not understand physics concepts and principles up to application levels. Similarly, Omosewo (2009) pointed out that traditional didactic methods which have dominated our science classrooms are responsible for students' lack of understanding of the sciences. Hence, a shift from the teacher-centered pedagogy of learning physics to a learner-centered one becomes necessary. A potent shift in pedagogical practice could involve the integration of Information and Communication Technology (ICT) as part of whole class, group, and individual student activities to support didactic classroom teaching. Gusen (2010) defined ICT as the combination of computer and telecommunication system to improve teaching, learning, research and communication in education. UNESCO (2011) provided a broader definition of ICT to mean computers, mobile phones, digital cameras, satellite navigations systems, electronic instruments and data recorders, radio, television, computer networks, satellite systems and almost anything which handles and communicates information electronically.

The use of ICT has changed our conventional ways of learning and proposes the need to rethink education in terms of a more current context (White, 2010). ICT use allows for increased individualization of learning. Adomi and Kpangban (2010) asserted that in schools where new technologies are used, students have access to tools that adjust to their attention span and provide valuable and immediate feedback for literacy enhancement. In Nigeria, the application of ICT in the teaching and learning process has been integrated in the school system at different levels. Adeosun (2010) stated that Nigeria is a signatory to a number of pacts and treaties to the World Declarations on Education such as the Education for All and the Millennium Development Goals. ICT resources can be used to find, develop, analyze and present information, as well as to model situations and solve problems. For instance, physics students' use of ICT devices would allow for rapid fitting and calculation of slope and intercept values from manually entered data. Some ICT materials that could be provided for physics students include among others the following: laptops, palmtops, projector, projection screen, microphone, speakers, video clips from the Internet, sensors, software, memory and storage, monitors, white boards, cell phones, digital cameras, webcam, scanners, printers, copiers, and Microcomputer-Based Laboratory (MBL) tool.Physics students' knowledge of how to use ICT facilities is a critical aspect of meaningful learning of physics concepts using ICT devices. This is so because Ugwuanyi, Chiegwu, Osuagwu and Ogbu (2017) rightly observed that the utilization of the ICT puts the student on the driving seat on the highway of learning.

Despite the important place of ICT in the teaching and learning of physics, ICT use in schools could be constrained by a number of internal and external factors. Adomi and Kpangban (2010), Josiah and Sharon (2010) identified these constraints to include poor ICT infrastructure, inadequate ICT facilities in schools, limited ICT skills among physics teachers, frequent electricity interruption, high cost of ICT facilities and components, inadequate physics educational software, lack of maintenance culture and lack of ICT skills and knowledge on the part of physics students. It could be deduced from literature that the challenges to effective use of ICT in schools can be grouped into institutional factors, student-related constraints and teacher related challenges. Philip, Oluwagbemi and Oluwaranti (2010) noted that tertiary institutions in Nigeria lack adequate infrastructure to effectively tap into the opportunities offered by the cyberspace.

The study by Maharana, Biswal and Sahu (2009) explored the use of information and communication technology by medical students. Findings revealed that respondents were of the opinion that ICT should be included in their syllabus. Zakaria, Watson and Edwards (2010) conducted a research on the use of Web 2.0 technology by Malaysian students. Result showed that students preferred finding information related to education using search engines instead of

asking friends or teachers.Ugwuanyi, Chiegwu, Osuagwu and Ogbu (2017) examined the knowledge and utilization of ICT among radiography students in South East Nigeria. It was revealed that most of the students had good knowledge of ICT, received training and that most of their knowledge of ICT was based on Microsoft office. However, these reviewed studies on students' utilization of ICT were not specifically on physics students and not in the University of Jos; hence the need for the current study.

Statement of the Problem

The use of ICT in teaching and learning has been shown to be effective in enhancing quality education. Thus, integrating ICT in the teaching and learning of physics is seen as a panacea towards improving students' understanding of physics concepts. Tertiary institutions in Nigeria, particularly universities, have made efforts towards the provision of ICT facilities required for effective teaching and learning. University of Jos, which has a reputation for being a centre of academic excellence, is not left out. However, the extent of the use of ICT facilities among students, particularly physics students, is still a thing of concern. Therefore, the problem of this study is poised by the question: What is the extent of the use of ICT facilities among undergraduate students of physics in the University of Jos, Nigeria?

Purpose of the Study

The purpose of this study was to investigate physics students' use of ICT in University of Jos, Nigeria. Specifically, the study sought to:

i. determine the extent of the availability of ICT resources for the teaching and learning of physics in University of Jos.
ii. examine the extent to which undergraduate physics students of the University of Jos, are knowledgeable in the use of ICT resources, including software applications in learning.
iii. determine the extent of the utilization of ICT resources for learning by undergraduate physics students of the University of Jos
iv. find out the challenges facing undergraduate physics students' use of ICT resources for learning in the University of Jos

Research Questions

The following research questions were raised to guide the study:

i. What is the extent of the availability of ICT resources for the teaching and learning of physics in the University of Jos?
ii. To what extent are undergraduate physics students of the University of Jos, knowledgeable in the use of ICT resources, including software applications in learning?
iii. What is the extent of the utilization of ICT resources for learning by undergraduate physics students of the University of Jos?
iv. What are the challenges facing the undergraduate physics students' use of ICT resources for learning in the University of Jos?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

i. There is no significant relationship between the availability of ICT resources and students' use of ICT resources for learning physics in the University of Jos.
ii. There is no significant relationship between students' knowledge and use of ICT resources for learning physics in the University of Jos.

iii. There is no significant difference between male and female students' challenges of using ICT resources for learning physics in the University of Jos.

Research Methodology

The study employed the cross-sectional descriptive survey research design. The population of the study consisted of 227 physics students of University of Jos, which comprised of 100 physics (major) students and 127 physics (education) students. The sample for the study was 100 students (64 males and 36 females). This represents 44% of the population which, according to Awotunde and Ugodulunwa (2004), was sufficient for the study. Probability Proportionate to Size (PPS) sampling technique was employed to select physics major and physics education students for the study. Physics Students' Use of ICT Questionnaire (PSICTQ), designed by the researchers was used as instrument for data collection. The PSICTQ was made up of two sections: Section A was on students' information, and section B contained the questionnaire items. The positive items were rated on the Likert scale with Strongly Agree (SA) having a score of 5, Agree (A) having a score of 4, Undecided (UD) having a score of 3, Disagree (D) having a score of 2 and Strongly Disagree (SD) having a score of 1. The rating was reversed for negative items. The criterion mean (3.0), which is the mean of the Likert scale, was used to decide the acceptability or otherwise of a factor. Josiah and Sharon (2010) posited that a factor is accepted if the calculated mean of that item is equal to or greater than the criterion mean; and if the calculated mean of an item is less than the criterion mean, the factor is rejected. It was on that basis that the researchers took decision.

The PSICTQ was subjected to face and construct validity by two experts from the University of Jos, Nigeria: One of the experts was from the Technology Education unit in the Department of Science and Technology Education, and the other was from the Test and Measurement unit in the Department of Educational Foundations. The reliability coefficient of PSICTQ was found to be 0.84 using Cronbach's Coefficient Alpha method. Mean and standard deviation were used to answer the research questions. Hypotheses one and two were tested at 0.05 level of significance using Spearman Rank Order Correlation Coefficient while hypothesis three was tested using t-test statistics at 0.05 level of significance. All computations were done using the Statistical Package for Social Sciences (SPSS) version 25.

Results

Research Question One

What is the extent of the availability of ICT resources for the teaching and learning of physics in the University of Jos?

Table 1: Mean Rating of Extent of the Availability of ICT Resources

Factors	N	Mean	St. Dev.	Decision
Computer Laboratory	100	3.370	1.341	Accepted
Internet service	100	3.481	1.359	Accepted
e-Library	100	2.022	1.371	Rejected
Interactive whiteboard	100	2.114	1.197	Rejected
television Set	100	3.983	1.348	Accepted
Projector	100	3.852	1.417	Accepted
Software applications	100	3.233	1.384	Accepted
Grand Mean		3.151	1.345	

Criterion Mean = 3.0

Table 1 reveals that the ICT resources available for use by physics students in the University of Jos are computer laboratory, internet service, television set, projector and software applications. However, those that are limited include e-Library and interactive whiteboard. The grand mean of the items (3.151) suggests that ICT resources needed for

effective learning by physics students are available, though not adequate. Thus, physics students depend on the ICT resources in the University of Jos to enhance their learning.

Research Question Two

To what extent are undergraduate physics students of the University of Jos, knowledgeable in the use of ICT resources, including software applications in learning?

Table 2: Mean Rating of Extent to which Students are Knowledgeable in the use of ICT Resources,including Software applications

Factors	N	Mean	St. Dev.	Decision
Microsoft word processing	100	4.343	0.343	Accepted
Microsoft power point	100	3.452	1.445	Accepted
Desktop publishing	100	2.885	1.581	Rejected
Website design	100	2.811	1.577	Rejected
Computer programming	100	2.722	1.513	Rejected
Software installation	100	3.914	1.519	Accepted
Microsoft excel and other spread sheets applications	100	3.073	1.470	Accepted
Grand Mean		3.314	1.350	

Criterion Mean = 3.0

Table 2 shows that physics students are more knowledgeable in the use Microsoft word processing, Microsoft power point, software installations and Microsoft excel and other spread sheets applications. The table also indicates that physics students have limited knowledge of the use of desktop publishing, web designing and computer programming. The grand mean of the items (3.314) suggests that physics students in the University of Jos are knowledgeable in the use of ICT resources, although some deficiencies existed. The limited knowledge of students in the use of these resources could be linked to the inadequacy of ICT resources or the unavailability of teaching/learning materials in that area.

Research Question Three

What is the extent of the utilization of ICT resources for learning by undergraduate physics students of the University of Jos?

Table 3: Mean Rating of Extent of Students' Utilization of ICT Resources for Learning

Factors	N	Mean	St. Dev.	Decision
I use ICT devices like Laptop to source information/literature	100	4.152	1.273	Accepted
I use ICT facilities for presentation	100	4.067	1.284	Accepted
I use ICT facilities for teleconferencing	100	2.434	1.403	Rejected
the use of ICT devices accelerates learning of difficult topics in physics	100	4.112	1.325	Accepted
I use ICT facilities for preparing my term papers and assignment	100	4.245	1.199	Accepted
I use the internet to browse and download articles and journals	100	3.144	1.189	Accepted
I feel library materials like books are more useful for learning than ICT resources	100	2.674	1.401	Rejected
Grand Mean		3.547	1.296	

Criterion Mean = 3.0

Table 3 reveals that students use ICT devices like Laptop to source information, prepare term papers and assignment and that the use of ICT devices accelerates learning of difficult topics in physics. It also revealed that students use ICT facilities for presentation and that they use the internet to browse and download articles and journals. The students are also of the opinion that ICT resources are more useful in learning than library materials like books. The items' grand mean (3.547) suggests that physics students in the University utilized ICT resources in learning physics concepts. However, it was also revealed that the use of ICT resources for teleconferencing by the students was limited.

Research Question Four

What are the challenges facing the undergraduate physics students' use of ICT resources for learning in the University of Jos?

Table 4: Mean Rating of Extent of Students' Challenges in using ICT Resources for Learning

Factors	N	Mean	St. Dev.	Decision
Limited ICT infrastructure like personal computers and desktops	100	4.293	1.328	Accepted
Unreliable power supply	100	3.571	0.987	Accepted
Insufficient ICT staff	100	4.354	1.329	Accepted
Poor internet services	100	4.390	1.324	Accepted
limited time for using ICT facilities	100	3.132	1.491	Accepted
Absence of ICT accessories like, modem, printers and flash	100	2.475	1.425	Rejected
Limited e-Library facilities	100	3.714	1.473	Accepted
Grand Mean		3.704	1.337	

Criterion Mean = 3.0

Table 4 shows that the challenges faced by physics students in using ICT resources in learning include insufficient ICT staff, poor internet, limited ICT infrastructure like personal computers and desktops, limited e-library facilities, unreliable power supply and limited time for using ICT facilities. However, the absence of ICT accessories likemodem, printers and flash were not major challenges to students' use of ICT. On the whole, a grand mean of 3.704 shows that those items listed in the table are the challenges physics students face in the use of ICT resources for learning in the University of Jos.

Hypothesis One

There is no significant relationship between the availability of ICT resources and students' use of ICT resources for learning physics in the University of Jos.

Table 5: Results of Spearman Rank Correlation of the Relationship Between Availability and Use of ICT Resources by Physics Students

Variable	$\bar{X}$	SD	N	r^s-cal.	p	Decision
Availability of ICT	3.151	1.345	100	.411	.001	H_O Sig.
Use of ICT Resources	3.547	1.296				

$p < .05$

Table 5 reveals that $r^s(100=.411, p=.001)$, which implies that $p < 0.05$. Therefore, the null hypothesis was rejected and conclusion was drawn that there is a significant positive

relationship between the availability of ICT resources and physics students' use of ICT resources in the University of Jos. Hence, H_O was statistically significant at 0.05 level.

Hypothesis Two

There is no significant relationship between students' knowledge and the use of ICT resources for learning physics in the University of Jos.

Table 6: Results of Spearman Rank Correlation of the Relationship Between Students' Knowledge and Use of ICT Resources for Learning

Variable	$\bar{X}$	SD	N	r^s-cal	p	Decision
Knowledge of ICT	3.314	1.350	100	.453	.000	H_O Sig.
Use of ICT Resources	3.547	1.296				

$p < .05$

Table 6 established that $r^s(100=.453, p=.000)$, signifying that $p < 0.05$. Thus, the null hypothesis was rejected and the study concluded that there was a significant positive relationship between the students' knowledge of ICT and the use of ICT resources for learning physics by the students of the University of Jos.

Hypothesis Three

There is no significant difference between male and female students' challenges of using ICT resources for learning physics in the University of Jos.

Table 7: Results of t-test statistics for the Difference Between Challenges facing Male and Female Physics Students' Use of ICT Resources

Gender	N	$\bar{X}$	SD	df.	t-cal.	p	Decision
Male	64	4.370	1.313	98	2.673	.132	H_O Not Sig.
Female	36	3.861	1.524				

$p > .05$

Table 7 indicates that $t(98=2.673, p=.132)$, which also means that $p > 0.05$. Hence, the study failed to reject the null hypothesis and the conclusion drawn therefore was that there was no significant difference between the challenges facing male and female physics students in the use of ICT resources in the University of Jos. In other words, both groups of students faced the same challenges; hence students' gender does not posed threats in the utilization of ICT resources.

Discussion

The findings on the extent of the availability of ICT resources in the University revealed that ICT resources are available for use by physics students, even though e-Library resources, interactive whiteboard and software applications needed for learning by physics students were limited. This result is not in agreement with that of Hamilton-Ekeke and Mbachu (2015) who revealed that basic ICT facilities like computers are unavailable for students' use. The findings on the extent to which physics students are knowledgeable in the use of ICT resources revealed that the students are more knowledgeable in the use of Microsoft word processing, Microsoft power point, software installations and in the use of Microsoft excel and other spread sheets application. This is in conformity with the findings of Ugwuanyi, Chiegwu, Osuagwu and

Ogbu (2017) who examined students' knowledge and utilization of ICT, and found that most of their knowledge of ICT was based on Microsoft office.The results of hypothesis tested established that there was a significant positive relationship between students' knowledge of ICT applications and the use of ICT resources by physics students of the University of Jos.

The findings on physics students' utilization of ICT resources revealed that the students use ICT devices like Laptop to source information, prepare term papers and assignment. It was also revealed that they use ICT facilities for presentation and that they use the internet to browse and download articles and journals. However, it was revealed that students' use of ICT resources for teleconferencing was limited. This finding is in line with that ofAhmed (2009) who reported that almost all the respondents in the study used computers for their research works. The findings from the hypothesis tested revealed that there is a significant positive relationship between the availability of ICT resources and physics students use of ICT resources in the University of Jos.

The results of analysis for challenges facing physics students use of ICT resources revealed such major challenges as insufficient ICT staff, poor internet, limited ICT infrastructure like personal computer desktops, limited e-library resources, unreliable power supply and limited time. This result corroborates that of Osuchukwu, Obuezie and Ogwuche (2017) who identified challenges of using ICT to include staff, epileptic power supply and irregular internet connectivity among others. The findings of the hypothesis on challenges of using ICT by gender established that there was no significant difference between the challenges facing male and female physics students in the use of ICT resources in the University of Jos. This finding is in contrast to the result of previous study by Mahmood and Bokhari (2012) who reported an ICT use gap in favour of females.

Conclusion

The aim of this study was to assess the extent of the use of ICT resources by physics students in the University of Jos. The findings from results of analysis revealed that ICT resources available are computer laboratory and internet services, projectors, while e-library facilities and interactive whiteboard were limited. It was found that students are knowledgeable in Microsoft word processing, Microsoft power point and spread sheet as software application provided by ICT resources. Furthermore, the study revealed that physics students use ICT resources for sourcing information and literature, presentation, and for preparing term papers and assignment. However, the study identified limited infrastructure, unreliable power supply and insufficient ICT staff as major constraints faced by the students. There were no gender gaps in the challenges of using ICT by the students. The study concluded, therefore, that undergraduate physics students use ICT resources in the University of Jos.

Recommendations

The following recommendations were proffered towards improving students' use of ICT resources for the teaching and learning of physics:

i. The federal government and stakeholders should ensure that modern and functional ICT resources, such as e-library and interactive white board, are made available for students' use.
ii. Students should be taught the application of ICT resources in desktop publishing, computer programming and web designing that can improve the learning of physics
iii. The university authority should employ more ICT resources supporting staff, while the available ones should attend refresher training programmes in ICT.

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BIOINFORMATICS: AN APPLICATION OF EMERGING TECHNOLOGY IN TEACHING GENETICS

By

Daniel Okolo, Agbefa[1], Maria Abah[1], Obed Yilshik Musa[2], Danladi Sani[3]& Christine Agbowuro (Ph.D)[1]

1. Department of Science & Technology Education, Faculty of Education, University of Jos
Email**:** okoloeyeso@gmail.com
2**.** Department of Science Education, Federal University of Kashere, Gombe State
3. Department of Basic Science, College of Agriculture Lafia, Nasarawa State

Abstract

Bioinformatics is an emerging technology in the field of biology. Its primary goal is to increase the understanding of biological processes by focusing on its developing and applying computationally intensive techniques. Basic Local Alignment Search Tool (BLAST), Molecular Sequence Alignment Tools, RNA Structure Prediction Tools and many others are tools used for bioinformatics applications. Genomics study, Proteomics study, Identification of Genetic Diseases, Genetic Modification of Plant and Animals and others shows how bioinformatics is

applied in the studies of genetics. Challenges such as corruption and insecurity, Biology teachers' competences in the use of bioinformatics and cost and maintenance are seen as factors that could affect the application of bioinformatics. Compulsory training and workshop, Government and stakeholders, provision of Intensive security and Students orientation were given as recommendations.

KEY WORDS: Bioinformatics and Genetics

INTRODUCTION

The speed of technology is moving more rapidly than anyone could have predicted. Emerging technologies are influencing every aspect of our lives with the education sector having the lead in the utilizations of the emerging technologies in developed countries. Emerging technologies appear not only to boost motivations and academic achievement but also increase national productivity both in human capital and economic growth. Veletsianos (2016) explained emerging technologies as tools, concepts, innovations, and advancements that promote learning. Mohanad (2013) stated that emerging technologies are science-based innovations with the potential to develop a new pedagogical skills or transform an existing one. Emerging technologies can be seen as knowledge-making tools for improving scientific investigation and to facilitate new instructions. Alison (2019) states that emerging technologies do not only stem from their novel material structure (seemingly new design or look) but also from their enabling of novel ways for teachers and students to coordinate pedagogical activities and knowledge construction.

Bioinformatics is an emerging technology in the field of biology. It is an aspect that involves the applications of advanced computer science and engineering in facilitating knowledge. As opined by Mallawaarachchi (2017), various biological analyses result in exponential amounts of biological data and it becomes very hard to analyze them using manual means. It is as a result that Computer Science comes to the rescue, hence, bioinformatics can be considered as a field of data science for solving problems in genetics. According to Wong (2016), it is an interdisciplinary field that develops methods and software tools for understanding biological data and combines computer science, statistics, mathematics, as well as engineering to analyze and interpret biological data. Wani, Ganie, Rani, Mehraj, Mir, Baqual, Sahaf, Malik and Dar (2018) view bioinformatics as the mathematical, statistical and computing methods that aim to solve biological problems using DNA and amino acid sequences and related information. In line to this, Nikwan and Bahram (2017) explained bioinformatics as the mathematical, statistical and computing methods aim at solving biological problems using DNA, RNA and amino acid sequences and related information. Bioinformatics analysis has the capacity to enhance understandings about the genome structure and the microorganism restructuring process. It is the field of science that merges biology, computer science and information technology into a single context.

Bioinformatics deals with computational management and analysis of biological information (genes, genomes, proteins, cells, ecological systems, medical information, robots, artificial intelligence, etc. Kumar and Chordia (2017) stated that bioinformatics is a fascinating subject having input of engineering art as well as of science. Bioinformatics are mostly engaged in designing new algorithms, software, developing updated databases which all help in solving many biological problems. According to Abdurakhmonov (2016), common uses of bioinformatics include the identification of candidate genes and nucleotides. Such identification is made with the aim of better understanding the genetic basis of disease, unique adaptations, desirable properties (especially in the agricultural species), or differences between populations.

Donovan (2016) defined genetics as a branch of biology that deals with the transmission and variation of inherited characteristics in particular chromosome and DNA. It is the process in which a parent passes certain genes onto their children. In another way,

Esposito (2017) defined genetics as a science that studies the variation and transmission of features or traits from one generation to the next. According to Itefa (2018), genetics is an important branch of biology which came from the word "gene" meaning the study of heredity, genes and variation. The bases for hereditary diseases are the changes in genes which are passed on from one generation to the next via the germ line cells. The study of genetics is very important in the improvement of agricultural plants such as disease resistance, insect resistance and synthesizing of plants with multiple qualities; use of genetics for improvement in animals such as disease resistance and utility of domesticated animals; genetics for treatment of diseases and genetics for betterment of human race (Jamieson & Radick, 2017; Itefa, 2018). Also, the study of genetics can be applied in several aspects of biology such as Taxonomy, Embryology, Cytology, Biochemistry, Ecology, Statistics and to mention but few. In fact, the entire studies of biology cannot be complete without the knowledge of genetics. This is because all living things have genes that exist throughout the body. According to Brian (2017), genes are a set of instructions that determine what the organism is like, its appearance, how it survives, and how it behaves in its environment. They are central in the study of molecular, cellular, organismal, family, population, and evolution.

IMPORTANCE OF BIOINFORMATICS IN THE STUDY OF GENETICS

Basically, the primary goal of bioinformatics is to increase the understanding of biological processes. As earlier stated, it is due to its focus on developing and applying computationally intensive techniques to achieve understanding of genetics which set it apart from other approaches. Hack and Kendall (2013) stated that bioinformatics develops and utilizes computational algorithms to understand and interpret genetics based on genome-derived molecular sequences and their interactions. Bioinformatics focuses on providing practical tools to organize and analyse basic genomic, proteomic and other "omics" data, including sequence analysis and its visualization. Bioinformatics has developed out of the need to understand the code of life, that is, DNA. The massive DNA sequencing projects have evolved and added in the growth of the science of bioinformatics. Dahiya and Lata (2017) revealed that the ultimate goal of bioinformatics is to uncover the wealth of biological information hidden in the mass of sequence, structure, literature and other biological data. Some of the research efforts in genetics that were conducted using bioinformatics include sequence alignment, gene finding, genome assembly, drug design, drug discovery, protein structure alignment, protein structure prediction, prediction of gene expression and protein interactions, genome-wide association studies, the modelling of evolution and cell division/mitosis.

HOW TO USE BIOINFORMATICS IN THE STUDY OF GENETICS

Analyzing biological data using bioinformatics to produce meaningful information involves writing and running software programmes that use algorithms such as discrete mathematics, control theory, system theory, information theory, and statistics. Misra, Panda and Parida (2013) stated that bioinformatics now entails the creation and advancement of databases, algorithms, computational and statistical techniques, and theory to solve formal and practical problems arising from the management and analysis of biological data. Wani, Ganie, Rani, Mehraj, Mir, Baqual, Sahaf, Malik and Dar (2018) further spelt out the following process involved in the use of bioinformatics for the study of genes and genetics materials:

i. Store/retrieve biological information (databases)
ii. Retrieve/compare gene sequences
iii. Predict function of unknown genes/proteins
iv. Search for previously known functions of a gene
v. Compare data with other researchers
vi. Compile/distribute data for other researchers

In view of the process involved in the use of bioinformatics for the study of genes and genetic material as spelt out by Wani, Ganie, Rani, Mehraj, Mir, Baqual, Sahaf, Malik and Dar

(2018), first, the sequences of corresponding molecule(s) are retrieved from public databases. After refinement, if needed, they are subjected to various tools that enable prediction of their features related to their function, structure, evolutionary history or identification of homologues with a great accuracy. Which tool should be used for what depends on the very nature of analysis to be carried out. For example, data retrieval tools allows one to search and retrieve data from a wide range of data domains. Similarly, pattern discovery tools allow researchers to search out different patterns in the given data. Another set of tools is dedicated to carry out sequence comparison. These tools such as BLAST (Basic Local Alignment Search Tool) enable one to compare gene or protein sequences to study their evolutionary history or origin. The data visualization tools allow researchers to view data in graphic representation, compile and distribute the data for other researchers.

BIOINFORMATICS TOOLS FOR GENETIC STUDIES

Software tools for bioinformatics range from simple command-line tools, to more complex graphical programmes and standalone web services available from various bioinformatics companies or public institutions. Some of the bioinformatics tools for the study of genetics include:

Basic Local Alignment Search Tool (BLAST): Wani, Ganie, Rani, Mehraj, Mir, Baqual, Sahaf, Malik and Dar (2018) defined BLAST as an algorithm for comparing biologically and genetically sequence informations, such as amino acid sequence of different proteins or the nucleotides of DNA sequences. It is a tool used to identify library sequences that resembles the query sequences. It is also a tool for alignment of sequences. According to Rana, Kunwar and Rajendra (2012), BLAST program compares nucleotide or protein sequences to sequence databases and calculates the statistical significance of matches and it can be used to infer functional and evolutionary relationships between sequences as well as help identify members of gene families. For example, to identify the unknown gene (query sequences) in the mouse, the scientist will perform a BLAST search of the human genome (library sequences) to see whether the human carrying the similar gene or not. Rana, Kunwar and Rajendra (2012) pointed out that BLAST was originally developed by NCBI (National Center for Biotechnology Information) to map annotations from one organism to another and that it works through the use of heuristic algorithm. Heuristic algorithm according to Wani, Ganie, Rani, Mehraj, Mir, Baqual, Sahaf, Malik and Dar (2018), is an algorithm that is able to produce an acceptable solution to a problem in many practical scenarios and are typically used when there is no known method to find an optimal solution, under the given constraint. Also, Saikou, Collins, Jonas, Lucas and Gordon (2018) stated that Using a heuristic method, BLAST finds homologous sequences, not by comparing either sequences in its entirety, but rather by locating short matches between the two sequences. It identifies homologous sequences using a heuristic method which initially finds short matches between two sequences; thus, the method does not take the entire sequence space into account. After initial match, BLAST attempts to start local alignments from these initial matches. This also means that BLAST does not guarantee the optimal alignment, thus some sequence hits may be missed. Rana, Kunwar and Rajendra (2012) also revealed that BLAST can be used for a lot of different purposes such as:

i. **Looking for species:** If you are sequencing DNA from unknown species, BLAST may help identify the correct species or homologous species.
ii. **Looking for domains:** If you BLAST a protein sequence (or a translated nucleotide sequence) BLAST will look for known domains in the query sequence.
iii. **Looking at phylogeny:** You can use the BLAST web pages to generate a phylogenetic tree of the BLAST result.
iv. **Mapping DNA to a known chromosome:** If you are sequencing a gene from a known species but have no idea of the chromosome location, BLAST can help you. BLAST will show you the position of the query sequence in relation to the hit sequences.

v. **Annotations:** BLAST can also be used to map annotations from one organism to another or look for common genes in two related species.
vi. **Searching for homology:** BLAST can also be used to search for the similarity of genes in species.

OTHER BIOINFORMATICS TOOLS

Other bioinformatics tools used for biological and genetical studies as reviewed by some researchers (E.g Rana, Kunwar & Rajendra, 2012; Dahiya & Lata, 2017; Wani, Ganie, Rani, Mehraj, Mir, Baqual, Sahaf, Malik & Dar, 2018) are listed below:

Molecular Sequence Alignment Tools: A sequence alignment is a schematic arrangement of one sequence of DNA, RNA and protein sequences on top of another where the residues in one position are entitled to have a common evolutionary origin. This method is used to identify regions of similarity that may be a consequence of functional, structural, or evolutionary relationships between two or more sequences.

RNA Structure Prediction Tools: The study of RNA structure has developed a distinct set of computational tools designed explicitly for RNA applications. Frequently, different regions of the same RNA strands fold together via base pair interactions to make complicated secondary and tertiary structures that are essential for different biological function.

Protein Structure Prediction Tools: Protein structure prediction is the most important method in the area of developing science. It is also known as the holy grail of modern biology. It helps in the prediction of the three-dimensional structure of a protein from its amino acid sequence i.e. the prediction of its secondary, tertiary, and quaternary structure from its primary structure.

Microarray Analysis Tools: Microarray analysis is used in the interpretation of the data generated from experiments on RNA, DNA and protein microarrays. It enables the researchers to investigate the expression data of a large number of genes in a great number of organisms with entire genome in a single experiment. Microarrays are a significant and advanced technique both because they may contain a very large number of genes and are very small size.

APPLICATION OF BIOINFORMATICS IN THE STUDY OF GENETICS

Bioinformatics is important to genetic research because gene of living organisms generally, contain vast amounts of information that the human mind cannot grasp without the help of computational methods in bioinformatics. Bioinformatics plays very important role in the analysis of gene and protein expression and regulation. It aids in comparing, analyzing and interpreting of genetic and genomic data and more generally in the understanding of evolutionary aspects of molecular biology. In a more integrative level, bioinformatics helps to analyze and catalogue the biological pathways and networks that are an important part of systems biology. Bioinformatics has emerged as an essential field of science that is facilitating biological discoveries without which it will be merely impossible to capture, manage process, analyse and interpret the huge amounts data that is available especially after whole genome sequencing projects (Wani, Ganie, Rani, Mehraj, Mir, Baqual, Sahaf, Malik & Dar, 2018).

The applications of bioinformatics in the study of genetics can be seen in some of the following areas:

Genomics study: This refers to the study of genes and their expressions. This field generates a vast amount of data from gene sequences, their interrelation and functions. To manage this vast enormous data, the application of bioinformatics will be of significant importance. Misra, Panda and Parida (2013) stated that bioinformatics is beginning to provide both conceptual bases and practical methods for detecting systemic functional behaviours of the cell and the organism. Bioinformatics plays a vital role in the areas of structural genomics, functional genomics and nutritional genomics.

Proteomics study: This is concerned with the study of protein structure, function, and interactions produced by a particular cell, tissue, or organism. It deals with techniques of genetics, biochemistry and molecular biology. Misra, Panda and Parida (2013) revealed that

the vast data of protein-protein interactions, protein profiles, protein activity pattern and organelles compositions can easily be managed and accessed by using bioinformatics tools, software and databases.

Transcriptomics study: This deal with the study of sets of all messenger RNA molecules in the cell. This can also be called as Expression Profiling where DNA microarray is used to determine the expression level of mRNA in a given cell population. The microarray technique generates vast amount of data and one experiment requires hundreds of runs. Hence, bioinformatics will the best technique to run such experiments. Bioinformatics is used for transcriptome analysis where mRNA expression levels and RNA sequencing (RNAseq) can be determined. Also, bioinformatics will be very important in the analyses of the continuously changing cellular transcriptome.

Evolutionary Studies/Phylogenetics: This is concerned with the study of evolutionary relationship among individuals or group of organisms. Taxonomists find the evolutionary relationship using various anatomical methods that take too much time. Using bioinformatics, phylogenetic trees are constructed based on the sequence alignment using various methods. Various algorithmic methods are developed for the construction of phylogenetic tree that are used depending on the various evolutionary lineages.

Identification of Genetic Diseases: The entire genome being stored in a DNA molecule is mind blowing. It is possible to encode such huge amounts of data in a single minute entity and decode them precisely to create unique human beings with their own unique characters. However, certain alterations in gene expression can cause fatal genetic diseases. Healthcare ecosystems require measures to identify such diseases and provide treatment and preventive measures to help save human lives. According to Mallawaarachchi (2017), bioinformatics has proven to possess great potential to identify diseases beforehand, determine treatment and help make human lives better. With the inspiration and knowledge of computer science, fields such as gene technology, medicine and healthcare can evolve from curing individual patients to healing entire populations.

Genetic Modification of Plant and Animals: Research has further shown that in agriculture, bioinformatics helps in the insect resistance, improve nutritional quality, rational plant improvement, waste cleanup, climate change studies, and development of drought resistance varieties. Current and new methods in livestock species using data from experimental or field studies with bioinformatics are helping in understanding the systems genetics of complex traits and provide biologically meaningful and accurate predictions. It also plays important roles in biotechnology, antibiotic resistance, and forensic analysis of microbes, comparative studies, evolutionary studies and veterinary Sciences (Dahiya & Lata, 2017). Bioinformatics in the area of genetic modifications of plants and animals, help in crop breeding, insect resistance, improved nutritional quality, plant- pathogen interactions, better understanding of and interaction with agriculturally important microorganisms, animal production and animal health and control of infectious diseases in animals. It again helps in the improvement for plant resistance against biotic and abiotic stresses, weather prediction Increased cultivation of crops in poorer soils and renewable energy applications. It also enables the detection of disease outbreaks faster at an early stage globally (not limited by geography), faster elucidation of causes of disease outbreaks and risk analysis or prediction of the future.

CHALLENGES OF APPLICATION OF BIOINFORMATICS FOR BIOLOGY/GENETICS STUDIES

Just like other emerging technologies, bioinformatics also is faced with challenges that affect its efficient applications. The challenges of corruption and insecurity are affecting every aspect of life of Nigerians, including education. According to Olagunju (2012), money meant for the purchase of educational equipment are mismanaged and misappropriated and contracts for the purchase of school equipment like bioinformatics tools and the like are not done or executed poorly yet millions of naira must have gone into these contracts. Insurgents and kidnappers, according to Kavanagh (2019), have destroyed infrastructure meant for teaching

and learning in schools while many teachers have been kidnapped and killed at their duty posts. Lack of stable power supply is another serious challenge that the application of emerging technologies could face. Nigeria is a country where electric power supply is probably the worst among developing nations. Electric power supply is not reliable in the country. Therefore, anything that makes use of electric power will surely have problems.

Biology teachers' competences in terms of adequate knowledge base on emerging technologies and pedagogic skills, is a challenge identified to influence the application of bioinformatics in biology/genetic studies. Researches have shown that many biology teachers are not technologically literate to use some of the emerging technologies in the classroom (Omorogbe & Ewansiha, 2013; Cabellon & Brown, 2017). Achieving the goals of bioinformatics requires qualified and highly technologically thinking skilled teachers. The biology teachers must need to move to a more technologically integrated approach to teaching. Wilson (2014) added that irrespective of the quantity and quality of technology placed in classrooms, the crucial point to how those tools are used is the teacher. Thus, teachers must have the competence and the right attitude towards technologies.

CONCLUSION

Bioinformatics is a highly interdisciplinary field that aims to analyze biological data through technologies and methods of biology, mathematics, statistics and computer science. It is also a hybrid field that brings together the knowledge of biology and the knowledge of information science, which is a sub-field of computer science. Methodologies through the various bioinformatics tools have a high yield in the selection of candidate genes. The tools of bioinformatics are helpful in every field of life. Application of various bioinformatics tools in biological research enables storage, retrieval, analysis, annotation and visualization of results and promotes better understanding of biological system in fullness. The bioinformatics field has immensely contributed to the exponential growth of all biological databases in genetics that shows more than one possible abstraction. Effective and correct application of bioinformatics in the area of genetics can greatly transform biotechnology and bioengineering sector.

RECOMMENDATION

From the forgoing, the following measures are recommended:

iv. Compulsory training and workshop on the uses, handling and pedagogical skills applications of bioinformatics be organized for biology teachers for effective and meaningful utilization.
v. Government and stakeholders should shoulder the cost of purchase and maintenance of the bioinformatics and other emerging technologies,
vi. Intensive security should be provided nationwide against vandalization of academic structures by insurgents such as Boko Haram and armed bandits.
vii. Students should be given orientation on the importance of bioinformatics and other emerging technologies in making learning interesting and simple.

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COMMUNITY PERCEPTION OF TECHNO-ENTREPRENEURSHIP FRAMEWORK OF SCIENCE TECHNOLOGY ENGINEERING ARTS AND MATHEMATICS FOR SUSTAINABLE DEVELOPMENT IN PLATEAU STATE

By

Prof. V. V. Apagu
School of Technology and Science Education
Department of Technology Education
Modibbo Adama University, Yola
vanduheb4u@gmail.com

J. M. Mafwalai, Ph.D (Mstan, Mtepan, Mnavted)
School of Vocational and Technical Education
Department of Technical Education
Federal College of Education, Pankshin
mafwalaijohn64@gmail.com

Abstract
The level of Science Technology Engineering Arts and Mathematics (STEAM) facilities available in most communities are such that, only the literate members ascend to key organizational positions, which consequently slows down sustainable development. However, techno-entrepreneurial framework provides structural concept, shape or order, intended to serve as a support or guide for raising the procedure of sustainable development programme. This happens with collaborative production, based on the shared perception of technology in a given community. With grand mean of 4.85 and 4.18 on potentials and techno-enterprise of *canarium* seeds respectively, the responses of youths, adults and elders of Kwalla community agreed on the availability and usage of *canarium* seeds for the production of appropriate building materials for sustainable development. Similarly, ANOVA analysis accepted $\mathbf{H_{01}}$ and $\mathbf{H_{02}}$, with (p-value=0.606>0.05) and (p-value=0.459>0.05) respectively, in favour of the potentials and usability of *canarium*-seeds, for techno-enterprise. With such spirit of community organization, social changes are created in the economic and STEAM education for sustainable development. Sources of these changes are hinged on the discovery of perception. The study therefore recommended the application of *canariumschweinfurthii bursecarea* (Atili) seeds, as suitable agro industrial waste, found in oil milling communities of Plateau State, for utilization as appropriate raw material for techno-enterprise in the building construction material industry, as a suitable process in Science Technology Engineering Arts and Mathematics (STEAM).

Introduction

Community is a system of systems integrated with each other in a cluster of families, within a geographical unit with statutory marks for maintaining simple institutions, legal and political identities (Moe 1959). In every community, techno-entrepreneurship in Science Technology Engineering Arts and Mathematics (STEAM), broadly involves successful innovation, managerial skills to utilize resources effectively, makes appropriate feasibility analysis, be skilful in marketing human resource management, financial management, manufacturing management and networks within risks. This differs from the description of an entrepreneur in general; in terms of individual discovery, individual economic innovator, individual controller about the unknown, individual belief with lower information cost and an individual with certain personality traits as a charismatic leader. These traits have resulted into having a process whereby, a community is mobilized to identify its needs and problems within the environment in order to develop the zeal for more integration towards satisfying the identified needs. The problem of development is more pronounced by the fact that, the financial wherewithal of the greater population of the rural and urban poor, homeless and inadequately housed masses are too small to even build affordable houses as asserted by (Osazuwa and Cornelius, 2018), unless available and cheap building materials become affordable through techno-entrepreneurship.

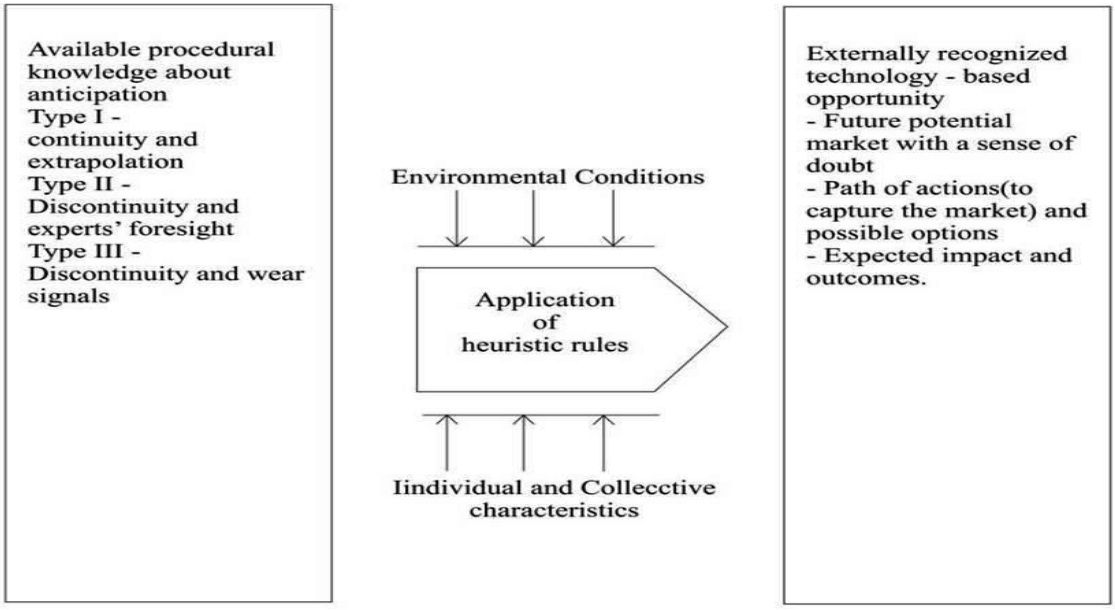
STEAM Community andTechno-entrepreneurship Framework

Sourcing needed raw resources like *canarium*-seeds and techno-preneurs in any community for the development of cheap, available and affordable building raw materials can be possible, through the diffusion of cultural traits, religious education of individuals, urbanization through industrialization and the application of Science Technology Engineering Arts and Mathematics (STEAM) education. So, communities require the conservation of finite resources in STEAM education, through direct reduction of amounts used, more efficient use and seeking alternatives. This is possible through the reduction of waste, recycling, harnessing local resources and minimization within a set of techno-entrepreneurial, social, cultural and institutional measures implemented with and for the inhabitants of rural communities. Sustainable development in Nigeria is mostly centred on agricultural, trade and industrial programmes, while STEAM education is set to explore biocrete potentials through the techno-

entrepreneurial perception framework of a typical rural community, despite all risks in techno-entrepreneurship.

Risk is not seen as a new development by Carson (2008), but that many different ones recur in life and rural development. These include risk suffered, endured, ignored, realized, encountered, refused, taken, regretted, survived, faced, accepted, weighed, chosen, embraced and the ones to overcome. In the 1950s and today, the criteria of children at risk can be noticed in race, gender, poverty, ghetto culture, street childhood, broken home-parenthood, poor education, youthfulness, single parenting, under-age marriage and lack of professional training or job skills. Some productive skills studied as requirements for the production of teacher-made block laying and concreting equipment, include; design measurement, marking-out, cutting, chiselling, trimming, driving, boring, shaping or fabrication, sand-preparing or smoothing, assembling, painting, lettering, appropriate selection use and manipulation of tools, care of tools, observation safety and creative ability (Mafwalai 2010). The framework (Fig.1) developed for techno-entrepreneurship by Blanco (2007) is a typical structure for STEAM.

Fig. 1 Framework: Anticipation and Heuristic Rules for Opportunities Recognition



Source: Blanco (2007)

The framework presents communal relationship between opportunities, heuristic rules and anticipation approaches in techno-entrepreneurship by multiplying the cases through case-based learning methodology, research, development, creativity and innovation. On the whole, Blanco (2007) stressed the ability to recognize business opportunities as one of the first and major skills that techno-entrepreneurs should acquire through STEAM, as it will dramatically shape the future of a given venture. This is made possible by opposing traditional capitalists who; (exploit existing resources, fields and activities, engages in new activities) and or ventures that did not exist before. The process of opportunity recognition is therefore a necessary skill in techno-entrepreneurship, so also are information gathering. This is necessary in order to match Science, Technology, Engineering, Arts and Mathematics (STEAM) education opportunities with market opportunities throughout the technology development process. Another skill is in identifying embedded procedural knowledge about anticipation, to act before an event occurs. This position can be perceived from the quote of Steve Job (1550-2010) the Co-founder of Apple and Pixer, as impacted by the theory of Effectuation (Sarasvathy, 2001). "Don't let the noise of others opinions" drawn out your own inner vice. And most importantly,

have the courage to follow your heart and intuition. They somehow already know what you truly want to become. Everything else is secondary'' (Bailetti, 2012 p.5). Since techno-entrepreneurship is teachable as a vocation, Monica and Cristian (2012) require teachers to possess qualities and skills on empathy, communication, scientific culture, democratic principles and good classroom management to be a model with well-defined techno-entrepreneurial value programmes.

Techno-preneurship Training and Sustainable Development

In fact, different types of education and training programmes for entrepreneurial communities and development have a common base, the emphasis is on skills that entrepreneurs need. However, Marques and Albuquerque (2012) acknowledge that lack of knowledge on the impact of personal and initiative characteristics on entrepreneurial educators don't generate necessarily entrepreneurs, but can promote, or potentiate with learned pedagogical goals and possible tools, or capacities to be involved in entrepreneurial pedagogy. Therefore, Bulsara, Gandhi and Porey (2014) connect techno-entrepreneurship to Science Technology Engineering Arts and Mathematics (STEAM) education, to the person who undertakes techno-entrepreneurship as a techno-entrepreneur. Techno-entrepreneur is one who organizes, manages and assumes the risk of technology based business enterprises. Therefore, techno-entrepreneur also needs technical management skills, business management skills and motivation. Techno-entrepreneurship basically has its roots in the field of entrepreneurship. Techno-entrepreneurship is thus Science Technology Engineering Arts and Mathematics (STEAM) education related through interdisciplinary and multi-level as modelled by Therin (2007).

Techno-entrepreneurs are a key catalyst in training and in the process of industrial formation and sustainable development with sufficient technical knowledge. From the highlights on techno-entrepreneurship so far, Prodan also contributed in Therin (2007) that techno-entrepreneurship is a style of business leadership that involves the identification of high-potential technology-intensive commercial opportunities, gathering resources such as talent and capital and managing rapid growth and significant risk using principled decision-making skills. It is aimed at the study of entrepreneurial activities in technology-intensive environments. This is based on the importance that, techno-entrepreneurship combines the factors associated with entrepreneurship and the ones due to the highly uncertain nature of Science Technology Engineering Arts and Mathematics (STEAM) education and sustainable development. Thus, Blanco's contribution in Therin (2007) captured techno-entrepreneurship as one of the most important sources of economic values creation and development in Europe and, that techno-entrepreneurs aim at creating and capturing economic value through the exploration of new technology-based solutions. This provision varies from the models of entrepreneurship education and training programs in which future technical entrepreneurs are not identified, as illustrated by Valerio, Parton and Robb (2014).

The model by Valerio, et al, shows that the education and training programs focus on building general knowledge and skills about or for the purpose of starting or operating an enterprise are devoid of scientific and technical qualification through STEAM education. The contribution also identified seven levels or key elements of techno-entrepreneurship that are linked to a new technological entrepreneur, these are; universities, corporations, capital, market or customers, government and advisors. Such development requires entrepreneurship capital, entrepreneurial knowledge and entrepreneurial capacity as significant implications for entrepreneurial performance (Sebikari, 2014). Principal entrants for techno-entrepreneurship are scientifically qualified workers in the higher institutions of learning or research or industrial firms. Practicing and emerging technological entrepreneurs are commonly required to possess different knowledge, skills and other characteristics than non-technological entrepreneurs. Others are the ones who started their new technology-based firm on their individual research and development, not within the institutions of learning or existing companies. Bulsara, Gandhi and Porey (2014) have therefore advocated teaching entrepreneurship to engineering students

as an independent academic discipline which is distinctive and unique component of the free enterprise system. It is in this light that Okpara (2007) describes the experience of enterprises the world-over as a revolution in terms of new technologies, increase use of automation and computers as a revolutionary challenge for entrepreneurs to manage with appropriate creative skills and methods.

Statement of Problem

For economic intensions and the need to improve Science Technology Engineering Arts and Mathematics (STEAM) education and skills, ruralites move. People with higher education in rural communities are also pulled-out to compatible job areas in urban communities with employment opportunities. Similarly, in rural communities where poverty or inadequate STEAM educational infrastructure exist, those who want to receive STEAM education have to migrate to other areas where such facilities are found. Rural areas being the source and origin of most materials used in building construction still experience the prevalence of shanty structures. The basic building materials required to build more durable houses are either not available, or available at unaffordable prices. There are calls to encourage appropriate biocrete technology (Stulz, 1986) and techno-entrepreneurship (Therin, 2007), in order to promote rural development. This cannot be achieved if African olive seeds or *canarium*-seeds continue to be discarded at the expense of low-cost technology for rural housing development and delivery. The naturally hard shells of the seed have been treated as throw-away agro-waste to accumulate; the community thus becomes an ignition point for pollution agents, while potential techno-entrepreneurs and the building construction industry ignore the possible viability of available and useful building raw materials. The study explored appropriate technology within the construction industry through the use of *canarium*-seeds, to produce appropriate building materials. The study is therefore in response to the appropriate technology interest, to harness *canarium*-seeds as agro or bio-waste in order to address the response of youths, adults and elders on the techno-potentials of *canarium*-seeds by oil milling communities in Plateau State.

Purpose of Study: To determine the perception of youths, adults and elders on the potential usage of *canarium*-seeds for rural development.

Research Question: What is the perception of youths, adults and elders on the potential usage of *canarium*-seeds for rural development?

Hypotheses

(H_{01}): There is no significant difference in the perception of youths, adults and elders on the potentials of *canarium*-seeds for building for rural development.

(H_{02}): There is no significant difference in the perception of youths, adults and elders in the usage of *canarium*-seeds for techno-entrepreneurship in rural development.

Methodology

Instrument on the Perception of Techno-enterprise Potentials of *canarium*-seeds for rural development (PERTECH) was developed, based on the relevant building requirements of the study in a rural setting. The instrument, with Sections A and B had five items each. Section A was used to find out the perception of respondents on the potentials of *canarium* seeds in the area of study, while section B supplied responses on the usage of *canarium*-seeds for techno-enterprise in housing. Mean ($\bar{x}$) was used to analyze data from the rseponses, while standard deviation (SD) was employed to denote the dispersion of mean scores and obtain homogeneity or otherwise, while analysis of variance (ANOVA), tested the hypotheses. Each item in both sections of the instrument was rated on a five point Likert scale of Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SD) valued at 5, 4, 3, 2 and 1 respectively. The lower and upper class limit values of real or whole number range from; 4.50 to 5.49, 3.50 to 4.49, 2.50 to 3.49, 1.50 to 2.49 and 0.50 to 1.49.

The instrument was subjected to face and content validation in order to determine the acceptability and justification of the items by (Uzoagulu 2011). Draft copies of the instrument were validated by five professional teachers in the Federal College of Education, Pankshin, from the Department of Technical Education, Department of Business education and Home

Economics Education Department. Application of reliability statistics on the multiple response type instruments was subject to the suggestion of Deji cited by Lidima (2017). Based on cluster administration, the reliability coefficient of 0.942 was obtained by Group A, 0.943 by Group B and 0.935 by Group C, while the overall Cronbach's Alpha coefficient value of 0.954 was obtained for the whole instrument. Thereafter, the instrument (Table 1) was administered to cross-section of Kwalla community.

Method of Data Analysis

Data from respondents and laboratory test results were used for analysis, using mean and standard deviation, Analysis of Variance (ANOVA) was employed to test the null hypothesis at 0.05 level of significance while. The decision rule was based on the Likert decision scale of strongly agree to strongly disagree and vice versa. In deciding on the hypotheses tested, the hypothesis without significant difference was accepted, where the P-value was greater than 0.05 level of significance, thereby indicating that there was no significant difference in the mean value of the responses by the three groups of respondents on any item. Where the P-value is less than 0.05 level, it was an indication of hypothesis of significant difference in the mean responses of the three groups of respondents. The whole population of 79 respondents were made up of 41 youths (18-24), adults (25-32) and elders (32 and above), from which the required data were used to obtain results and bases for discussion. Hence, no sampling technique was employed.

Results and Discussions

This section presents the results of the analyses of data collected from the respondents and tabulated. Section A of Table 1 presents the mean and the standard deviation on the respondents' perception on the potentials of *canarium* seeds and usage of *canarium*-crete for rural housing in group A. The overall grand mean was 4.02 representing 80.4% with standard deviation of 0.287, it implied that the respondents' perception was high. The mean values for each age group depict that since the mean responses are greater than 3.50, which is the value for decision making for each item; it shows that all the respondents agree with the items on the potentials of *canarium* seeds and usage of *canarium*-seeds for techno-entrepreneurship.

Table 1
Mean Responses of Youths, Adults and the Elderly on Techno-enterprise Potentials of *Canarium*-seeds for Rural Educational Housing

N=79

SN	SECTION A: Potentials of *Canarium* seeds	$\bar{x}_A$	$\bar{x}_B$	$\bar{x}_C$	$\bar{x}_G$	S D	Rem
1.	*Canarium* trees and seeds are in abundance at Kwalla for commerce.	4.51	4.22	4.61	4.45	.203	A
2.	*Canarium* trees can be multiplied into business forests.	4.40	4.15	4.17	4.24	.139	A
3.	*Canarium* seeds can be used to produce building materials because the shells or carnels are hard.	4.00	3.50	4.08	3.86	.314	A
4.	*Canarium* seeds can be converted from refuse to aggregates in Kwalla.	4.24	4.16	4.23	4.21	.044	A
5.	The *canarium*-crete beam model construction in Kwalla can be commercialized.	4.82	4.89	4.84	4.85	.036	A
	SECTION B: Usage of *canarium* seeds for techno-enterprise in housing						
6.	Masons in Kwalla have the basic skills for producing sand-crete blocks and concretes for commercial purposes.	4.12	4.12	4.03	4.09	.052	A
7.	Houses in Kwalla will be cheaper to construct with *canarium* seeds.	4.06	4.05	4.09	4.07	.021	A

8.	*Canarium*-crete will create markets for the people if used as building material for flooring, casting beams and columns.	4.20	4.12	4.32	4.21	.101	A
9.	Rural housing with *canarium*-crete will enhance techno-enterprise skills by using appropriate materials in Kwalla.	3.52	4.09	4.18	3.93	.358	A
10.	More cost effective houses can be constructed if *canarium*-crete is used in rural areas.	4.21	4.12	4.22	4.18	.055	A

$\bar{x}_A$(Youths),$\bar{x}_B$(Adults),$\bar{x}_C$(Elders)and $\bar{x}_G$= Grand Mean of Groups A, B and C; while SD= Standard Deviation; Rem.= Remark; A= Agreed and N= Number of Respondents.

Results in Table 1 Section B reflect the mean perception of youths, adults and elders on the potentials of *canarium* seeds as useful for techno-enterprise potentials toward rural development.The mean responses and standard deviation are the expression of the respondents on items 1-5 (Availability of *canarium* seeds) with group mean of 4.39, 4.18 and 4.39 for youths, adults and elders respectively, 0.150 as standard deviation. While the mean and standard deviation of respondents on items number 6 to 10 (Usage of *canarium*-crete for techno-enterprise) are 4.03, 4.10 and 4.17 for youths, adults and elders in that order, with standard deviation of 0.117.

Findings

The research question sought to find the perception of youths, adults and elders on the potentials on *canarium-seeds* for rural housing in the study area shows that *canarium* seeds possess potentials useful for the manufacture of appropriate building materials. Also revealed by the grand mean scores of 4.21 with standard deviation of 0.13, respondents agree on all the items in the questionnaire as those perceptions required for practicing techno-entrepreneurship with *canarium*-seeds in the study area. Generally, the values of standard deviation reveal that the mean responses of the respondents were not too dispersed from each other in the perceptions and that they were not far from the mean. In conclusion therefore, *canarium*-seeds have been highly accepted as a source of techno-entrepreneurship in Kwalla community.

H_{01} – There is no significant difference in the perception of youths, adults and elders on usage of *canarium* seeds for rural development.

Table 2: Analysis of Variance (ANOVA) of the Perception of Youths, Adults and Elders on the Potentials of *Canarium-seeds.*

Source of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0.150	2	0.075	0.522	0.606
Within Groups	1.723	12	0.144		
Total	1.872	14			

Table 2 shows the ANOVA table for Perception of Youths, Adults and the Elderly on the Potentials of *canarium*-seeds. The result revealed that there is no significant difference between the perception of youths, adults and the elderly on the potential of *canarium*-seeds with F- Value of 0.522 (p-value=0.606 >0.05). The ANOVA result in Table 2, presents the significant difference in the responses of participants' perception on the usefulness of *canarium* seeds across groups A (youths), B (adults) and C (elders). The result shows there is no significant difference since the p-values of 0.218, 0.159 and 0.378 were greater than the 0.05

significance level. Hence H_{02} was accepted and it was concluded that there is no significant difference in the perception based on the grouping of the respondents. The result also produced the ANOVA in Table 3 on the significant difference on the responses of youths, adults and the elderly on the usefulness of *canarium* seeds for techno-enterprise across youths, adults and elders in the community.

In Table 3 The ANOVA result revealed that there is no significant difference between perception of youths, adults and elders on usage of *canarium seeds* for techno-enterprises, with F- value of 0.832 (p-value=0.459> 0.05).

Table 3: Analysis of Variance (ANOVA) on Perception of Youths, Adults and Elderly on Usage of *Canarium* seeds for Techno-enterprises in Rural Development

Source of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	0.053	2	0.027	0.832	0.459
Within Groups	0.385	12	0.032		
Total	0.438	14			

Table 3 also shows there is no significant difference since the p-values of 0.746, 0.665 and 0.979 were greater than the 0.05 significance level. Hence, H_{02} was accepted and concluded that there is no significant difference in the usage of *canarium*-seeds for rural development based on the mean values of perception by the respondents.Result of ANOVA on H_{01} obtained p-values of 0.218, 0.159 and 0.378 for *canarium* seeds and 0.746, 0.655 and 0.979 for the usage of *canarium*-crete to be greater than 0.05 alpha level of significance. Therefore, hypotheses stands accepted or not rejected.Conversely, there was no significant difference in the perception of youths, adults and elders on the techno-enterprise potentials of *canarium*-seeds for techno-enterprise. The null hypothesis (H_{02}) was upheld, because the p-value of 0.378 for availability of *canarium* seeds and 0.979 on usage of *canarium* seeds were greater than the cut-off alpha value of 0.05 level of significance. The findings of this study confirmed the opinion of Stulz (1986), supporting the successful application of agro industrial waste for construction and Bailetti (2012) on the process as a specific technological knowledge used to create and capture added values for a firm, being one of the most important sources of economic value creation (Therin, 2007). Basic technical and vocational skills are however required to be possessed for practicing techno-entrepreneurship (Sebikari 2014; Valerio, Parton & Robb 2004; Bulsara, Gandhi & Porey 2014; Umunadi 2014; Kwami 2013; Mafwalai 2011; Doyle 2017). Mavridou and Banti (2016).

Conclusion and Recommendation: Members of Kwalla community participated in the construction of a lightweight reinforced *canarium*-crete beam to exhibit skill for the techno-enterprise potentials of *canarium*-seeds. There was no significant difference in the perception of youths, adults and elders of the community on the techno-enterprise potentials (H_{01}) and usage (H_{02}) of *canarium*-seeds for rural development. The perception of youths, adults and the elderly on the potentials of canarium-seeds was greater than the perception value of application of the seeds. The null hypotheses on no significant difference in the perception of youths, adults were rejected. Based on the analysis of statistical data of the study, it was concluded that the potentials of *canarium*-seeds for rural housing was accepted for implementation if approved. Therefore,four recommendations based on the findings of the study for implementation are:

1. Suitable and quality *canarium*-seeds should be approved by the enforcing authority of building regulations as an appropriate material for rural housing delivery.
2. Building materials research institutes should collaborate with relevant ministries, departments and agencies to explore the discovered potentials of *canarium*-seeds as a building raw material for rural housing delivery.
3. Training institutions and skill acquisition centres, affiliated professionals and agencies should emphasize the application of techno-entrepreneurship in research development and innovation on agro industrial waste for producing biocrete building materials.

4. NGOs and faith base organizations should establish training outfits in rural areas for the techno-entrepreneurial training.

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POSTGRADUATE STUDENTS' MODE OF STUDY AND THEIR UTILIZATION OF MOBILE TECHNOLOGIES FOR LEARNING IN AHMADU BELLO UNIVERSITY ZARIA, KADUNA STATE, NIGERIA

By

Zaharaddeen Bala, NAMADI
Department of Educational Foundation and Curriculum
Faculty of Education
Ahmadu Bello University, Zaria
E mail:znamadibala00@gmail.com

Akubugwo Ijeoma, GINIKANWA. PhD
Department of Curriculum studies
Faculty of Education
Abia State University, Uturu
E mail: ije1468@gmail.com

Muhammad, BUKAR
Department of Curriculum and instruction
Umar Sulaiman College of Education Gashua
E mail: mbukar22@gmail.com

&

Mohammed, GAMBO
Department of Curriculum and instruction
Umar Sulaiman College of Education Gashua
E mail: mohammedgambo2019@gmail.com

Abstract

This study investigated postgraduate students' mode of study and their utilization of mobile technologies in Ahmadu bello university Zaria Kaduna state Nigeria. The study adopted a survey design. The study targeted postgraduate students of eleven departments in the faculty of education Ahmadu Bello University Zaria, based on accessibility. A total of 658 postgraduate students were sampled using Research Advisors (2006) model. Researchers-designed questionnaire was used for data collection and the instrument was validated by the researchers. Mean was used to answer the research questions poised, while Analysis of Variance (ANOVA) was used to test the hypothesis. A coefficient reliability of 0.87 was obtained for the instrument through Cronbach alpha using split-half method of pilot test. The results of the study established that postgraduate students utilize mobile technologies for learning and research. The results further established that PhD postgraduate students utilize mobile technologies for learning and research more than other postgraduate students. The results of hypothesis testing indicated that there was no significant difference among postgraduate student' utilization of mobile technologies for learning and research purposes based on mode of study with the p-value 0.792 which is greater than 0.05 alpha value. It was however recommended among others that more orientation should be organized for all postgraduate students in other to bridge the gap in the differences between postgraduate students in their utilization of mobile technologies for learning.

Keywords: ICT, Mobile Technologies, Adoption, Postgraduate Diploma, Postgraduate Students. utilization

Introduction

The resultant effect of education should cater for the needs of individual citizens and society at large because education is important for the development of any society. The importance of education to mankind cannot be underestimated, most especially in this age of globalization where science and technological breakthroughs have become learning tools that can be implemented within and outside the classroom context. Education was defined by Iloanusi and Osuagwu (2009) as a major tool for national socio-economic growth and development. This implies that no societies' and socio-economic growth can develops without embracing education and effective learning is the main emphasis and concern.

Education is the illumination to every man's path. In every organization, including the educational system, information is always generated and stored in a particular medium before it is transmitted. While the process of generation and storage of this information is Information Technology, the process of its transmission to the intended audience or recipients is communication technology. Oludotun (2005) stated that ICT is a generic term referring to technologies for collecting, storing, editing, and passing on information in various forms. Communication is the process of transferring Information from one person to another as well as from the sender to the receiver with encoding and decoding means.

In a rapidly changing world, technology is essential for an individual to easily access and apply information. Technology has impact on the educational system. The new innovative of devices which are enhanced via technology are becoming more attracting, as it arrests and arouse users'

attention. Integrating these technologies into educational system will increase students' academic performance by arousing and arresting their attention. Thus, any institution that refuses to metamorphose with this trend of technology may become less relevant in human capital growth and development in its economy. ICT is an umbrella term which entails any communication device or application (Nana, 2012). The adoption of ICT in education is capable of empowering learners by transforming teaching and learning process from teacher-dominated/centered to learner-centered where teachers serve as facilitators of students learning' and at their pace. This transformation via ICT will result in increased learning, and also create opportunity for learners to develop their creativity, problem solving abilities, information reasoning skills and other higher-order thinking skills (Trucano, 2005). ICT can also be regarded as gadgets through which information could be sought and accessed.

Mobile Technologies refers to all forms of technologies that can be used to make work easier and delivered in short time. Jarvenpaa and Lang (2005) defined mobile technologies as handheld information technology and artifacts that encompass hardware devices, software interface and applications and communication network services. Therefore, mobile technologies could be regarded as the combined integration of hardware (PDAs, like palm pilot or handspring, mobile phones, and video game players), software (the applications that run on the device which include phone books, calendar programs and others) with its operating system and networking (networks are the infrastructure that supports the transfer of information) (Bola, 2015). Learning with mobile technologies is the exploration of handheld devices with wireless and mobile networks to facilitate, support, enhance and extend the band width of teaching and learning.

Postgraduate students need to be competent in utilizing ICT tools in their learning system. This will boost their academic, research and other learning skills. ICT is drastically altering the ways things are done in nearly every field of human activity (Adeyanju, 2012). Postgraduate education in Nigeria comprises studying for academic and professional degrees, certificates, diplomas or other qualifications for which first degree is required. In Nigeria, the postgraduate programmed is operated in the university under the control of the postgraduate school (Auriol, 2014). Postgraduate students are expected to embrace the use of mobile technologies in their learning and research as this will enhance and increase their learning rates and research activities.

Postgraduate mode of study refers to the approach and basis at which postgraduate students run their postgraduate programmed. In Nigeria, the programmed mode of study at postgraduate levels includes Full Time mode of study, Part time mode of Study and Distance Learning Mode of study. While the Full-Time mode of study and Part time mode of Study is majorly being run by the conventional universities, the Distance Learning Mode of study is majorly run by the National Open Universities and their respective centers. The use of electronic media for classroom instruction has its influence on the improvement of the standard of teaching in the classroom by making concept been taught more concrete.

Statement of the Problem

The new innovative devices which are enhanced via technology are becoming more attracting, as it arrests and arouse students' attention. Therefore, the limitation in the use of these technologies might jeopardize our learning system. The utilization of ICT tools in teaching and learning has become imperative at all levels of education. This is because teaching cannot be adequately effective without the use of ICT tools in schools in this 21st century (Adebisi, 2013). The mobile technologies should not only be used for social chat alone but it should be adopted into the teaching and learning process. Ogunduyile (2013) noted that some tertiary institutions have the electronic facilities but not maximizing its utilization. The use of mobile technologies

in Nigeria is still lagging behind compared to other developed nations in the globe. Most students use the mobile technologies for social self-chat but not for learning.

Research Questions

This study answered the following questions:

i. How do postgraduate students utilize mobile technologies in Ahmadu Bello University Zaria?
ii. What is the difference in the utilization of mobile technologies by postgraduate students in Ahmadu Bello University Zaria based on their mode of study?

Research Hypothesis

The following hypothesis was tested in this study:

Ho_1: There is no significant difference in the utilization of mobile technologies by postgraduate students in Ahmadu Bello University Zaria based on their mode of study.

Methodology

This study was a descriptive research of the survey type. The population for this study comprised all postgraduate students in Ahmadu Bello University Zaria. Postgraduate students were sampled across 11 Faculties. Stratified random sampling technique was used across the eleven Faculties in Ahmadu Bello University Zaria. and six hundred and fifty-eight (658) postgraduate students were sampled using Research Advisors (2006) model of sample size. The instrument used for data collection was a researchers-designed questionnaire with sections A and B for demographic data of the respondents and their utilization of Mobile technologies for learning respectively. Four Likert scale of Strongly agree, Agree, Disagree and Strongly agree was used as the response mode.

The questionnaire was vetted by the researchers and three other experts in the department of Educational technology and department of Computer science for face and content validity, and it was pilot-tested at the Faculty of natural science Ahmadu Bello University Zaria through the split-half method. The reliability coeffient of 0.82 was obtained through Cronbach alpha. The questionnaire was personally administered by the researchers following all ethical issues on questionnaire administration. Mean was used to answer the research questions, while the hypothesis was tested using Analysis of Variance (ANOVA) at 0.05 level of significance.

Results and Discussion

Research Question 1:

How do postgraduate students utilize mobile technologies in Ahmadu Bello University Zaria?

Table 1:

Postgraduate Students Utilization of Mobile Technologies

S/N	Items	Mean
i.	Mobile Technologies can be used to search and store information regarding lesson to be learnt	3.23
i.	Mobile Technologies allow easy access to information for research	3.55
i.	Mobile Technologies influence quick and better presentations.	2.65
i.	The use of mobile technologies allows receiving of lectures anywhere and anytime.	2.87
i.	The influence of mobile technologies results in competitive advantage compared to other devices	2.90
i.	The use of mobile technologies leads to increased classroom product quality.	2.56
i.	Use of mobile technologies gain significant skills and advantages in the learning process	2.59

/.	Mobile technologies allow for greater collaboration and promote group work	2.43
/.	With mobile technologies, students' progress and reports can be easily tracked	3.12
i.	Unlimited source of information is possible with mobile technologies	3.01
i.	Mobile Technologies allow for Global communication	3.34
i.	Assessing students' performance can be done instantly with mobile technologies	2.34
ɾ.	Course curriculum can reflect real world data and real-time information with Mobile Technologies	2.01
ɾ.	Geographically isolated or economically disadvantaged students can benefit from access to online software or resources for learning with Mobile Technologies	3.22
i.	Using mobile technologies in learning makes learning addictive	2.88
	Grand Mean	**2.85**

Table 1, presents the result on how postgraduate students utilize mobile technologies. The results indicated that mobile technologies can be used to search and store information regarding lesson to be learnt and mobile technologies allow easy access to information. Mobile Technologies influence quick and better presentations and the use of mobile technologies allows receiving of lectures anywhere and anytime. Furthermore, the results established that the influence of mobile technologies results in competitive advantage compared to other devices like the use of mobile technologies leads to increased classroom product quality and also the use of mobile technologies gains significant skills and advantages in the learning process. Mobile technologies allow for greater collaboration and promote group work.

With mobile technologies, students' progress and reports can be easily tracked and postgraduate students can source for unlimited information with mobile technologies. Postgraduate students believe that mobile technologies allow for Global communication. Assessing students' performance can be done instantly with mobile technologies. Postgraduate students agreed that course curriculum can reflect real world data and real-time information with Mobile Technologies. Geographically isolated or economically disadvantaged students can benefit from access to online software or resources for learning with Mobile Technologies. Using mobile technologies in learning makes learning addictive. The grand mean score on postgraduate students' utilization of mobile technologies was 2.85. Using a bench mark of 2.50 for the 4-likert type scale, since the grand mean score of 2.85 was greater than the benchmark, it can thus be deduced that postgraduate students utilize mobile technologies for their learning.

Research Question 2:
What is the difference in the Utilization of Mobile Technologies by Postgraduate Students based on their mode of study?
Table 2:
Difference in the Utilization of Mobile Technologies by Postgraduates Students

Mode of Study	N	Mean	Remarks	Mean Deviation
Full-Time	315	3.51	Utilized	0.00
Part-Time	115	3.46	Utilized	0.05
Distance Learning	228	3.56	Utilized	0.04
Total	658			

Table 2, presents the difference in the utilization of mobile technologies by postgraduate students based on mode of study. The table indicates that of the 658 postgraduate students that participated in this study, 228 distance learning Postgraduate students mostly

utilized mobile technologies with a mean score of 3.56, 315 fulltime Postgraduate students utilized mobile technologies more with a mean score of 3.51, while 115 Postgraduate part- time students had a mean score of 3.46. The difference in the mean gain of postgraduate students in their utilization of mobile technologies was very low. This indicated that postgraduate distance learning' students utilized mobile technologies more than their full- time and part -time counterparts in Ahmadu Bello University Zaria.

Hypothesis One

There is no significant difference in the utilization of mobile technologies among postgraduate students in Ahmadu Bello University Zaria based on their Mode of Study.

Table 3:

Significant Difference in The Utilization of Mobile Technologies Among Postgraduate Students Based on their Mode of Study

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.657[a]	2	.219	.350	.792
Intercept	70.448	1	70.448	112.672	.000
Mode of Study	.657	2	.219	.350	.792
Error	2.501	655	.625		
Total	73.607	658			
Corrected Total	3.158	657			

a. R Squared = .208 (Adjusted R Squared = -.386)

Table 3, shows the results on the significant difference in the utilization of mobile technologies among postgraduate students based on their mode of study. It indicated that $F(2, 658) = 0.35$, $p>0.05$, which means no Significant difference existed in the utilization of mobile technologies among postgraduate students based on their Mode of Study. Hence, the null hypothesis which stated that there is no Significant difference in the utilization of mobile technologies among postgraduate students based on their Mode of Study is hereby accepted. However, the marginal means on the differences in utilization are represented graphically in Figure 1.

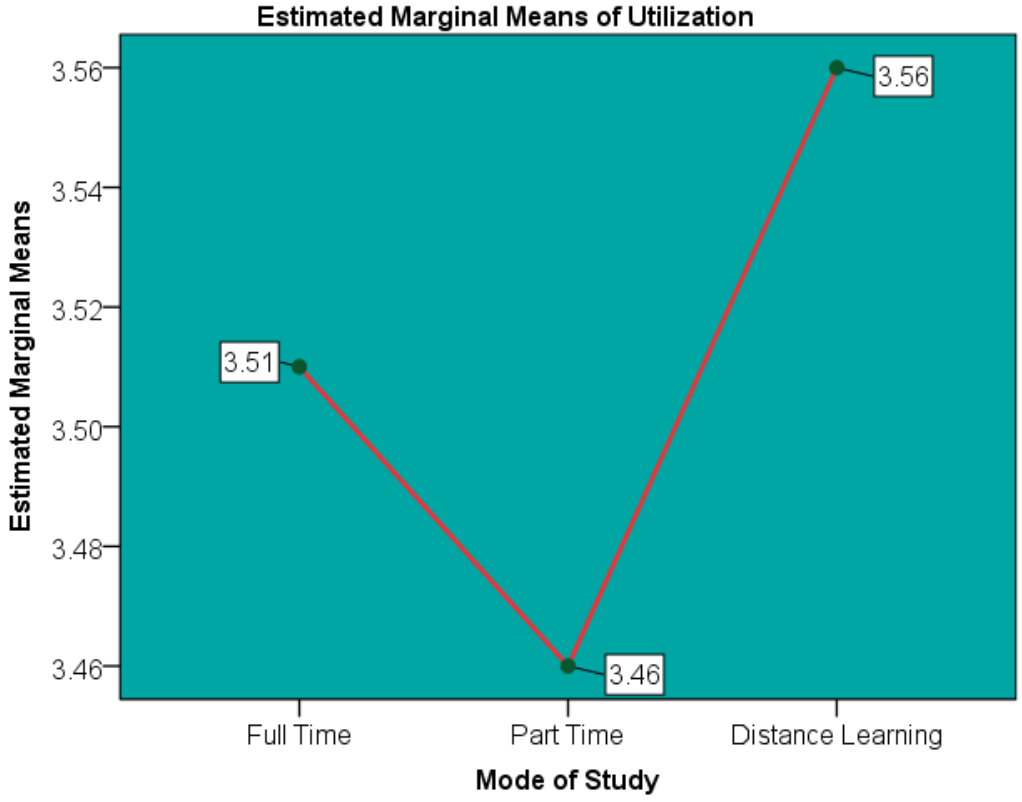

Figure 1: Estimated Marginal Means on Utilization of Mobile Technologies

Figure 1, presents graphically the estimated marginal means on the utilization of mobile technologies among postgraduate students in Ahmadu Bello University Zaria based on their Mode of Study. It revealed that distance learning postgraduate students utilize mobile technologies the most, next full time and part time postgraduate students respectively but the differences are negligible.

Conclusions

The study concluded that postgraduate students utilize mobile technologies for their learning. The effective utilization of the mobile technologies by postgraduate students could be of immense benefit towards their learning within and outside the classroom settings and also facilitate their research knowledge and skills. There were differences in the utilization of mobile technologies by postgraduate students based on their Mode of Study. The findings indicated that postgraduate students utilized mobile technologies more than their counterparts in Ahmadu Bello University Zaria. However, the findings further established that there were not significant differences in the utilization of mobile technologies by postgraduates based on Mode of Study in Ahmadu Bello University Zaria. This implies that differences existed in the utilization of mobile technologies by postgraduate students based on Mode of Study but the differences were not significant.

Recommendations

Based on the conclusions made, the following recommendations were made:

i. Postgraduate students should be encouraged to continue utilizing mobile technologies in their studies for both learning and research.

ii. More orientation should be organized for full time and part time postgraduate students on the usefulness of mobile technologies in learning. This will enable to bridge the gap

in the differences between postgraduate students in their utilization of mobile technologies for learning based on Mode of Study.

iii. A workshop could also be organized for all postgraduate students in order to maintain their level of utilizing mobile technologies for learning and research without gap.

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EFFECTS OF COMPUTER GRAPHIC ORGANIZERS AND EXPERIENTIAL LEARNING ON JSS II STUDENTS' ACHIEVEMENT AND RETENTION IN BASIC SCIENCE AND TECHNOLOGY

Asabe Edward Bash- asabebash@gmail.com
Department of Science and Technology Education
Faculty of Education, University of Jos, Jos

Isa Muluku- isamuluku@gmail.com
Federal College of Education, Zuba, Abuja (FCT)

Sonia Ishaku Longyil-longyilsonia@gmail.com
College of Education Gindiri, Plateau State, Nigeria.

Prof. Regina Marita Onabid Samba-sambaregina2015@gmail.com
Benue State University, Makurdi.

ABSTRACT

The study compared the effects of Computer Graphic Organizers and Experiential Learning on students' achievement and retention in Basic Science and Technology, Plateau State. Nigeria. Three research questions were answered and two hypotheses were tested at 0.05 level of significance. The study adopted a quasi- experimental design. Specifically, the separate sample pre-test post-test design. The population of the study comprised of 13,040 and a sample of 325 junior secondary two students from six secondary schools in Northern Zone of Plateau State were selected using a multi-sampling technique, specifically the purposive sampling technique. The Basic Science and Technology Test (BSTAT) with reliability coefficient of 0.71 was used for data collection. The data collected was analyzed using Mean and Standard Deviation to answer the research questions While Analysis of Covariance (ANCOVA) was used in testing the hypotheses at 0.05 level of significance. The findings revealed that there were significant differences in both Graphic Organizer and Experiential learning with mean scores ($\bar{X}$= 25.94, SD = 9.02) group I and group II had a mean score of ($\bar{X}$ = 29.01, SD = 10.08 before treatment. After treatment the results for experimental group II yielded a higher mean score ($\bar{X}$ = 61.54, SD = 14.62) than experimental group I ($\bar{X}$= 50.24, SD = 9.64). The mean difference is high with 5.34. On the interaction effect of method and gender, there was no interaction effect. This means that the interaction effect was unattainable. It was recommended among others that the two strategies can be used for teaching of Basic Science and Technology to enhance high achievement and retention in students. Furthermore, stake holders should organize seminars and workshops to train teachers on how to use Graphic Organizers and Experiential learning for teaching.

Introduction

Generally, Science and Technology is the bedrock of national growth, development and productivity. Science as a discipline is considered as the systematic study of knowledge of man and his environment, which depends on seeing and testing of facts (Mankilik, 2014). The researcher explains further that technology is the practical use of scientific knowledge and techniques to produce goods and services to meet human needs. It is through Science and Technology; modern gadgets in all phases of human endeavors have been invented, like electricity, aircraft, television, computers, medical kits, agricultural machines among others. The importance of Science and Technology to national development cannot therefore be over-emphasized. In spite of the importance of the subject to the development of the youths and the nation at large, students' achievement in the subject has been worrisome. Analysis of Basic Education Certificate Examination (BECE) in Basic Science and Technology in Plateau State from 2014-2018, reveals percentage credit pass as 26.49%, 24.80%, 18.06%, 17.15%, 23.82% (Plateau State Ministry of Education, 2017).One of the problems that are generating public concern in Nigeria today of course is this decline in the achievement of students. The BECE Chief Examiners' reports for the years also decry this trend from 2014 to 2018.

Many factors have been attributed to the underachievement and retention of students in Basic Science and Technology in BECE and the one that is most common is poor teaching methods (Anyaebunam, 2012; Mbanefo, 2016). Adegoke (2010) observed that the conventional lecture strategy is usually the dominant approach used by teachers in Nigeria and students are not actively involved in developing knowledge; the students generally remain passive listeners throughout the lesson. In view of the lapses inherent in the conventional lecture strategy of teaching Basic Science and Technology and subsequent low achievement and retention by students, researchers in science and technology are continually making efforts towards finding ways of improving students' understanding and retention in Basic Science and Technology. Studies by Samba, Kurumeh and Bash (2018) and Bash, Kabang and Dawal and Macmillan (2019) have shown that some teaching strategies such as the use of computer animated approach, inquiry approach, problem-based approach, peer tutoring approach, target task approach, jigsaw cooperative learning amongst others have been applied to tackle the low achievement and retention of students in Basic Science and Technology. Similarly, government and other professional bodies like Science Teachers Association

of Nigeria (STAN) have been organizing training and re-training workshops for science teachers with the aim of improving their instructional delivery capacity and by expanding students' achievement and retention in the field of Basic Science and Technology.

Tsoho (2010) also identifies teaching strategy as main key to retention in students on learnt materials. In conformity with the above statement, Chianson, Kurumeh and Obida (2010) found in a study that, teacher serve as a standard to students retention in mathematics and science concepts. The researchers further explained that the teaching strategies that involve active participation of students enhance retention. Despite these efforts, little or no appreciable improvement has been recorded in students' understanding in Basic Science and Technology subject. Therefore, there is the need to adopt activity and innovative teaching strategies with the aim of improving students' achievement in the subject. Among such innovative strategies are the use of graphic organizers and experiential learning in improving students' achievement and retention in Basic Science and Technology subject.

A Graphic Organizer (GO) is simply a graphical or spatial representation of text concept. It is an instructional tool that can help students to organize, structure the information and concept to relate with other concepts. Zaini, Moktar and Nawawi, (2010) state that the spatial arrangement of GOs allows the students to identify the missing information or absent connections in one's understanding. However, much has not been done in the area of graphic organizer in enhancing students' retention in this part of the world.

Experiential Learning (EL) is learning by doing or learning through experience (Northern Illinois University, 2011). Experiential learning is a type of learning in which students participate in some activities, reflect upon the activities and use their analytical skills to derive some useful insight from the experience, and then incorporate their new understanding into their lives (Nwafor, 2015). In experiential learning, personal experience is the central point for learning; it allows students to test the validity of the ideas that were created during the learning process. In the light of these findings, this study examined the efficacy of Computer Graphic Organizers and experiential learning on students' achievement and retention in Basic Science and Technology in Northern Zone of Plateau State, Nigeria.

Therefore, there is the need for further investigation, more so that Jacob and Linus (2017) found that, instructional method used in the classroom may influence gender and students' achievement in Basic Science and Technology. It is against this background that this study compared the effects of Computer Graphic organizers and Experiential on students' achievement and retention in Basic Science and Technology as researches have attributed students' low achievement and retention in the subject to teachers teaching techniques.

Aim and Objective of the study

1. Ascertain junior secondary school students' academic achievement when exposed to Graphic Organizers and Experiential learning.
2. Determine the interaction effect of method and gender on students' mean achievement scores in Basic Science and Technology?
3. Determine the mean retention scores of Basic Science and Technology students after treatment in the two experimental groups.

Research Questions

The following research questions formulated guided the study:

iv. What is the mean achievement scores of students when taught using Graphic Organizers and Experiential learning?

2. What is the interaction effect of method and gender on students' mean achievement scores in Basic Science and Technology?
3. What are the mean retention scores of students taught Basic Science and Technology using Graphic Organizers and Experiential Learning strategies?

1.5 Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference in the mean retention scores of male and female students taught Basic Science with Graphic Organizers.
2. There is no significant difference in the mean retention scores of male and female students taught Basic Science and Technology with Experiential learning.

Methodology

The study compared the effects of Computer Graphic Organizers and Experiential Learning on students' achievement and retention in Basic Science and Technology. The study employed a quasi-experimental design. Specifically, the study adopted a separate sample pretest posttest design. This design has no control group, and no randomization was applied on getting the samples for the experimental I (Graphic Organizer) and experimental II (Experiential learning) groups. A pre-test was administered to both experimental groups to determine if any difference exists in the ability of the two groups before treatment. Both experimental groups received separate treatments after which a post-test was administered to both the experimental groups thereafter. The population of the study is all the junior secondary schools in the Northern Zone of Plateau State which is 13,040 junior secondary school two (JSS II). 325 junior secondary two Basic Science and Technology students made up of 164 males and 161 females from six secondary schools formed the sample for the study.

Basic Science and Technology Achievement Test (BSTAT) with reliability coefficient of 0.71 was used to test the reliability of the instrument. Three research questions and two null hypotheses tested at 0.05 level of significance guided the study. Data collected was analyzed using mean and standard deviations to answer the research questions while Analysis of Covariance (ANCOVA) was used in testing the hypotheses. ANCOVA was used in the study to test the significant differences or control the initial difference between groups with the pretest serving as covariates.

Results:

xxii. Research Question One: What is the mean achievement scores of students when taught using Graphic Organizers and those taught Experiential Learning strategies?

Table 1: Mean and Standard Deviation of Achievement Scores of Students in Experimental Groups I and II

Group	N	Pretest		Posttest			
		X	SD	X	SD	Mean Gain	$\bar{X}_{Diff}$
Experimental I	153	25.94	9.02	50.24	9.64	24.30	8.23
Experimental II	172	29.01	10.08	61.54	14.62	32.53	

Table 1 reveal the mean and standard deviation of post-test mean achievement scores of the experimental groups I and II. The result for experimental group I yielded a mean score ($\bar{X}$= 25.94, SD = 9.02) and group II had a mean score of ($\bar{X}$= 29.01, SD = 10.08) before treatment. After treatment the results for experimental group II yielded a higher mean score ($\bar{X}$ = 61.54, SD = 9.64) than experimental group I ($\bar{X}$= 50.24, SD = 14.62). The mean difference is high with 8.23 for experimental groups I and II was low. This could be because both groups were exposed to treatment. The result further shows that those taught with Experiential Learning performed better than those taught using Graphic Organizers.

xxiii. Research Question Two: What is the interaction effect of methods and genders on students' mean achievement scores in Basic Science and Technology?

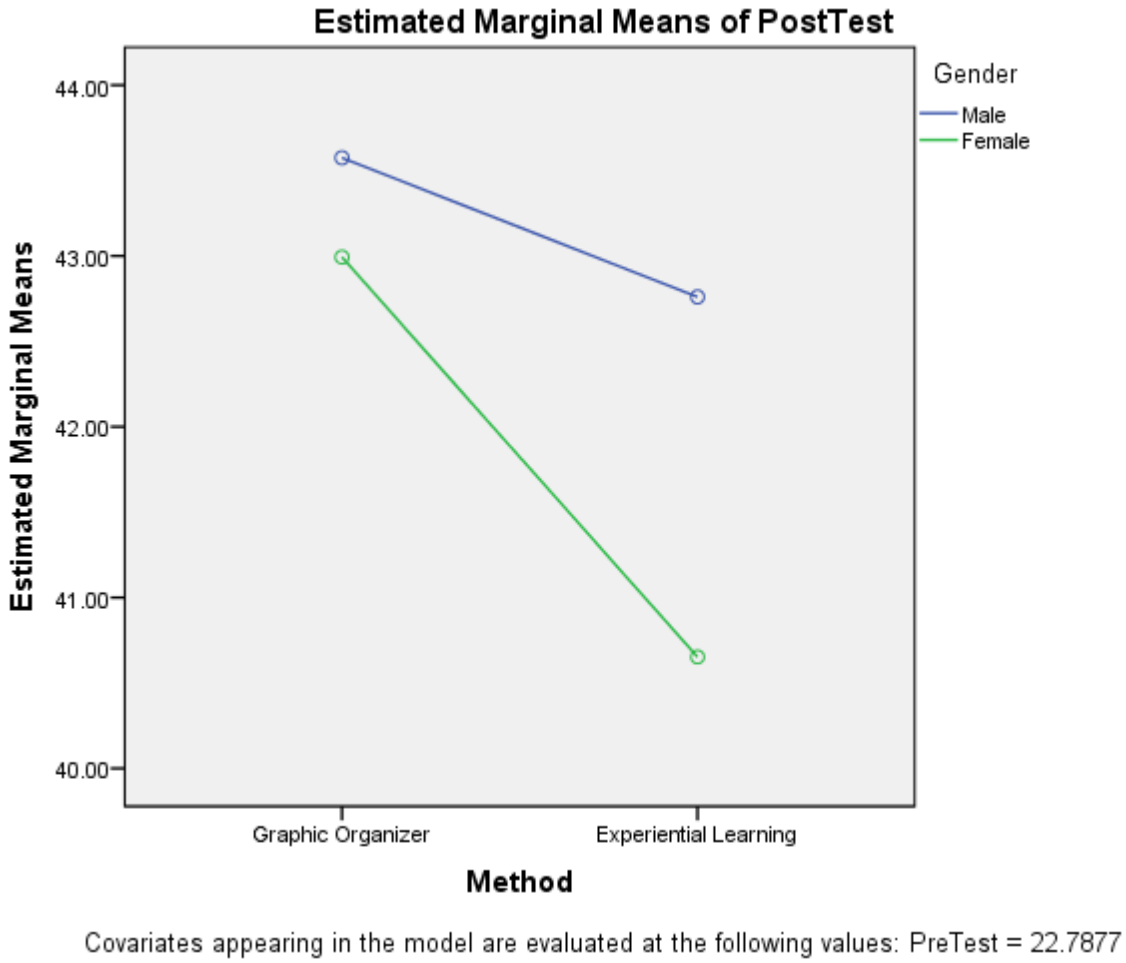

Figure1: Mean Interaction Effect of Methods of Teaching and Gender on Students' Achievement in Basic Science and Technology

In Figure 1, the profile plot/graph shows the interaction effect of methods of teaching and gender on students' achievement in Basic Science and Technology. The interaction pattern shows that the plots for males and females do not intersect though not parallel lines. This indicates that there is likelihood of an interaction effect between methods and gender in achievement for Graphic Organizers strategy. But when the plot is interpolated the intersection could only be at a far point, which means that the interaction effect between methods and gender may be tenable in this case.

xxiv. Research Question Three: What are the mean retention scores of students taught Basic Science and Technology with Graphic Organizers and Experiential learning strategies?

Table 2: Mean and Standard Deviation of Retention Scores of Students in Experimental Groups I and II

Group	N	Pretest		Retention			
		X	SD	X	SD	Mean Gain	$\bar{X}_{Diff}$
Experimental I	153	25.94	9.02	44.20	10.54	18.26	0.75
Experimental II	172	29.01	10.08	46.52	12.51	17.51	

Table 2 reveal the mean and standard deviation of post-test mean achievement scores of the experimental groups I and II. The result for experimental group I yielded a mean score ($\bar{X}$= 25.94, SD = 9.02) and group II had a mean score of ($\bar{X}$= 29.01, SD = 10.08 before treatment. After treatment

the results for experimental group II has retention mean score ($\bar{X}$ = 44.20, SD = 10.54) and experimental group I ($\bar{X}$= 46.52, SD = 12.51). The mean difference is low with 0.75. This could be because both groups were exposed to treatment. The result further shows that those taught with Experiential Learning had almost the same retention mean score as those taught using Graphic Organizers.

$H0_1$: There is no significant difference in the mean retention scores of male and female students taught Basic Science with Graphic Organizers.

Table 3: ANCOVA Mean Retention Scores of Male and Female Students taught Basic Science and Technology with Graphic Organizer

Source	Type III Sum Squares		Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	11	4	2		.19	.02
Intercept	1285	1	1285	6	.00	.68
Pre-achievement	2	1	2		.26	.00
Group	10	1	10		.02	.02
Gender		1			.94	.00
Error	612	152	1			
Total	11694	154				
Corrected Total	624	153				

a. R Squared = .019 (Adjusted R Squared = .007)

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the retention mean scores of male and female students taught Basic science and Technology using graphic organizers and experiential learning strategies. The effect of gender yielded, male (M = 58.22; SD = 13.59) and female (M = 58.36; SD = 14.25), It indicates that the mean score of male did not differ from that of female significantly. Table 3 further shows that F(1, 153) = .01, p >0.05, since the p- value of .94 is greater than 0.05 level of significance, the null hypothesis was not rejected, indicating that there was no significant effect of gender on the retention of students taught using graphic organizers strategy.

$H0_2$: There is no significant difference in the mean retention scores of male and female students taught Basic Science and Technology with Experiential learning.

Table 4: Summary Result of ANCOVA on Mean Retention Scores of Male and Female Students Taught with Experiential Learning.

Source	Type III Sum Squares	Df	Mean Squa	F	Sig.	Partial Et Squared
Corrected Model	144.22[a]	1	144.22	1.07	.19	.01
Intercept	33533.00	1	33533.00	270.0(	.00	.73
Gender	144.22	1	144.22	1.07	.16	.01
Error	14477.02	178	82.50			
Total	371052.00	180				
Corrected Total	14641.24	179				

a. R Squared = .110 (Adjusted R Squared = .044)

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the retention mean score of male and female students exposed to Experiential Learning. Table 3 shows that $F(1, 179) = 1.07$, $p > 0.05$, since the p- value of 0.16 is greater than 0.05 level of significance, the null hypothesis was not rejected, indicating that there was no significant effect of Graphic Organizers on male and female students' retention mean scores in Basic Science and Technology. The result further reveals an adjusted R squared value of .044 which means that 0.4 percent of the variation in the dependent variable which is students' mean retention score in Basic Science and Technology is explained by variation in the treatment, while the remaining is due to other factors not included in this study.

Discussion

The study compared the effects of Graphic Organizer and Experiential Learning on student's achievement and retention in Basic Science and Technology. The findings on post-test mean achievement scores of experimental groups I and II of male and female students taught Basic Science and Technology using Graphic Organizers. The mean scores for gender (males and females) yielded a higher that males differ from females. This implies that female students performed better than male students in Basic Science and Technology when taught Basic Science and Technology using Graphic Organizers. This study agreed with the study of Chabari, (2018) who conducted a study on effects of Graphic Organizers and Experiential Learning on students' achievement and found that the females performed better when taught Basic Science and Technology using Graphic Organizers and Experiential Learning and also Bursal (2013) who conducted a study using Science courses, the result showed that there was a significant difference in the achievement of students in favour of girls..

The findings on the interaction effects of methods and gender on students' retentive ability in Basic Science and Technology revealed that male performed slightly better than the female when taught using Graphic Organizer. It also revealed that despite the fact that both male and female were exposed to Graphic Organizer and Experiential Learning strategies, male students had a slightly higher mean retention scores than female in favour of Graphic Organizers learning strategy. This study lend credence with the study of Gabriel, Osuafor, Cornelius, Obinna and Francis (2018) who examined the effect of cooperative learning on the interaction effect of students in secondary school and found a significant difference in the interaction of male students than female.

Another finding on gender in the post-post result in this study was that there was no significant effect in the retentive ability of male and female students taught Basic Science using Graphic Organizer and Experiential Learning strategies. This finding is in agreement with the findings of Godpower-Echie and Owo (2019) who found no significant difference in the retention of male and female taught Basic Science using inquiry-based method of teaching.

Conclusion

The study concluded that the use of Graphic Organizers and Experiential Learning enhances students' achievement and retention in Basic Science and Technology. The strategy can be used in teaching Basic Science and Technology subject since there was no much significant difference in their achievement and retention level. The interaction effect of method and gender was not attainable as shown on the graph.

Recommendations

1. Basic Science and Technology teachers should use Graphic Organizer and Experiential Learning because the strategies provide opportunity for Basic Science and Technology students to think meaningfully and improve their retention level.

2. Teacher training institutions should include the use of Graphic Organizer and Experiential Learning as part of the strategies that teachers must use in teaching Science generally.

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ASSESSMENT OF INFORMATION COMMUNICATION AND TECHNOLOGY COMPLIANCE AND UTILIZATION FOR CURRICULUM DELIVERY AMONG BASIC SCIENCE AND TECHNOLOGY TEACHERS IN PLATEAU STATE, NIGERIA

By

Ayuba Bayara Kabang
kabangayuba@gmail.com
Department of Science and Technology
Education, Faculty of Education,
University of Jos, Plateau State

and

Augusta Ndidi Ojoko
austa74d@yahoo.com
Department Of Integrated Science, School Of
Secondary Education, Science Programmes,
Federal College Of Education, Kontagora,
Niger State

ABSTRACT

Information and communication technology has brought profound changes to almost all spheres of life, including educational practices. The role of Information Communication and Technology in the development of knowledge is widely recognized. This study investigated how teachers' Compliance and Utilization of Information Communication and Technology (ICT) impact on their curriculum delivery in Plateau State, Nigeria. Four research questions were raised to guide the study. The study

adopted survey design. The population of this study is 651 Basic Science and Technology teachers in 2019 academic year, from where a total of 250 respondents were sampled. The instrument titled "ICT Compliance and Utilization Assessment" questionnaire (ICUAQ) was developed by the researchers and validated by experts in the Faculty of Education, University of Jos was used for data collection with a reliability coefficient of 0.84, established through the Cronbach alpha coefficient analysis. Data generated based on the research questions were analyzed with descriptive statistics using percentages. Findings revealed that most Basic Science and Technology teachers though agreed that the ICT can be used to achieved the subject teaching objectives show non-compliance skills in the use of Information Communication and Technology and accessing it resources. The study revealed that teachers make less use of ICT in terms of frequency in the use of ICT in lesson preparations, teaching and learning. Based on the findings, the study concluded that objective of ICT in education in Nigeria has not been met, and that Basic Science and Technology teachers are yet to derive the benefits of ICT in curriculum delivery. Consequently, the study recommended that government and other stakeholders such as Parents Teachers Association (PTA) and Old Students should liaise with schools to determine the training needs of staff members and help them to organize appropriate training programmes in schools.

KEYWORDS: Curriculum, Science, Technology, Teacher, Education, ICT

INTRODUCTION

The concept Information and Communication Technology (ICT) refers to a communication device or application, including: radio, television, cellular phones, computers and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. Rinji (2013) sees ICT as a basic building block of modern society or as a permanent feature in the landscape of teaching and learning. The author further observed that it is no longer possible, nowadays, to conceive education without information and communications technology. Thus, one can go even further to observe that education is increasingly being defined by ICT. Like other countries, teachers in Nigeria must recognize that if they are to be continuously relevant in a world transformed by ICT, they need to have opportunities to acquire and develop ICT skills no matter the cost.

Ukpong (2016) observes that the globalization of the 21st century and its associated revolution in technology has led to a groundswell interest on how computers and internet can best be harnessed to improve the efficiency and effectiveness of education at all levels and in both formal and non-formal settings. Hence, Telephone, radio and television which have longer and richer history as instructional tools are now given less attention, while, there is greater emphasis on the use of computer and internet in the teaching-learning processes.

The use of computer and internet is still low in Nigeria and other developing nations, if there are used at all, due to limited infrastructure and high costs to access, poor attitude, lack of awareness and orientation. For teachers to continue to be relevant in their present profession, they need to be competent in the use and application of computer and internet in curriculum delivery. Gana (2015) and Ugochi (2015) accept that when Information and communication technology is used in the teaching and learning processes, it will improve and boost the ego of the schools to a large extent. Dania and Enakrire (2012) also concurred that ICT allow learning to take place in many ways: online, self-paced, personal or collaborative, and that an edutainment approach is often used in making lessons more lively and fun, especially for young children. Again, ICT applications for education are also made for classroom management, timetabling, activity planning, personnel administration, and communications with parents.

The pedagogical rationale for promoting ICT in schools is concerned with the use of ICT in teaching and learning. It is intimately related, therefore, to the economic and social rationales, but ICT also has additional application in the teaching and learning process. It provides teachers with a range of new tools to facilitate traditional pedagogies; it also and perhaps more importantly, presents the teacher with the potential to develop new teaching methods. For teachers in a culture of all-pervasive technology, ICT provides new, and more exciting and relevant, learning opportunities. It contributed to teaching and learning in varying ways.

In a study reported by Inspectorate (2008), findings revealed the following: that significant number of teachers lack intermediate (or better) ICT skills in a wide range of areas. Interviews with teachers in case-study schools found that ICT was least likely to be used to develop teamwork and collaborative skills. High levels of integration of ICT were found in the science and applied science subjects, and Mathematics. The principals, teachers and students stated that ICT has the potential to improve students' motivation and engagement and to make learning more exciting (Ukpong, 2016). In particular, principals and teachers stated that it contributes to improve teaching materials and methods and to improve learning outcomes.

In Nigeria, very little literature has been published on the impact of ICT on schools and especially on teaching and learning in the study area. This paper become timely to examine the extent to which ICT has been embraced by teachers in schools and, more importantly, assesses the impact that ICT has had on teaching and learning. The ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change (Rinji, 2013; Chidi-ehiem, 2015).

There are developments in the Nigerian education sector which indicate some level of ICT application in the secondary schools. The Federal Government of Nigeria, in the National Policy on Education (Federal Republic of Nigeria, 2014), recognizes the prominent role of ICTs in the modern world, and has integrated ICTs into education in Nigeria. . To achieve the feat, government intends to provide necessary infrastructure and training for the integration of ICTs in the secondary school system. Unfortunately, the integration of ICT in the teaching and learning processes is still at a minimal level. This view finds bearing by Kwacha (2007), that the computer is not part of classroom technology in more than 90 percent of Nigerian public schools due to lack of literate ICT teachers. This implies that the chalkboard and textbook continue to dominate classroom activities in most Nigerian secondary schools. Simon (2014) discovered that the unavailability of some ICT components in schools hampers teachers' use of ICTs. Lack of adequate search skills and of access points in the schools were reported as factors militating the use of the Internet by secondary school teachers (Kwacha, 2007; Simon, 2014).

The Federal Ministry of Education has launched an ICT-driven project known as School Net (www.snng.org) which was intended to equip all schools in Nigeria with computers and communications technologies. In June 2003, at the African Summit of the World Economic Forum held in Durban, South Africa, the New Partnership for African Development (NEPAD) launched the e-Schools Initiative, intended to equip all African high schools with ICT equipment including computers, radio and television sets, phones and fax machines, communication equipment, scanners, digital cameras, and copiers, among other things in teaching school subjects as Basic Science and Technology.

Basic Science and Technology occupies a special position in the junior secondary school curriculum. Basic science and technology is the foundation to science courses for the senior secondary and tertiary levels of education in Nigeria. Duru (2013) defines Basic science as a core subject and a foundation to all the sciences at the senior secondary school and at all science related occupations. It is also seen as an approach to science teaching in which concepts, principles and methods of science are presented to express the fundamental unity of scientific thought. Basic science is taught in the Nigerian Junior secondary schools as a unified subject. Science Teachers Association of Nigeria STAN (2011) classified basic science contents into four major units as; you and environment, living and non-living things, science and development and you and energy with their respective subthemes.

The contribution of science and technology to national development is contained in the aims and objectives of the National Curriculum Review of 2011 in which the Basic science and technology formed an integral part. The objectives in specific terms include value orientation, poverty eradication, job creation, wealth generation and economic empowerment that are directed factors in national growth and development (NERDC, 2014). Basic science and technology also has the following teaching objectives, to; develop interest in science and technology, acquire basic knowledge and skills in science and technology, apply scientific and technological knowledge and skills to meet societal and personal needs, become aware of numerous career opportunities provided by science and technology (in the world of work), avoid drug abuse and related vices and be safety or security conscious (NERDC, 2012).

No matter how carefully worded the objectives may be, their realization revolves around the quality of teachers or experts in the subject area currently in the teaching service. This view is in consonance with the Federal Republic of Nigeria, FRN (2014) which upheld that no education can rise above the quality of its teachers. Basic science and technology teachers like their counterparts in other subject areas must embrace the use of and application of ICT in their teaching practices. This is not only to make them blend with the current global trend, but to make them more efficient and effective in curriculum delivery through the use of modern communication technologies such as computers, internet, projectors, digital cameras, software and others. The purpose of this study is to investigate the extent of teachers ICT compliance and how it has affected curriculum delivery in Plateau State, Nigeria.

Statement of the Problem

The teaching of Basic Science and Technology in Nigeria has suffered a lot of setbacks. Ukpai (2012) noted that most secondary schools teachers including Basic Science and Technology teachers are yet to embrace the use of modern technologies in their classroom practices and other pedagogical activities. They are yet to explore the advantages inherent in the use of computers, internet, modem and other ICT infrastructures in the teaching learning processes. This is sure to affect the quality of performance in curriculum delivery and concomitant learners' achievement. Even when the relevance of ICT in pedagogy has become so apparent, the penetration of the technology in schools, measured in terms of availability of computer, printers, digital cameras, projectors, scanners, and whiteboards are quite unrealistic in Nigerian schools. Besides, in-service training schemes for teachers are a matter of policy without practical implementation. A few questions seem pertinent at this point: To what extent are teachers ICT compliant in Plateau State, Nigeria? How adequate is ICT infrastructures in the schools? To what extent has ICT affected curriculum delivery in the schools? It is the lacuna that exists between these pertinent questions that gave impetus to this study.

Purpose of the Study

The purpose of this study is to investigate Basic Science and Technology teachers ICT compliance and utilization in curriculum delivery in Plateau State, Nigeria. Specifically, the study aims to:

iii. determine the extent of Basic Science and Technology teachers use of ICT in realizing teaching objectives in Plateau State, Nigeria.
iv. find out the extent to which Basic Science and Technology teachers have ICT sources in curriculum delivery in Plateau State, Nigeria.
v. investigate the extent Basic Science and Technology teachers access ICT for lesson planning and preparation in Plateau State, Nigeria.
vi. determine the extent of Basic Science and Technology teachers' use of ICT in teaching and learning in Plateau State, Nigeria.

Research Questions

The following research questions guided the study:

1. What is the extent of the Basic Science and Technology teachers' use of ICT in realizing teaching objectives in Plateau State, Nigeria?
2. What is the source of Basic Science and Technology teachers' access to ICT in curriculum delivery in Plateau State, Nigeria?
3. What are Basic Science and Technology teachers' skills in accessing ICT information for lesson planning and preparation in Plateau State, Nigeria?
4. How frequent do Basic Science and Technology teachers use ICT in their curriculum delivery in Plateau State, Nigeria?

Method

The research design adopted a survey design in the study in which a questionnaire was used for data collection from the respondents. The target population of the study comprised of all basic science and technology teachers in public secondary schools in Plateau State. The population of the study

comprises of 651 public secondary schools teachers. The sample size of this study is 250 (38.4% of the population) respondents selected through random sampling technique. The instrument used for the study was a questionnaire known as "ICT Compliance and Utilization Assessment Questionnaire" (ICUAQ) used for data collection. The ICUAQ was validated by three experts in the Faculty of Education, University of Jos. The reliability of the instrument was established using Cronbach Alpha coefficient which gave an index of 0.84. The researchers personally administered the questionnaire to all the respondents. The respondents worked independently under the supervision of the researchers. This ensured maximum return of the questionnaire and also helped avoid external influences on the respondents. The research questions were analyzed using percentages

RESULTS AND DISCUSSION OF FINDINGS

Table 1: Teachers' use of ICT in Realizing Teaching Objectives in Basic Science and Technology

S/N	**Item**	Agree	%	Disagree	%
1.	ICT stimulates students' interest in learning	215	86	35	14
2.	ICT makes easy evaluation of students class work	230	92	20	08
3.	ICT reduces teacher workload as he obtains information from Internet	210	84	40	16
4	ICT promotes interaction among students	220	88	30	12
5.	ICT helps teacher in realizing teaching objectives easily	239	96	11	04

The data in Table 1 shows that most of the respondents were of the opinion that the use of ICT is paramount in realizing the teaching objectives of Basic Science and Technology. From the table high percentages indicated teachers' opinion that ICT can be used in the subject for realizing teaching objectives with low percentages of teachers' disagreed.

Table 2: Teachers source of ICT Accessed for Basic Science and Technology

Curriculum Delivery

S/N	**items**	**Agree**	**%**	**Disagree**	**%**
1.	I have a modem to access information for my Basic Science and Technology curriculum delivery	95	38	155	62
2.	I have a computer to access information for Basic Science and Technology curriculum delivery	80	32	170	68
3.	I access information from the school laboratory internet service for Basic Science and Technology curriculum delivery	60	24	190	76
4.	My school has a projector for use during lesson	15	06	235	94
5.	I use my phone to access any information I need	245	98	05	02

From Table 2, high numbers of the respondents have their source of assessment of ICT information from their ear-phones with low percentage number of respondents from modem, computer and school laboratory internet service for Basic Science and Technology curriculum delivery while a good number of the respondents have no source for their assessment.

Table 3: Basic Science and Technology Teachers' Skills to Accessing ICT Information for Curriculum Delivery

S/N	**Items**	**Agree**	**%**	**Disagree**	**%**
6.	I can use modem to access information for my lesson preparation	70	28	180	72
7.	I can use computer to access information for lessons in class	40	16	210	84
8.	I can use Internet to access information for my lesson in class	30	12	220	88
9.	I can use phone to access information for my lesson in class	245	98	05	02
10.	I lack ICT skills in a wide range to access information for use	210	84	40	16

As revealed in Table 3, high percentage of the respondents 98% indicated that teachers have the skills to operate the ear phone to access information for their curriculum delivery and while 84% of the respondents lack the skills to access it through the use of modem, computer and Internet sources.

Table 4: Frequency at which Teachers Used ICT in Basic Science and Technology Curriculum Delivery

S/N	Items	Every Lesson %	Some Time %	Not at All %	
1.	I use computer in Basic Science and Technology curriculum delivery	10 (4)	5(2)	235 (94)	
2.	I use the Internet in Basic Science and Technology curriculum delivery	20 (8)	20 (8)	210 (84)	
3.	I use the projectors in delivery my lesson	3 (1.2)	2 (0.8)	245 (98)	
4.	I use the ear-phone in Basic Science and Technology Curriculum delivery	245 (98)	3 (1.2)	2 (0.8)	

Table 4 revealed that low number of the respondents use computer, modem, Internet and projector for the subject delivery every lesson and sometime while high number of the respondents indicated their non-usage at all. Similarly, high numbers of the respondents use their ear-phone every lesson during the Basic Science and Technology curriculum delivery while very low percentage indicated their non-usage at all.

DISCUSSION

The findings of the study revealed that a significant number of the respondents agree that the use of ICT in Basic Science and Technology make realization of the teaching objectives easily. Hence, teachers agreed that the use of ICT simulates students toward learning, makes students' evaluation easily, reduces teachers' workload, promotes students interaction and help in realizing the teaching objectives easily. This finding is in consonant with Ukpong (2016) who stated that majority of Social Studies teachers knew about the use of ICT in realizing the subject teaching objectives but lack facilities for use.

Secondly, the study revealed that insignificant number of the respondents have modem, computer and internet as sources for ICT information for Basic Science and Technology curriculum delivery while the highest percentage of the respondents were not. This is quite unrealistic in the face of the relevance of ICT in pedagogy. Moreover access to ICT as the ear-phone was found to be higher on personal cubage than as provided by the schools, if our schools are yet to integrate ICT in their curriculum, how can we survive in the global trend.

Thirdly, high percentage of the respondents indicated that teachers have skills to access information for their curriculum delivery through the use of ear-phone while 84% of the respondents lack the skills to access it through the use of modem, computer and Internet. This finding is in agreement with Ahmodu, Saidu and Garba (2015) who stated that majority of students teachers in Federal College of Education, Kano have accessed to their phones for accessing information rather than any other mean available to them due to lack of facilities. Adetinirin (2012) opines that certain factors affecting people use of ICT comprises of poor power supply, insufficient time and inadequate resources.

Finally, the study also revealed that low number of the respondents have computer, modem, Internet and projector for the subject delivery regularly while high number of the respondents indicated their non-usage. Similarly, high numbers of the respondents use their ear-phones regularly for the Basic Science and Technology curriculum delivery while very low percentage indicated their non-usage. This could be because the browser ear-phones are within teachers reach as they can pay for airtime and use them. Integration of ICT in curriculum delivery implies that it should be frequently applied as the need arises in instructions in the classroom but this is not the case with the Basic Science and Technology teachers in the study area.

CONCLUSION

The following conclusions were drawn based on the findings that; Teachers knew about the use of ICT in attaining Basic Science and Technology teaching in schools but lack facilities; the objectives of ICT in education in Plateau State, Nigeria are not been met. Evidence from this study revealed that insignificant numbers of teachers have accessed ICT in curriculum delivery; teachers are not frequent in the use of ICT for lesson planning and preparation and a significant number of teachers are yet to apply ICT in teaching and learning in Basic Science and Technology. Therefore, Basic Science and Technology teachers in Plateau State secondary schools are yet to derive the benefits associated with ICT in curriculum delivery.

RECOMMENDATIONS

The following recommendations seem pertinent in the light of the findings of this study.

1. Government should provide loan schemes to teachers for the acquisition of laptops and computers or other ICT infrastructures.
2. Stakeholders should in a collaborative effort develop ICT laboratories for schools. This can be achieved by starting with the pilot schools in each Local Government Areas from which surrounding schools could benefit from.
3. Principals should encourage and facilitate regular and suitable ICT training for teachers.
4. Stakeholders in education should work more closely with the schools to determine the training needs of staff members and help them to organize appropriate training programmes.

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EFFECTS OF INDIVIDUALIZED ALGEBRAIC BLOCKS STRATEGY ON UPPER BASIC STUDENTS' ACHIEVEMENT IN ALGEBRA IN ABUJA MUNICIPAL AREA

By

Nneka Anthonia Ogbuanthonia_nneka@yahoo.com
Department of Science, Technology and Mathematics Education, Nasarawa State university keffi

Clement O. Iji
UNI Agric Makurdi, Benue State

&

Christopher Danjuma Musa
Department of Science, Technology and Mathematics Education,
Nasarawa State University Keffi

ABSTRACT

The study investigated the effect of individualized Algebraic blocks on upper basic students' achievement in algebra. The population comprised of all public schools in Abuja Municipal Area Council made up of 30,974 upper basic students. Simple random sampling was used to select 155 students from two different schools. A quasi-experimental design was adopted for the study which was made up of one experimental group and a control group. Algebra Achievement Test was used for data collection. The instrument was validated by two mathematics educators and one expert in measurement and evaluation for both face and content validation. Kuder Richardson's formula K_{R-21} was used to estimate the reliability of the instrument and the index were found to be 0.71. Mean and Standard deviation were used to answer research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses formulated at 0.05 level of significance. The study revealed that students taught algebra using individualized algebra block strategy had better achievement than those taught using lecture method. It also revealed that male students achieved better than the female students in individualized strategy. It was recommended among others that teachers should adopt individualized algebra blocks strategies in teaching algebra aspect of mathematics in upper basic schools.

INTRODUCTION

Mathematics is relevant to everyday life and can be seen as the pivot on which all other subject revolve. Its study is generally considered as pre-requisite for the preparation of every informed citizen and serves as a gateway into numerous career choices in life. This may be why okafor (2011) mentions that everybody uses mathematics in one way or the other in solving life problems. The growth and development of every country depends mainly on its technological advancement. Modern day's science and technological breakthrough is built upon mathematics. In line with this, Okafor (2011) believes that mathematics education worldwide has been regarded as a pre-requisite for scientific and technological development. Nations that desire to forge ahead scientifically and technologically cannot afford to toy with the mathematical knowledge of her citizenry (Iji, Ogbole & Uka,2014).

The instructional methods and strategies used in the teaching and learning of mathematics is vital, as these constitute what and how mathematics could be taught in schools. Instructional strategies adopted by the teacher could influence the affective, psychomotor and cognitive outcome of the learner. Many teachers do not use teaching methods and teaching aids that can stimulate students' interest. In most of Nigeria classroom, mathematics is hardly related to real life situation even when it is obvious to do so with little or no effort (Iji, Ogbole & Uka,2014) claim that many teachers use only the teaching method they know even if the method is not relevant to the concept under discussion and this to a great extent has affected the teaching and learning of algebraic concepts.

Algebraic blocks are concrete mathematical aids which have existed in a variety of forms for some considerable time which can be used individually in mathematics class to make concrete model of abstract mathematical ideas.(Ojo & Ojo 2011)

Individualized algebraic blocks strategy is a learning strategy in which each student manipulates the algebra blocks individually to achieve the set goal. Amoo (2011) is of the opinion that students should be given the opportunity of thinking and manipulating objects by themselves rather than the teachers and textbooks doing the thinking for them. Those who have the ability to grasp a particular concept in a short amount of time can move on to the next subject, while those who are having difficulties in understanding the concept can move at a slower pace, in order to delve further into the topic. As such, every learner is given the opportunity to get the most out of the experience, even if he/she is in a class where there are other learners who possess different skill levels or strengths.

Achievement according to Mohammed and Mohammed (2010) is the knowledge, understanding and skills that students show as a result of a specific educational experience. Achievement in algebra can be defined as the knowledge and understanding students gain from experiences in algebra.

Gender as a variable has over the years, received considerable attention in many studies on science in general and mathematics achievement in particular. The issue of gender is currently a world trend and has remained an annual problem in mathematics achievement any time WAEC and NECO release their yearly result. Closing the gender gap in mathematics performance and having equality of outcome should be the utmost goal of every teacher (Cope, 2015).

Statement of the Problem

Algebra is often seen as a difficult aspect of mathematics by students, probably because it uses letters to represent numbers and so they cannot grasp its abstract nature. This has led to Nigerian secondary school students viewing mathematics as difficult and abstract in nature because they have great difficulty in understanding, assimilating and retaining the mathematics concepts especially algebra taught to them in the classroom Consequently, this has led students

into rote learning a number of algorithms without the knowing why they are applying a particular algorithm. The resultant effect is poor achievement in mathematics. This poor achievement has been of great concern to parents, teachers, students and the nation as a whole. If this poor achievement continues, the growth of the nation's economy will be highly affected. Therefore, the problem of this study is to find out the effects of individualized algebraic blocks strategy on students' achievement in algebra.

Purpose of the study

1. Find out the achievement of students in algebra when taught using algebraic blocks and lecture method.
2. Find out the achievement of male and female students in algebra when taught using individualized algebraic blocks strategy.

Research Questions

The following research questions were answered in the course of this study:

v. What are the pre-test and post-test mean achievement scores of students taught algebra using individualized algebraic blocks, and lecture method?
vi. What are the pre-test and post-test mean achievement scores of male and female students taught algebra using individualized algebraic blocks strategy?

Statement of Hypotheses

The following null hypotheses were tested at 0.05 levels of significance:

$H0_1$: There is no significant difference between the pre-test and post-test mean achievement scores of students taught algebra using individualized algebraic blocks strategy and lecture method.

$H0_2$: There is no significant difference between the pre-test and post-test mean achievement scores of male and female students taught algebra using individualized algebraic blocks strategy.

Method

The research design used for this study was a quasi-experimental design. Non equivalent intact class used. The population of the study consisted of 30,974 students in upper basic schools in Abuja municipal Area council for the year 2017/2018 session. The sample for this study was 155 upper basic seven students spread across two intact classes. The method of sampling used was simple random sampling. Two schools were randomly picked by lucky dip from the list of all upper basic schools in AMAC. In each school an intact upper basic seven students were used for the study. One of the intact class were assigned by balloting as experimental and taught using individualized strategy while the other which was the control was taught using lecture method. the instrument used in the study for data collection was Algebra Achievement Test (AAT). Data collected were analysed using mean, standard deviation and ANCOVA. The Kunder Richardson's formula K_{R-21} was used to estimate the reliability of the instrument and was found to be 0.71. Pre-test was given to the students before the treatment and post-test was given after the treatment.

Results

Research Question 1: What are the pre-test and post-test mean achievement scores of students taught algebra using individualized algebraic blocks strategy and lecture method?

Table 1: The pre-test and post-test mean scores and standard deviation in AAT of students in individualized algebraic blocks strategy and lecture method.

Teaching Strategy	No of Students	Type of Test	Mean	Standard Deviation
Individualized	73	pre- test	28.73	10.47
		Post- test	51.32	9.48
Lecture method	82	pre-test	25.70	9.70
		Post-test	39.28	9.40

Table 1 shows the mean scores and standard deviations of the students in the experimental and control group. The mean scores of students taught with individualized strategy were 28.73 and 51.32 in pre-test and post-test respectively and standard deviation of 10.47 in pre-test and post-test of 9.48 in the AAT. For students, who were taught using lecture method, their mean scores were 25.70 and 39.28 and standard deviation of 9.70 and 9.40 in pre-test and post-test respectively. Students taught with individualized algebra block strategy had higher mean score than those taught with lecture method.

Research Question 2: What are the pre-test and post-test mean achievement scores of male and female students taught algebra using individualized algebraic blocks strategy?

Table 2: The pre-test, post-test mean achievement scores and standard deviation in AAT of male and female students in individualized algebraic blocks strategy.

Group	Gender	No of Students	Type of Test	Mean	Standard Deviation
IAB	Male	38	pre-test	21.18	5.29
			Post-test	24.03	4.48
	Female	35	Pre-test	18.29	2.88
			Post-test	21.11	4.28

Table 3 shows the mean achievement scores and standard deviation in AAT for male and female students in individualized strategy. The male students in individualized strategy had mean pre- achievement scores of 21.18 and mean post- achievement scores of 24.03 with standard deviation of 5.29 in pre-test and 4.48 in post-test while the female students had mean pre- achievement scores of 18.29 and mean post- achievement scores of 21.11 with standard deviation of 2.88 in pre-test and 4.28 in post-test. Male students taught using individualized strategy had mean achievement scores higher than female students taught using individualized strategy. The standard deviation scores for male and female in the group was not at much variance implying that the efficacy of the treatment.

Hypothesis one: There is no significant difference between the pre-test and post-test mean achievement scores of students taught algebra using individualized algebraic blocks strategy and lecture method.

Table 3: ANCOVA results in AAT of students in individualized and lecture methods.

Source	Type III sum of squares	df	Mean square	F	Sig	Remark
Corrected	9060.103[a]	2	3020.034	39.236	0.000	S

Model						
Intercept	40454.786	1	40454.786	525.582	0.000	S
Group	5939.234	1	2969.617	38.581	0.000	S
Pre-test	2444.317	1	2444.317	31.756	0.000	S
Error	17703.435	230	76.971			
Total	531336.000	233				
Corrected Total	26763.538	155				

S = Significant at $P < 0.05$

Table 3 shows the summary of the Analysis of Covariance (ANCOVA) result on students' achievement scores in AAT. The result indicated that the noted difference between mean achievement scores of the two groups is significant at 0.05 alpha levels. This is from the fact that $F_{(1,230)} = 38.581$ and $P = 0.000 < \alpha = 0.05$. The null hypothesis that there is no significant difference in the mean achievement scores of students taught using individualized strategy and lecture method was therefore rejected showing that difference exist.

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Hypothesis two: There is no significant difference between the pre-test and post-test mean achievement scores of male and female students taught algebra using individualized algebraic blocks.

Table 4: ANCOVA result in AAT of male and female students in individualized algebra blocks strategy.

Source	Type III sum of squares	df	Mean square	F	Sig	Remark
Corrected Model	2625.600[a]	2	1312.800	23.665	0.000	S
Intercept	10444.193	1	10444.193	188.274	0.000	S
GenderIAB	17.238	1	17.238	46.979	0.579	NS
Pre-test	2606.087	1	2606.087	0.311	0.000	S
Error	3938.616	71	55.473			
Total	201494.000	74				
Corrected Total	6564.216	73				

S = Significant at $P < 0.05$

Table 4 shows the ANCOVA results of male and female students in AAT in individualized algebra blocks. The result reveals that the noted difference between the male and female students is significant at 0.05 alpha level since $F_{(1,71)} = 46.979$ and $P = 0.579 > \alpha = 0.05$. The null hypothesis was therefore not rejected indicating that there is no significant difference in the mean achievement scores of male and female students taught algebra using individualized algebraic blocks strategy.

Discussion

Students' achievement in algebra improved using individualized algebra blocks strategy. The findings from analysis of data collected show a significant difference in post achievement scores of students taught using individualized algebraic strategy and lecture method. Also the analysis of the data collected reveals that male students in individualized algebra blocks strategy achieved better than the female students. The finding contradicts Mohammed and Mohammed (2010) study which reveals that male and female students taught using games, and

simulations did not differ significantly both in achievement and in interest. Also the finding agrees with Ojo and Ojo (2011) study who found that students taught mathematics using individualistic approach achieved higher than those taught using lecture method.

Conclusion

The findings of this study have shown that individualized algebra blocks strategy has significant effect on students' achievement than lecture method. However, this result imply that the learning approach which is mainly conventional employed by mathematics teachers in teaching might have been partly responsible for the persistent under-achievement of students in mathematics. The implications of this findings hinge on the development of better teaching strategies for teaching of mathematics.

Contribution to knowledge

In addition to contributing to the current body of literature about the use of algebraic blocks to increase upper basic students' interest and improve their achievement,

the study provided beneficial information to schools considering adopting instructional models that involve hands-on learning and use of manipulative materials in mathematics education.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Mathematics teachers should adopt the use of individualized algebraic block strategy in teaching algebra aspect of mathematics in order to enhance students' achievement in mathematics
2. Mathematics teachers should use blocks as instructional material while teaching some abstract topics like algebra to enhance students' achievement in mathematics.

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EFFECTS OF OVER - SCHOOLING ON SENIOR SECONDARY SCHOOL SCIENCE TEACHERS'JOBPERFORMANCE FOR NATIONAL DEVELOPMENT IN NIGERIA.

by

Ejiga, Peter Job, Msc and Raymond Tahdok Ibrahim

Department of Science and Technology Education, Faculty of Education.
University Of Jos, Plateau State.
petejiga@yahoo.com,,ibrahimraymond80@gmail.com

&

Rilwanu Mohammed
Department of Physics
Aminu Saleh College of Education Azare, BauchiState
myrilwan@gmail.com

Abstract

The study was carried out to determine the effects of over-schooling on science teachers' job performance at the senior secondary school level in Jos metropolitan of Plateau state. To guide the study, two specific objectives, two research questions and two nullhypotheses were formulated. Descriptive survey design was adopted for the study. The population for the study consisted of Public Secondary School Principals and Science Teachers in Jos metropolitan of Plateau State, totaling 2500. The sample of the study was 250respondents (82 principals and 168 teachers). All the 82 public secondary school principals in the Jos metropolitan were involved in the study, the simple random sampling technique was used in drawing two science teachers (1 male,1 female) from each of the schools. The instrument used for the study was an adapted structured questionnaire, the Over-schooling and Science Teachers' Job Performance (OSTJP). The questionnaire was validated by experts in measurement and evaluation. Reliability co-efficient obtained was 0.79. The data collected were analyzed usingthe independent t-test to test the hypotheses at 0.05 level of significance. The data analyzed were presented in tabular form based on each research question and hypotheses. The first hypothesis was upheld while hypothesis two was rejected signifying nosignificant difference in the mean responses of principals and science teachers on the participation of teachers withhigher degrees in school activities at the senior secondary school level. Based on the findings, it was concluded thatover-schooled science teachers at the senior secondary school level in Jos metropolitan of Plateau State were committed to teaching despite thelow returns to their education; and that they were less interested in school activities other than teaching. It wasrecommended, among others, that science teachers with higher degrees at the secondary school level should bemotivated by given them incentives like hazards allowance and organizing workshops, seminar and conferences for science teachers, so that they can put in their best in the system.
Keywords: Over-Schooling, Science Teachers' Job Performance, Higher degrees, low returns, secondary school, Nigeria.

Introduction

The National Policy on Education (2013) specifies the Nigerian Certificate in Education (NCE) as theminimum qualification for teaching at the basic and upper basic level. InNigerian schools, at the senior secondary school level, the Bachelor's Bsc. (Ed) BA (Ed) is generally upheld as the standard qualification for every science teacher (Dolton, 2000). On the

basis of this, attempts are beingmade to phase out science teachers who are unable to go beyond the NCE level from secondary schools. Although the senior secondary school system science teachers below first degree are not qualified to teach at this level and does not require any higher degrees from the science teachers, it is interesting to note that this level of education has a good number of science teachers with higher degrees (Dolton &Vignoles, 2000).

This assertion that science school teachers at the senior secondary school system rejects science teachers with higher degree such as Msc. (Ed) or PhD, amounts to over-schooling as the teachers with higher degrees possess levels of education in excess of thatwhich is required for their jobs (Dolton &Vignoles, 2000). Based on this background, the study wasundertaken to determine the effect of over-schooling on science teachers' job performance at the senior secondary school level in Jos metropolitan of Plateau State.Scholars and researchers, administrators and Government agencies have published series of studies on the qualitative structure of the labour market andthe match between educational levels and job levels of workers and employees (Van der Meer, 2000). In theUnited States and many other countries, studies have been published about the possible consequences of a rapidrise in educational attainment (Wielers& Van der Meer, 2002). In Nigeria, and indeed Plateau State today, government policy tends to encourage participation in higher education as can be seen in the Free EducationPolicies and various scholarship programmes mounted by the Federal and State Governments, multinationalcompanies, NGOs and private individuals. The cornerstone of such policies lies in the belief that a moreeducated labour force leads to increase in economic growth and development (Gemmel, 1996).

Concept of Over-schooling

The word over - schooling has various meanings to different people. Van derMeer and Glebbeck (2011), viewed over-schooling as a situation where workers have jobs which isbelow their qualifications. Cohn, Johnson, &Ng Ying-Chu (2000), observed thatover-schooling occurs whenever earnings are affected by how individuals'education matches their required occupation. Green, McIntosh &Vingnoles(2000), have pointed that over-schooling is an excessive turnout of graduates from tertiary institutions thus creating a gap between what is produced by theeducational system and what is demanded in the labour market.

There are manyschools of thought that agree that over-schooling is the same as over-education (Chevalier & Lindley, 2007Ng Ying-Chu,2000,). The issue of over-schooling has been verycontroversial. Gill and Solberg (1992), Van der Velden and Smoorenburg (2000),published a report, that out of 1741 cases of insanity studied, 205 were as a result ofover-study. Conversely, Freeman (1976), and Van Meer (2006), in their studies ofover-schooling concluded that over-schooling and wages are rewarding only to theextent that the former leads to increases of the latter.The authors would rather stay with the fact that over-schooling is a directresult of the school producing graduates that will not be adequately absorbed by thelabour market.

This definition may be supported by studies of occupational changes.Ng Ying-Chu (2000), conducted a study of occupational changes and came up with the resultthat over 35% of women who have acquired higher qualifications changed occupations, while 40% of the male counterparts also changed between 2000 and 2007.Generally speaking, the accelerating pace of technological changes hascaused complete changes in the nature of a given occupation within a few years.Although automation is usually associated with this process, it is but one aspect of abroader movement consisting of many interacting and powerful technologies.Technological advances have apparently caused present jobs to disappear and alsoresulted in the emergence of previously unknown occupations. Often the person whoperformed the old jobs are not capable of undertaking the new ones because theyrequire further education and retraining, and when such workers are retrained on thejob, the issue of over-schooling disappears and job performance is at a decrease.

Occupations created by new technologies seem to have several characteristicsthat differ from occupations that tend to be phased out. For example, occupations thatare in danger of

being phased out usually involve demonstration of fewer psycho-productiveskills and more cognitive understanding some new-technology-orientedoccupations call for higher-order skills and application of greater technicalknowledge. Performance in the foregoing occupations usually requires a morecomplete functional education than the performance in the jobs or occupationsreplaced. In many cases workers in the new-technology occupations need morematurity via human relations training in order to successfully meet the jobrequirements and to achieve good performance. As a result of these characteristics of emerging occupations, versatilityin skills application may be more valuable than a high degree of specialization. It isa known fact that modern technology creates an increasing number ofoccupations that provide services rather than goods. Sometimes these occupations callfor combinations of traditional skills. For example, in the teaching and learning of electromagnetism, modern physics, electricity and so on demand acombination of cognitive, psycho-productive and perceptual skills. In addition, these advance topics often demand different kinds of teaching and learning skills, which may be described as scientific skills, in addition to technical knowledge. Anindividual in this group of occupation would require additional schooling inpublic/human relations (Johnson, 1978; Kazanas, 1980; Miller and Usoro, 1981).

Although, the use of technology in teaching and learning eliminates some unskilled and low-skilled teaching jobs, it alsotends to upgrade skills and training requirements in the more highly specialized teaching jobs that required scientific knowledge to perform effectively in class both the theory and practical skills, to the extent that animation may be necessary to explain a difficult topic. This trend is beginning to affect middle-management and higher levels of theoccupational structure so that retraining is becoming a continuing aspect of employment in the teaching business. This is where technical and scientific knowledge eliminate what is general accepted as over-schooling. Science and Technology has had profound impact on scientific discoveries, where increases in technical and scientific know how has done a lot the mechanization andimproved fertilizers, feeds, and pesticides in the agro-agricultural industries, medicine, space travels, robots, electric cars and so on, have led to science and technological breakthrough, with sharplydecreased employment. Science and Technology education therefore, becomes apanacea for over-schooling, if the individual must perform well in the labour market or in any educational technology institutions.

Also, over-schooling can be described as the extent to which an individual possesses a level of education in excess of that whichis required for his particular job. The phenomenon was first brought to the attention of researchers by Freeman(1976) cited in McGuiness (2006). Freeman concluded from his study that as the excess qualified workforce hasto settle for jobs that do not require their qualifications, the returns for education plummet. Lower returns shouldreduce the investment in higher education and the labour market should then return to an equilibrium point.

However, this is not the case as can be seen even in the Nigerian education system today; the demand of higher education still remains high, encouraging more of over-schooling. This occurs mostly at the senior secondary school level. Someof these science teachers with higher degrees have developed qualities that make them suitable for higher jobs whereasothers appear to lack these scientific and technological skills.A number of studies have shown that over-schooled teachers have lower returns to their education (Belfield & Sloane, 2000). This becomes disincentive and subsequentlyaffects their level of job performance (Groot & Van den Brulk, 2000). Teachers with higher degrees at the senior secondary school level in Plateau State fall within this bracket. They seem to be discouraged from putting intheir best and are always searching for better jobs. These classes of science teachers apparently show lack of interest inschool activities, including teaching. This results in poor job performance.(Belfield & Sloane, 2000).

Performance could be described in various ways. It could be described as an act of accomplishing or executing agiven task (Okunola, 2000). It could also be described as the ability to combine skillfully the right behavior towards the achievement of organizational goals

and objectives (Olaniyan, 2005). Public education ultimatelysucceeds or fails based on the performance of the teachers. Education authorities have tried to improve theperformance of the teaching workforce by raising the qualification requirements. Research shows, however, thatthese credentials have little to do with teaching excellence, as measured by students' performance (Gordon, Kane&Staiger, 2006). Oncea science teacher is employed, education authorities do very little additional screening andcommonly award promotion after two or three years, regardless of the teachers' performance.

The most effective science teachers generally receive no incentives to work in many instances. Science teachers with higher degrees at the senior secondary school level often feel wasted as no recognition is given to such qualifications at that level in Nigeria(Olaniyan, 2005).Job performance is commonly used, yet inconsistently defined. It most commonly refers to whether a personperforms an assigned job well. Despite the confusion over how it should exactly be defined, performance is avery important criterion that relates to educational outcomes and successes. Among the most commonly acceptedtheories of job performance is the work of Campbell, McCloy, Oppler, & Sager (1993).

Coming from apsychological perspective, Campbell describes job performance as an individual level variable. That is,performance is something a single person does. This differentiates it from more encompassing constructs such asorganizational performance or national performance, which are higher level variables. Equally, Abramis (2004)defined job performance as a worker's effective execution of tasks or job and useful contributions to the social work environment. Teachers' job performance is directed towards the realization of education goals andobjectives.Performance therefore has to be goal relevant. Teachers' performance must be directed towards educationalgoals and objectives that are relevant to their job. It does not include activities where effort is expended towardachieving peripheral goals (Campbell, 2003). Maurer (2001) identified the following as factors affecting employees' job performance:

1.**Ability:**The capacity to learn and perform the tasks required.

2.**Standards:** Expectations to achieve and guidelines by which to achieve them.

3. **Knowledge and Skill:**The information and expertise necessary to perform the job.

4.**Feedback:**Feedback from management that effectively communicates the status of the person'sperformance, based on measurable guidelines and tools.

5. **Environment:**Acceptable working conditions, such as enough time and equipment to perform the jobeffectively.

6.**Motivation:**Incentives in place that positively reinforce good performance.

Although, all of these factors are crucial to a teacher's success on the job, only one aspect-knowledge and skillcanactually be improved by training. If any of the other factors are the cause of decreased performance,management or other forces in the school system must institute the changes necessary to resolve the problem. Studies have shown thatdifferences in teaching quality between certified and uncertified teachers are small compared with the differencein teaching quality within each groupStaiger (2006). In other words, there are good teachers and bad teachers, regardless oftheir certification. Much more relevant to predicting long-term performance of teachers' performance in thefirst few years of teaching.

Gordon, Kane &Staiger (2006) concluded from their study that good and bad teachers can be identified afteronly a year or two in the classroom. In particular, they found that teachers' performance during their first twoyears on the job provides a lot of information about their likely effectiveness in subsequent years rather thanJournal of Education and Practicehigher qualifications. On the average, students assigned to third-year teachers who performed poorly during theirfirst two years lose ground relative to other students, whereas students of third-year teachers who performed well gained ground. Staiger, 2006) also found out that students assigned to the best quarter of teachers ended upabout 10 percentile points ahead of students assigned to the worst quarter of teachers. By implication, teachers' job performance has no significant relationship with their levels of educational attainment (over-

schooling). Higher degrees or over - schooling do notmake the science teacher perform better at the senior secondary school level. A considerable body of evidence shows that differences in science teacher performance are largely unrelated to whethera teacher is certified (Gordon, Kane &Staiger, 2006). The research on teacher job performance findsconsiderable variation in estimated job performance, suggesting there is great potential for improving educationthrough teacher workforce accountability policies such as teacher tenure reforms, selective retention, salaryincentives, and targeted professional development rather than higher qualifications (Aaronson, Lisa & William,2007).

Owoeye (2007) asserted that variables of job performance such as effective use of the scheme of work, effectivesupervision, monitoring of students' work and discipline are virtues, which science teachers should uphold in the schoolsystem. UNESCO (1996) Report observed that the pace of development of any nation is a function of theadequacy of its science teachers; that no state of art, infrastructure or adequate funding would ensure success in theschool system, when the teachers fail at the delivery level. The teachers as the primary actors in the business ofchild training and development should be recognized and treated well, if improved performance and highproductivity is to be achieved. It is not the higher degrees that facilitate teachers' job performance but their level of motivation. Owoeye (2007). Over-schooled science teachers who are not sufficiently motivated, and whose returns on education arenot comparable with those of their colleagues elsewhere suffer from inequity (Adams, 1963). This may lead tolow morale and poor performance.

Aim and objectives of the Study

The study was carried out to determine the effects of over-schooling on teachers' job performance at thesecondary school level in Jos metropolitan of Plateau State, Nigeria. Specifically, the study sought to:

1. Find out the level of commitment of science teachers with higher degrees to teaching at the senior secondaryschool level.
2. Investigate the level of participation of science teachers with higher degrees in school activities.

Research Questions

The following research questions were formulated.

1. What is the level of commitment of science teachers with higher degree to teaching at the senior secondaryschool level?
2. What is the level of participation of science teachers with higher degree in school extra - curriculum activities?

Research Hypotheses

The following null hypotheses were formulated to direct the study.

1. There is no significant difference in the mean responses of principals and science teachers on thecommitment of teachers with higher degree or over- schooling to teaching at the senior secondary school level.
2. There is no significant difference in the mean responses of principals and science teachers on participation of teachers with higher degree in the school extra-curricularactivities at the senior secondary school level.

Methodology

The design chosen for the study isdescriptive survey design. The reason for preferring thedesign method was because the study is carried out on a group of principals and science teachers. In which the structured questionnaire was used to elicit information from the respondents based on the research questions and purposes of the study. The t – test analysis was used to test the hypotheses at 0.05 level of significance and based on the result, a decision was taken.

The population for the study consisted of all the Public Secondary School Principals and Teachers in Jos metropolitan of Plateau State. There are 82 such schools with a science

teacher population of 2500 includingthe principals.The sample of the study stood at 250 respondents (82 principals and 168 teachers). The purposive samplingtechnique was used in drawing the sample of the principal as all the principals were involved in the study, whilethe simple random sampling technique was used in drawing the sample of the teachers (1 male, 1 female) fromeach of the schools. A structured questionnaire, "Over-schooling and Science Teachers' Job Performance" (OTJP) wasdeveloped and used in collecting data for the study.

The instrument used for the study was a questionnaire adapted from Woolfolk (2005) and validated by experts in measurement and evaluation. And a reliability testcarried out using Cronbach Alpha Formula. This gave a reliability coefficient of 0.79.The data collected were analysed using independent t-test.

Results.

Question 1. What is the level of commitment of science teachers with higher degree to teaching at the senior secondaryschool level?

Hypothesis 1

There is no significant difference in the mean responses of principals and science teachers on the commitmentof teachers with higher degrees to teaching at the senior secondary school level.

Table 1. Weighted means and t-test of the responses of principals and science teachers on the commitment of teachers withhigher degrees to teaching at the senior secondary school level

S/N.	Commitment to Teaching	Means		t-value	Remarks
	Teachers with higher degree:	**Principals**	**Teachers**		
xxv.	Come to school regularly	3.8	3.7	0.98	NS
xxvi.	Are punctual to school	2.6	2.6	1.53	NS
xxvii.	Write and submit their lesson note	3.6	3.5	1.02	NS
xxviii.	Attend to their classes conscientiously	3.3	3.3	1.05	NS
xxix.	Give marks and record students' test	3.2	3.2	1.06	NS
xxx.	Fill school records.	2.8	2.8	1.12	NS
xxxi.	Are involved in the conduct of Examination	3.7	3.6	0.94	NS
xxxii.	Are steady in school	2.5	2.5	1.66	NS

N_1= 82; N_2= 168; df = 248; t-cri = 1.96; Average t-cal = 1.16; at 0.05 level of significant
S = Significant; NS = Not Significant

Table 1

This indicates no significant difference in the mean responses of the principals and science teachers in all theidentified performance indices, with t-values less than the critical t-value of 1.96. The null hypothesis wastherefore upheld. Meaning that both the principals and science teachers agreed that teachers with higher degrees are committed to theirduties as teachers. They prepare their lessons, go to class, give and mark assignments.

Question 2. What is the level of participation of science teachers with higher degree in school extra - curriculum activities?

Hypothesis 2

There is no significant difference in the mean responses of principals and science teachers onparticipation of teachers with higher degrees in school activities at the senior secondary school level.

Table 2:

Weighted mean and t-test of the responses of principals and science teachers on participation of teachers withhigher degrees in school activities

S/N.	Commitment to Teaching	Means	t-value	Remarks

	Teachers with higher degree:	**Principals**	**Teachers**	
vii.	Take part in extra curricular activities.	3.11.22.24		S
viii.	Participate in club activities.	3.61.7	1.99	S
ix.	Participate in staff meetings.	3.33.31.11		NS
x.	Participate in PTA meetings	2.72.71.21		NS
xi.	Take part in school discipline	3.62.13.17		S
xii.	Accept responsibilities from the principal	3.2 2.81.82		NS
xiii.	Assist in all aspects of schoolwork	2.81.023.51		S
xiv.	Show interest in school matters	2.61.022.92		S

N_1= 82; N_2 = 168; df = 228; t-cri = 1.96; Average t-cal = 2.25; at 0.05 level of significant
S = Significant; NS = Not Significant
Table 2

This reveals a significant difference in the mean responses of the principals and science teachers on participation ofteachers with higher degrees in school activities at the senior secondary school level. The t-values in 5 of the 8identified items are greater than the critical t-value. Besides the average t-value of 2.25 is greater than the criticalt-value of 1.96 leading to the rejection of the null hypothesis. Meaning that, a significant difference in the mean responses of the principals and teachersregarding the participation of teachers with higher degrees in school activities other than teaching, which means that science teachers with higher degrees are not getting adequate returns totheir education at the secondary school level. This lowers their morale, hence affects their participation in schoolactivities that are not directly related to teaching.

Discussion of Findings

Data analysis in hypothesis one revealed no significant difference in the mean responses of senior secondary schoolprincipals and science teachers on the commitment of science teachers with higher degrees to teaching. The null hypothesis was therefore upheld. Which means that both the principals and science teachers agreed that science teachers with higher degrees are committed to theirduties as teachers. They prepare their lessons, go to class, give and mark assignments. The study therefore agrees with the findings of Owoeye (2007). Though, the finding is contrary tothat of Groot and Van den Brulk (2000). These scholars noted from their studies that the low returns to educationreceived by over-schooled teachers serve as a disincentive for the teachers, resulting in poor job performance.Credentials, according to Gordon, Kane and Staiger (2006) have little to do with teaching excellence or workperformance. Hardwork or commitment to duties is not predicated on the level of education. Teachers withhigher degrees, though not sufficiently motivated, still perform effectively at the secondary school level in Jos metropolis of Plateau State. Oftentimes they do these to justify their higher status and the leadership role they are expected togive to their subordinate.

The test of hypothesis two indicated a significant difference in the mean responses of the principals and teachersregarding the participation of science teachers with higher degrees in school activities other than teaching. The nullhypothesis was rejected. Most of the calculated t-values were greater than the t-critical. This study is in line withBattu, Balfield and Sloane (2000) who stated that science teachers with higher degrees are not getting adequate returns totheir education at the secondary school level. This lowers their morale, hence affects their participation in schoolactivities that are not directly related to teaching. This is obvious because a number of teachers with higherqualifications seem not bothered by any school activities outside teaching. This could further be explained interms of the higher status obtained by these teachers. They see themselves as being superior in terms of qualifications to other teacherswith lesser qualification and hence should not take part in most of the activities they do.

Conclusion

Based on the findings of the study, it is concluded that over-schooled science teachers at the senior secondary school level in Jos metropolitan of Plateau State are committed to teaching as science teachers who have no higher degrees, and over-schooled science teachers in senior secondary schools in the state show more interest in school activitiesoutside teaching.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Science teachers with higher degrees at the senior secondary school level should be encouraged with incentives, such as hazards allowance, accommodation, and transport. Promotions should be if the teacher is due, attending conferences, workshops and seminars to justify their higher educational status and serve as anencouragement for other teachers. This will motivate the science teachers to put in their best in the system.
2. The senior secondary school system should be re-designed in such a way that any senior class that does better in promotion examinations with hundred percent performance in his/her subject the science teacher should be rewarded. This will accommodate and attract science teachers with higher degrees to do better in the job.
4. Polices like training and retraining of science teachers should be put in place to recognize higher degrees at the senior secondary school level, this will enhance job performance.

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INFLUENCE OF THE USAGE OF PHONE TECHNOLOGY ON NATIONAL CERTIFICATE OF EDUCATION (NCE) SCIENCE STUDENTS' ACHIEVEMENT IN FEDERAL COLLEGE OF EDUCATION (TECHNICAL) POTISKUM YOBE STATE

By

Dr. Sambo Muhammed Alh. Hudu
Department of Science Education
Federal University Lafia.

Tagans Yohanna
Department of Integrated Science
Federal College of Education (Tech.) Potiskum, Yobe State.
Yohannatagans@Yahoo.Com

Ali Linda David & Mariyam Maigari
Department of Integrated Science
Federal College of Education (Tech.) Gombe State.

Abstract

The study sought to find out the extent to which the uses of phones influence national certificate in Education (NCE) science students' academic achievement in federal college of education

(technical) Potiskum Yobe State. The research design adopted for this study was descriptive survey. This design was used to seek information on the influence of phone on students' academic performance in Federal College Education (Technical) Potiskum Yobe State, Nigeria. Three research questions were raised and answer with their corresponding hypothesis for this study. The survey provided insight into the research problem that described the variables of interest in FCE (T) Potiskum Yobe State. The populations used for this study are Two hundred and fifty students' formed the sample. A stratified sampling technique was used in selecting the sample size. The data was collected using questionnaires for students'. The data was analyzed using the z-test, and one way ANOVA. Three hypotheses were tested at 0.05 level of significance. The findings are that the phone has great potential as a learning tool and it could positively and negatively influence learning science in colleges of Education in Nigeria. After analyses the results were presented in the form of tables. The study came up with the following recommendations A well-resourced mobile learning facility centre needs to be established within the colleges, where staff and students who lack experience with using mobile phone will be trained and have the opportunity to use these phones to support educational experiences, Students should take a more active role in the learning process and take an interest in using mobile phone to improve educational experiences, Science lecturers should encourage students in the use of mobile phone in their learning among others.

Introduction

Science is a dynamic discipline that deals with investigation geared toward the understanding of the real or natural world. McComas (2014) posits that science consists of the discovery and exploration into the world, which determines the questions that lead to compelling and consistent generalizations and explanations, using the process of investigating and producing evidence that can be reviewed by others. Science provides us with an important means for understanding how the world operates and how we exist and interact with our physical surroundings. Science can thus be observed as both a body of knowledge as well as a process (http://undsci.berkeley.edu). Science is derived from the Latin word scientia which means knowledge. The process of science is a scientific method. This is the process of developing a precise, consistent, duplication of a real world model, in which scientists work together towards a particular goal over time (http://en.wikipedia.org). In other words, science can be explained as a system that constructs and puts in order knowledge that can be explained and predicted about the world (Heilbron, 2013). Scientific knowledge generally takes the form of facts, concepts, principles, models, theories and laws (National Research Council, 2010). Vavolua (2015) explains "science as involving experimentation and understanding advanced methods as well as techniques for gathering data, determining facts, formulating and testing hypothesis. Consequently, science is considered to be a difficult discipline as compared to others, especially since it is mainly about complex concepts, theories, laws and models which generally do not only involve instruction of a body of knowledge but also include the procedures and practices of scientific work.

Phone has gained immeasurable ground in the lives of students all over the world. Mobile phone is a common sight today in our schools as you see students going to school/class with some of the most Expensive and sophisticated phones, tablets and ipads that have all the applications, facilities and software that can connect them to the internet and all forms of social media platforms, other web sites and soon, where they chat, access, stream, download, upload, exchange and play different kinds of Media contents, which most often, are pornographic in nature (Olofuniyi, Fashiku, and Owombo 2012). The portability and memory capacity of some of these gadgets make it easier for them to keep materials for viewing whenever and wherever it seems conducive for them. The use of security PINs and Passwords on these phones makes these contents secured from the scrutiny and prying eyes of parents and teachers. As a result of that, most of the mobile phones in the hands of these adolescents contain one form of pornographic content or the other (McGuigan, 2015).

Phone can be used in science learning by the use QR codes. This type of technology is a two-dimensional bar code that can be read on any mobile phone that has a built-in camera. Many mobile phones have the ability to download free QR code readers. Once the code is accessed, it allows users to receive immediate information, such as text, video, an image or link to a web page and so on. QR codes can be utilized in learning in order to display printed materials such as lecture notes, links to reading materials or labels of equipment in a science laboratory. In a chemistry classroom, one practical example of QR codes would be instruments with those barcodes on, which connect students to their correct operating instructions (Williams and Pence, 2011).

Phone can also assist science students to construct a connection between learning science in the classroom and their personal experiences in the outside world (Waycott and Kennedy, 2009). Fozdar and Kumar (2007) conducted a research to better appreciate students‟ attitudes and perceptions towards the effectiveness of phone learning. Results of this research showed that adopting phone into the learning environment can improve retention of science students. This could be done by supplementing and supporting teaching and enhancing students learning experiences. In South Africa, Motiwilla (2007) found phone as effective and a useful supplementary tool for learning. This tool provided interaction, flexible access, convenient use and efficiency in delivering personalized content. Students found the interaction tools simple to use for discussing educational materials with other students and lecturers.

Phones have become almost essential part of daily life since their rapid growth in popularity in the late 1990s, Ling (2014). A nationwide survey conducted in 2010 shows that mobile phones are the most necessary medium of communication for adolescents. It has virtually affected the society's accessibility, security, safety and coordination of business and social activities and has hence become a part of culture of the whole world. Ling (2014), posit that traditional agents of socialization are families and schools. The expansion of educational system as a result of the need for highly skilled workers lead to the school system taking increasing larger responsibilities in socialization. Surprisingly, research on the influence of mobile phone on our schools today has not been given much attention. Researchers have discovered that the use of mobile phone in schools is problematic. As Ling and Helmerson (2012) posits, the phone is "at cross purpose with the mission of the school". While in school students are supposed to take on their prescribed roles as students with full concentration on their studies and free from contact with the outside world. However, the phone gives room to blending students' roles with other roles thus distracting and disrupting the students' academic work (Gergen, 2013 In the past when fixed telephones were the norm in schools, there were minimum distractions and disruptions but presently with the invasion of phone and the eagerness of parents to maintain contact with their wards, the device is becoming part of the classroom. Thus, the phone has the power to undermine the schools' authority and weaken their control over students as well as affect their level of academic achievement. The recent technological advancements, the innovation of computer and other discoveries in the field of information technology brought about the introduction of the phone and its multifunction's ranging from voice calls, messaging, data use, multimedia, games (both online and offline) and other social media services (Jackson, Zhao, Kolenic, Fityerald, Herold, and Venoye, 2008). The phone is used as a means of interactions among people in which they create, share, and exchange information and ideas in virtual communities and networks (Blumstock and Eagle, 2010). It also uses a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0 that allows the creation and exchange of user-generated contents (Mayer and Mereno, 2015). Furthermore, the phone is used for storing different contents on the micro SD cards or the phones' internal memory (Meek, 2016). Over the past decade, technology has become increasingly important in the lives of adolescents. As a group, adolescents are heavy users of newer electronic forms communication such as instant messaging, e-mail, browsing, uploading and downloading, games and text messaging, as well as communication oriented Internet sites such as blogs, social networking, and other sites for

sharing photos, videos and ideas, all of which are as a result of the phone. Internet access has exposed many adolescents to different kinds of contents. Just of recent, the availability of different kinds of affordable and inexpensive android phones made it very easy for the adolescents to have access to different types of social media and pornographic sites where they access, download, exchange and watch pornographic films of different sexual orientations from all over the world. Taylor and Harper2016. It was against this back ground that the study is aim to investigate the influence of the usage of phone on national certificate of education science students' achievement in federal college of education (tech) Potiskum Yobe State.

Statement of the problem

Evidence has shown from past NCE students result in FCE (T) Potiskum Yobe State Nigeria that most students fail science and its related discipline due to too much time spent on browsing, pinging and chatting with friends instead of studying their books which tend to affect them negatively. Instead of concentrating on their classroom work, they give more emphasis to the use of the mobile phone in their classes, dormitories and even on the football field. This may be partly attributed to lack of teaching materials, lack of supervision by the parents and the teachers etc, and this may affect the students' performance and achievement in school. The booming of phone currently gives numerous opportunities for students to utilize phone applications in supporting learning activities (Wendeson et al, 2010). Brown (2012) posits that phone technologies such as mobile teleconferencing and SMS can support interaction and collaboration. In addition, these technologies play an important part in education. Many researchers (Robson, 2012) believe that phone technologies can supplement the conventional learning in the classroom as well as create an environment beyond the classroom. In a research conducted by Gaskell and Mills (2010) it was proven that phone technologies played an important role in education. Phone technologies offered a major chance in enhancing access to learning and enabling many institutions, especially in higher education to develop learner support as well as learning opportunities in ways which would build on modern techniques.

Mobile learning is certainly capturing the attention of the students' to a greater degree than passive learning and has immense possibilities. For example, students gain positive performance and confidence, while learning at their own pace, interacting with lecturers and communicating their ideas to a greater extent (Project K-Nect, 2010). A study by Shuler (2009) points out possibilities in which phones can encourage educational experiences. Firstly, phones offer opportunities for students to gather, access, and process information beyond the classroom and support learning in a real-world context. Secondly, phone technologies encourage and promote collaboration as well as communication, which are considered vital for 21st -century academic success. Thirdly, phones can help encourage instruction that is adaptable to individual and diverse learners (Halpen, 2012). It was against this backdrop that this study sought to investigate the influence of the usage of phone technology on national certificate of education science students' achievement in Federal College of education (tech) Potiskum Yobe State, Nigeria.

Objectives of the study

The study intends to achieve the following objectives to:

1. Determine the influence of mobile phone usage on academic performance among NCE science students of FCE (T) Potiskum Yobe State of different parental occupation.
2. Find out the average performance of students who use phone for academic activities on NCE science students of FCE(T) Potiskum Yobe State
3. Determine the frequency of usage of mobile phone for academic purposes among female and male NCE science students of FCE (T) Potiskum Yobe State.

Research Questions

This study will be guided by the following research questions:

1. What is the influence of phone usage on academic performance of NCE science students of FCE (T) Potiskum Yobe State of different parental occupation?

2. What is the average performance of students who use phone for academic activities among NCE science students of FCE (T) Potiskum Yobe State?
3. What is the frequency of phone usage on academic performance of male and female NCE science students of FCE (T) Potiskum Yobe State?

Hypotheses

The following hypotheses are formulated to be tested statistically at: 0.05, level of significance:

vii. There is no significant difference on the influence of phone usage on academic performance among NCE science students of FCE (T) Potiskum Yobe State of different parental occupation.
viii. There is no significant difference on average performance of students who use phone for academic activities among NCE science students of FCE(T) Potiskum Yobe State.
ix. There is no significant difference on the frequency of phone usage on academic performance among male and female NCE science students of FCE (T) Potiskum Yobe State.

Methodology

The research design adopted for this study was a descriptive survey. This design was used to seek for information on the influence of phone on students' academic performance in FCE (T) Potiskum. Thus survey provided insight into the research problem that described the variables of interest. The relationships between the independent and dependent variables were defined, estimated, predicted and examined. A descriptive survey was found appropriate because, it provides useful and in-depth information to questions related to whom, what, when, why and how in relation to objectives of the study. The students' population of NCE students in FCE (T) Potiskum for the 2015/2016 session was 3,262 students. FCE (T) Potiskum has five schools with a total population of 3,262 students consisting of 2,157 male students and 1,105 female students. The sample for the study is 250 respondents selected from the total population of 3,262 respondents. This is in line with Krejcie and Morgan (2014) table for determining sample size from a given population. Stratified sampling technique was employed to select the sample for the study. Multi-stage sampling method was used for the selection of ten (10) Department in FCE (T) Potiskum Yobe State. One instrument was used in this study for effective and adequate data collection and was validated by two lecturers from the department to ascertain it reliability. Which is the adapted Phone Usage Questionnaire (PUQ) The Mobile Phone Usage Questionnaire (PUQ) adapted from Twum (2011) and used for this study is sub-divided into two (2) sections namely: Appendix A consisting of demographic variables of respondents such as gender, age and socio economic status. While Appendix B consists of items statements relating to mobile phone usage with a five (5) point rating scale, namely; Never, Rarely, Occasionally, Often or Very Often from which the respondents were required to choose. The data collected from this study were subjected to statistical analysis. The demographic variables of age, gender, parents' occupation and educational level were analyzed using frequency and simple percentage. Descriptive statistics of mean and standard deviation were used to answer the research questions. The hypotheses were tested using t-test and analysis of variance ANOVA. The confidence Level was put at 0.05 level of significance.

Result

The research question(s) used was answer with the corresponding hypotheses;

HO1: There is no significant difference on the influence of phone usage on academic performance among NCE science students of FCE (T) Potiskum Yobe State of different parental occupation.

Table 1: Results of One Way Analysis of Variance (ANOVA)

Variable	sum of squares	DF	mean square	f	p-value
Between groups	12.127	2	5.469	6.004	0.021
Within groups	173.328	248	0.514		
Total	185.455	250			

Table1 above shows that, the hypothesis was analyzed using one way Analysis of Variance (ANOVA) test statistics at P< 0.05. The test is significant because P-value 0.021 observed is less than P-value of 0.05. The observed F-value (6.004) is greater than the critical value of 3.00 at degree of freedom 300. This means that the null hypothesis was rejected that there is no significant influence of mobile phone usage on academic performance among NCE science students of FCE (T) Potiskum Yobe State. Therefore, there is significant influence of mobile phone usage on academic performance among NCE science students of FCE (T) Potiskum Yobe State students of different parental occupation.

HO2: There is no significant difference on average performance of students who use phone for academic activities among NCE science students of FCE(T) Potiskum Yobe State.

Table 2: Result of One Way Analysis of Variance (ANOVA)

Variable	sum of square	df	mean square	f	p-value
Between groups	18.581	2	8.736	5.232	0.021
Within groups	441.561	248	1.541		
Total	460.142	250			

Table2 above shows that, the hypothesis was analyzed using one way Analysis of Variance (ANOVA) test statistics at P< 0.05. The test is significant because P-value of 0.021 observed is less than P-value of 0.05. The observed F-value of 5.232 is greater than the critical value of 3.00 at degree of freedom 300. This means that the null hypothesis was rejected that there is no significant difference on average performance of phone usage on academic performance among NCE science students of FCE (T) Potiskum Yobe State. Therefore, there is a significant average performance of students' who use phone for academic activities among NCE (T) Potiskum Yobe State.

$HO_{3:}$ There is no significant difference on the frequency of phone usage on academic performance among male and female NCE science students of FCE (T) Potiskum Yobe State..

Table 3: One Sample t-test of hypothesis three

Variables	N	Means	Standard Deviation	df	t calculated	p-value
Male	162	22.212	5.4563	248	6.132	0.02
Female	135	21.021	4.82613			

From the above result presented, it shows that the probability value is less than 0.05 at5% level of significance. The z-calculated value is 6.132 and the z-critical is1.972 at degree of freedom 298 using two tailed significant level. That is the null hypothesis which states that there is no significant difference of the frequency of mobile phone usage on academic performance among male and female NCE science students of FCE (T) Potiskum Yobe State is hereby rejected. Therefore, there is a significant difference on the frequency of phone usage on academic performance among male and female NCE science students of FCE (T) Potiskum Yobe State students**.**

Discussion

The finding of this study shows that phone usage on academic performance among NCE Science students enhance students' achievement in science subjects. This collaborates with early findings of Blumenstock and Eagle (2010), they combined data from a field survey with transaction log data from a phone operator to provide new insight into daily patterns of mobile phone use in Nigeria. The analysis was divided into three parts. First, they presented a statistical comparison of the general Nigerian population to the population of phone owners in Nigeria. They found that phone owners are considerably wealthier, better educated, and more predominantly male than the general population. Second, they analyzed patterns of phone use and access, based on self-reported survey data. They noted statistically significant differences by gender; for instance, women are more likely to use shared phones than men. Third, they

performed a quantitative analysis of calling patterns and social network structure using phone operator billing logs. By these measures, the differences between men and women are more modest, but they observed vast differences in utilization between the relatively rich and the relatively poor. Taken together, the evidence in their paper suggested that phones are disproportionately owned and used by the privileged strata of Nigerian society.

The finding of this study also revealed that, there was not a significant average performance of students who use phone for academic activities among NCE Science students. This finding agrees with the early findings of Jackson, Zhao, Kolenic, Fitzgerald, Harold, and Voneye (2008), who examined race and gender differences in the intensity and nature of IT use and whether IT use predicted academic performance. A sample of 515 children (172 African Americans and 343 Caucasian Americans), average age 12years old, completed the surveys as part of their participation in the Children and Technology Project. Their findings indicated race and gender differences in the intensity of IT use; African American males were the least intense users of computers and the Internet, and African American females were the most intense users of the Internet. Males, regardless of race, were the most intense video game players, and females, regardless of race, were the most intense cell phone users. IT use predicted children's academic performance. Length of time using computers and the Internet was a positive predictor of academic performance; whereas amount of time spent playing video games was a negative predictor.

Finally, the finding of this study also shows that the frequency of phone usage does not significantly influence academic performance among male and female NCE Science students. This is in line with the findings of Lin (2014), Ling and Ytti (2012) who discovered that today's college students are less prepared for college-level work than their predecessors. Once they get to college, they tend to spend fewer hours studying while spending more hours working, some even full time (Smart, Kelley and Conant, 2017). In their study, they examined the effect of both time spent studying and time spent working on academic performance. Franzini (2013), and McGuigan (2015) who further evaluated the interaction of motivation and ability with study time and its effect on academic performance. The results suggested that non-ability variables like motivation and study time significantly interact with ability to influence academic performance.

Conclusion

The booming of phone currently gives numerous opportunities for students to utilize phone applications in supporting learning activities. Phone technologies such as mobile teleconferencing and SMS can support interaction and collaboration. In addition, these technologies play an important part in education. Phone technologies can supplement the conventional learning in the classroom as well as create an environment beyond the classroom where students can share learning materials via phone with other students' from other parts of the world.

Recommendations

Policy Recommendations for a better outcome of phone use, one needs to use an upgraded type of phone. The following will be required;

3. A well-resourced mobile learning facility centre needs to be established within the colleges, where staff and students who lack experience with using phone will be trained and have the opportunity to use these phones to support educational experiences. This could be a project in public colleges, which allow lecturers and students to appreciate smartphones. A follow-up with some training on the appropriate use of mobile phones in teaching and learning can be important. The use of this phone will also increase the satisfaction of students.
4. Students should take a more active role in the learning process and take an interest in using phone to improve educational experiences. Science students should be encouraged by their lecturers to make more use of chat rooms, such as viber and WhatsApp for group discussions, share images through Bluetooth for explaining

scientific concepts and processes, use video conferencing for face-to-face group discussions, read e-Books and download scientific materials from the internet.

5. Science lecturers should encourage students in the use of phone in their learning. These phones can provoke the interest of the students and make science learning more interactive. As a result, science lecturers should explore different ways in which phone can be used in teaching and learning. For example, phone learning through tutoring, games, quizzes, podcasts (audio/video) and e-books. This will make students more aware of the possibilities of these phones and therefore will try to exploit their full potential.
6. Curriculum planners and policy makers should consider students' learning styles in the use of phone in science learning. Instruction should be designed in such a way so as to connect with multiple learning styles that are appropriate through phones. Lecturers have a role in identifying their students learning styles hence should encourage matching phone and resources to these styles. This includes integrating sound, visuals, music and games into the learning environment.
7. Content developers and programmers should come together to design and develop educational phone applications that can be used in learning various topics in science in order to provide tools for authoring, manipulation and communication. These applications should be simple for easy navigation for both students and lecturers. A rubric for selecting applications should be developed and distributed to lecturers so as to provide specific criteria for effective learning. An online database should be established to provide relevant educational applications for lecturers and students.

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EFFECT OF COMPUTER ASSISTED INSTRUCTION ON PHYSICS STUDENTS'ACHIEVEMENT IN ELECTROLYSIS IN SULEJA, NIGER STATE.

By

Dr. Robert Goebognaan DAJAL&Ayodele DADA

Department of Science and Environmental Education, Faculty of Education, University of Abuja, Abuja Nigeria**.**

ABSTRACT

This study investigated the effect of computer assisted instruction on Physics students' achievement in electrolysis in Suleja, Niger State, Nigeria. The study had two research questions and two null hypotheses. A total number of 123 students consisting of 78 males and 45 females were selected using purposive sampling techniques, this formed the sample of the study based on the availability of computer system, using intact classes. The study adopted the pre-test, post-test, quasi-experimental design. The experimental group was taught using Computer-Assisted Instruction (CAI), while the control group was taught using conventional method for a period of six weeks. The instrument used for collection of data was Electrolysis Concept Achievement Test in Physics (ECATP) which had a reliability coefficient of 0.90 after validation. Data collected were analysed using mean and t-test statistics. The major findings from the study revealed that there was significant difference in the post-test mean scores of experimental and control group. This is in favour of the experimental group. Furthermore, there was no significant difference in the academic performance of the male and female in experimental group. The study also found CAI as an effective teaching method. It was therefore recommended that Federal and State Governments should adequately train Physics teachers on using Computer-Assisted Instruction in teaching Physics in our secondary schools.

Introduction

Physics is a branch of science that deals with the study of properties and interactions of time, space matter and energy. It probes into the principles governing the changes in matter and energy Okeke, (2011).The use of development in Physics today makes our lives very easy and comfortable. Example, man today, sits at home watches the changes taking place in different continents of the world through satellite communication. It is due to Physics that we are living in the word of electricity, air conditioners, refrigerators, radio, wireless, telephone, telegraph and computers, which made our lives most comfortable. Physics has also helped in transportation and due to it; man can cover thousands of kilometres in minutes and seconds. Physics has also helped the space exploration and astronomy, and that is why man has gone to the moon on one side and the deepest earth of the sea on the other. He has been able to observe the movement of smallest particles of an atom such as electron, proton, and neutron at microscopic level and observes the farthest stars and galaxies with telescope.

Despite these benefits the study of physics at the secondary level is faced with many challenges such as, poor performance, attitude issues, lack of laboratory equipment for effective study, students inability to apply knowledge gained in class outside the class room among many others

Keeping in view the importance of Physics, the interest and ability of the students in the subject is not up to the mark. There may be many reasons for that but the experts suggest that the main reason of it is that Physics is taught with the traditional conventional lecture method and new methods of teaching are rarely used. This situation calls for a change in the teaching method of Physics. The methods of teaching in the science curriculum should be such that it compels the students to think, and through their efforts, interests and practical work the students be able to reach their potentials.

Conventional method is widely used in the secondary and tertiary levels of education. Conventional teaching method is a method of teaching in which teacher talks, while students take note of some key points and is used primarily to introduce students to a new subject. It is also a valuable method for summarizing ideas, showing relationships between theory and practice Mills, (2009). Many teachers use this teaching method almost exclusively, as it is considered the simplest, and one can cover large amounts of material in a short period of time. However, this is not the most effective method of teaching students, especially younger ones, who often need a more engaging, hands-on strategy in order to learn effectively Paul & Dantani, (2012). It is in this regard that this study is aimed at investigating the effectiveness of Computer-Assisted Instruction (CAI) on students' academic achievement in electrolysis concepts of Physics. Garnett &Treagust, (2014) reported that the concept of electrolysis in Physics is one of the topics that students find difficult to deal with, in Senior Secondary Certificate Examination (SSCE). The difficulty in electrolysis concept in Physics is because of the conceptual demand in writing and balancing chemical equation which is also necessary in Physics like it is in Chemistry, The mathematical calculations in physics and other factors such as lack of laboratory apparatus, qualified teachers contributed to the poor performance of students in electrolysis concepts of Physics and if electrolysis concepts of Physics are by nature difficult, the problem could be further compounded by the teachers' inability to adopt appropriate instructional strategies and methodologies that could promote or enhance students understanding of the concepts.

The teaching method used by teachers is very vital in any teaching-learning situation as this may promote or hinder learning. It may sharpen mental abilities and encourage students to learn effectively or may discourage initiatives and curiosity of the students to learn effectively (Paul & Dantani 2012). Instructional strategy adopted by the teacher at all level of education in imparting knowledge and skills to the learners are determined by the teachers' abilities, topic to be taught, learners age, and available resource Paul & Dantani (2012). There is however the need for Physics teachers to understand that different topics in science may require different teaching approaches depending on the complexity and structure of the topics. Many strategies like inquiry method, demonstration method, problem solving method, and discussion method have been used in teaching Physics still the performance of students is still very low Adewopo, & Ogunjobi, (2016)

Statement of the Problem

There has been a great shift in emphasis in science teaching and learning over the years worldwide. The concern in recent times is to have science classrooms that are student- centred, activity oriented and which focus on understanding rather than rote learning and simple recall of knowledge Owolabi, Olorukooba, & Lawal, (2012). Students tend to memorize facts and principles, most of which they do not understand but only to regurgitate them during examination. Thus the retention of ideas, facts and principles learned in this way might not be worthwhile. The level of academic and professional competence of science teachers need to be raised to the level that teachers can teach students with a focus on understanding rather than frequent use of only lecture method that often lead to rote learning. Moreover, recall of knowledge and memorization are not appropriate focus of science learning (Okolocha 2010). The contemporary problems and needs of the society today centre on sound development of science and technology for which Physics education is pivotal.

Electrolysis is an important aspect of secondary school Physics curriculum FME, (2017). The concepts, as observed by Silberberg, (2000), deal with the study of the relationship between chemical change and electrical work. Electrolysis has been reported to be one of the topics that students find difficult to understand in secondary school Physics Oyelekan, (2011). Oyelekan (2011) investigated the competence

of selected Nigerian Physics students to solve electrolysis problems through the use of problem solving model. The results showed that the students generally found solving problems in electrolysis more difficult. In another study Thompson and Soyibo (2012) investigated the attitude of students towards Physics and their conceptual understanding of electrolysis. The result of their study revealed that 50% of the students regarded electrolysis as one of the most difficult concepts to understand. Oyelekan (2011) carried out a study to find out the level of understanding of selected Physics concepts by senior secondary school students in Osun State, Nigeria. The result of his study indicated that electrolysis is one of the topics in which the students find difficult to understand. However, no such study has been attempted or carried out in Suleja, Niger state.

Studies have revealed that the academic achievement of Nigerian students in ordinary level Physics was generally and consistently poor over the years. Physics is an important science subject that makes immense academic demands on the students in its learning. The learning of Physics is of enormous importance to science and technology, there is need to undertake this study.

Purpose of the Study

The Purpose of this study was to investigate the effect of computer-assisted instruction on physics students' achievement in electrolysis in Suleja Educational Zone of Niger State. The study was specifically carried out to:

1. determine the effectiveness of Computer-Assisted Instruction and conventional instructional method on the academic achievement of senior secondary school Physics students when taught electrolysis concepts of Physics.
2. find out if there is difference in the academic achievement of male and female students when taught electrolysis concepts of physics using computer assisted instruction.

Research Questions

To guide the study the following research questions were formulated:

1.what is the difference in the mean achievement scores of students exposed to Computer-Assisted Instruction and those exposed to conventional method when taught electrolysis concept of Physics?
2. what is the difference in the mean achievement scores of male and female students taught electrolysis concepts of Physics using computer -assisted instruction?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

H_{O1}: There is no significant difference in the mean scores of students exposed to Computer-Assisted Instruction and those exposed to conventional method when taught Electrolysis concepts.

H_{O2}: There is no significant difference in the mean achievement scores of male and female students taught electrolysis concepts using computer assisted instruction.

Research Design

The study utilized quasi experimental design. Quasi experimental design is a field experiment that makes use of control and experimental variables involving pre-test, and post-test. Quasi experimental is appropriate for this study because it has to do with two groups of experimental and control. The Experimental Group (EG) was exposed to Computer-Assisted Instruction while the Control Group (CG) was exposed to conventional method.

The design is represented as follows:

EG	0_1	x_1	0_2
CG	0_3	x	0_4

Figure 1; Representation of Research Design

Key

EG= Experimental Group
CG=Control Group
0_1= Pre-test for Experimental Group
0_3=Pre-test for Control Group
X_1=Treatment
X=No Treatment

0_2=Post-test for Experimental Group
0_4=Post-test for Control Group

Population of the Study

The population of this study covered a total of six hundred and forty students (640) in senior secondary schools in Suleja Educational Zone of Niger State, Nigeria of which there are six senior secondary schools. These are year two (SSII) students studying Physics as a subject in the six public senior secondary schools in Suleja Education Zone. (Ministry of Education Science and Technology Minna Niger state (2019)

Sample Size and Sampling procedure

The sample size for this Study consisted of 123 Physics students selected from two public co-educational secondary schools in the study area. In selecting the sample size for the study, purposive sampling technique was used to select two schools out of the six schools.

The selection was also based on the availability of computer laboratories in the schools. The schools were assigned as experimental and control groups respectively

Instrumentation and Validation

The instrument used for the study was Electrolysis Concepts Achievement Test in Physics (ECATP) developed by the researchers. ECATP consisted of 40 objectives test items with four options (A, B, C, and D) per item. The items were based on concepts in Electrolysis, covering Physics SS11 curriculum. In constructing ECATP, the researchers prepared the tables of specification (Test Blue Print) to guide the test development in accordance with senior secondary school curriculum.

The Electrolysis Concepts Achievement Test in Physics (ECATP) was subjected to face content and construct validity. The validation was done by three experts in the Department of Science and Environmental Education, University of Abuja, and two Physics teachers from senior secondary schools. The corrections made by the experts were used to review the instrument.

The reliability coefficient of Electrolysis Concepts Achievement Test in Physics (ECATP) was determined after pilot testing using test, re-test method. The two results of the tests were compared and computed using Pearson Product Moment Correlation with the aid of (SPSS) software package and the reliability coefficient was found to be 0.90. This indicated that the items were reliable within acceptable limits

Data Collection Procedure

Data for the study were scores obtained from Electrolysis Concept Achievement Test in Physics (ECATP). A pre-test was administered on the two groups (Experimental and Control) in two different schools.

The Experimental and Control groups were taught by the researchers for a period of six weeks using C.A.I and Conventional methods respectively. Thereafter, post-test was administered to both groups. The scripts were marked and scored with the use of marking scheme. The marks obtained from the pre-test and post tests were used as data for analysis.

Method of Data Analysis

The data collected from the study were analysed using frequency counts, mean scores and standard deviation to answer the research questions, while t-test statistics was used to test the null hypotheses at 0.05 level of significance. The analysis was computer-based, with the use of Statistical Package for Social Sciences (SPSS), version 21.

Presentation of Data

This section presents the result and interpretation of the data collected from the study based on research questions and hypotheses.

Answers to Research Questions

Research Question 1: What is the difference in the mean achievement scores of students exposed to Computer Assisted Instruction and those exposed to conventional method when taught electrolysis concepts of Physics?

Table 1: Mean and Standard Deviation of Pre-test and Post-test Scores for the Experimental and Control Groups

Groups	No.of students	Mean pre-test	Scores Post-Test	Standard Deviation	Mean Gain
Experimental	59	**15.50**	**31.55**	**16.05**	**6.91**
Control	**64**	**18.23**	**21.87**	**7.84**	**3.61**
Mean deference		**2.73**	**9.64**		**12.61**
Total	**123**				

Table 1 presented data on the mean and standard deviation of academic achievement of students in experimental and control groups. From the result obtained, there was difference in the mean academic scores of experimental and control groups; the students exposed to Computer-Assisted Instruction had a pre-test mean scores of (15.50) while the students exposed to conventional method had a pre-test mean scores of (18.23). After the treatment the students in the experimental group had a mean score of (31.55) while those in the conventional group had a post-test mean of (21.87). From all indications there was significant improvement in the mean academic scores of experimental groups who have been exposed to computer-assisted instruction by gaining 6.91 when compared to their pre-test result, while there was mean gain of 3.61 in the mean academic score of the students who were exposed to conventional method of instruction when compared to their pre-test score.

Research Question 2: What is the difference in the mean academic scores of male and female students taught electrolysis concepts using computer assisted instruction?

Table 2:Mean and Standard Deviation of Pre-test and Post-test Scores of Male and Female Students exposed to Computer-Assisted Instruction.

Gender	No.of students	Mean Pre-test	Scores Post-Test	Standard Deviation	Mean Gain
Male	**37**	**14.85**	**32.56**	**6.38**	**17.71**
Female	**22**	**14.58**	**32.13**	**7.04**	**17.55**
Mean deference		**0.30**	**0.43**		**0.16**
Total	**59**				

Table 2 presented the mean and standard deviation of academic achievement of male and female students exposed to Computer-Assisted Instruction only. From the result above, the male students had a Pre-test mean of 14.85 while the female students had a Pre-test mean of 14.58. After the treatment, the male students had a mean scores of (32.56) while the female a mean scores of (32.13). It is quite evident that there is little or no difference in the Post-test mean of both male and female students who were taught electrolysis concept of Physics.

Test of hypotheses

The following null hypotheses formulated were tested at 0.05 level of significance:

H_{o1} There is no significant difference between the mean academic score of students exposed to Computer-Assisted Instruction and those exposed to conventional method when taught Electrolysis concepts.

The post-test data generated through Electrolysis concepts Achievement Test In Physics (ECATP) were subjected to t-test independent statistics to determine if there is any significant difference between the academic achievement of the experimental group and the control group.
Summary of the analysis is shown in table 3

Table 3: Results of t -test Analysis of the Post-test Mean Achievement Scores of the Experimental and Control Groups

Groups	N	X	SD	Df	t-value	p-value	Decision
Experimental	59	31.55	6.91	121	1.66	0.00	Significant
Control	64	21.87	7.84				

The result of the t-test shown in Table 3 shows that t-value calculated 1.66 and p- value of (0.00) were observed at df= 121. Since the p-value is less than the alpha value of 0.05, there is significant difference between the two groups in terms of their mean academic achievement scores in the Post-test. This indicates that experimental group has higher score than the control group. Therefore, the null hypothesis that stated that there is no significant difference between the mean academic score of students exposed to Computer-Assisted instruction and those exposed to conventional method when taught Electrolysis concept was rejected.

H_{o2}: There is no significant difference between the mean scores of male and female students taught electrolysis concepts using Computer-Assisted Instruction.
The post-test data generated through Electrolysis concepts Achievement Test (ECATP) were subjected to t-test statistic to determine if there is any significant difference between the academic achievement of the male and female students. Summary of the analysis is shown in Table 4.

Table 4: Results of T-test Analysis of the Post-test mean Scores of Male and Female Experimental and Control Groups.

Groups	N	X	SD	Df	t-value	p-value	Decision
Experimental	37	32.56	6.38	57	1.68	0.081	Not significant
Control	22	32.13	7.04				

To determine whether the performance of the male and female differ following the respective treatments, the post-test mean academic scores were subjected to t-test.
The result shown in the table indicates that t-Value calculated (1.68) and p- value of (0.081) is observed at df= 57. Since the P-Value is greater than the alpha value of 0.05, it is evident that there is no significant difference in the post-test mean academic achievement scores between male and females taught using Computer-Assisted Instruction. Based on this result, the null hypothesis which states, "There is no significant difference between the mean scores of male and female students taught electrolysis concepts using computer assisted instruction was therefore accepted.

Summary of findings.
The summary of the findings were as follows.

1. There was a significant difference between the mean achievement scores of experimental group taught electrolysis concept of physics using computer assisted instruction and their counterparts in the control group using conventional lecture method.
2. There was no significant difference in the achievement of male and female students of those exposed to computer assisted instruction when compared to their counterparts in the conventional group.

Discussion of results

The result of testing the hypothesis one shows that the students in the experimental group who were taught electrolysis concepts of Physics using Computer-Assisted Instruction performed significantly better and achieved higher than their counterparts in the control group. The significant difference in academic achievement is in favour of experimental group, suggesting a greater effectiveness of Computer-Assisted Instruction over the conventional Method in teaching electrolysis concepts. This shows that the use of Computer-Assisted Instruction in teaching electrolysis concepts is viable in enhancing students' academic achievement at senior secondary level of education (Okolocha 2010)

Therefore, the results of this study have shown that the use of computer assisted instruction has significantly improved students' academic achievement scores in electrolysis concepts. The findings emanating from this study are in agreement with the findings of Kolawale & Abiodun (2011) who found and reported that there was significant difference in the performance of students taught chemistry using CAI.

Hypotheses two cantered on gender related differences on academic achievement of male and female exposed to electrolysis concepts using Computer-Assisted Instruction the Post-test result of testing hypothesis two showed there was statistically no significant difference between the Post-test mean score of male students and the Post-test mean score of female students. This implies that the level of academic achievement in electrolysis concepts of male and female students expose to Computer-Assisted Instruction is relatively the same. This finding agrees with the finding of Yusuf and Afolabi, (2010) who in their study found out that male and female students did not differ significantly in their performance when they are taught biology concept using computer aided instructional package. The finding of this research is also in contrast with the finding of Nakaka and Okwo (2011) who found that male students found computer aided instruction to be more interesting than their female counter-parts.

Conclusion

Computer assisted instruction is gender friendly thus, it should be used to teach both male and female students without bias of favouring one gender than the other.

Recommendations

Based on the findings, the following recommendations were made:

1. Physics teachers should be encouraged to incorporate computer assisted instruction method of teaching since it has been found to promote high achievement in students.
2. Stakeholders and relevant professional bodies like Science Teacher Association of Nigeria (STAN) should organise seminars, workshops and conferences for physics teachers to adopt the use of computer-assisted instruction in teaching physics.
3. The Federal and State Governments should provide conducive learning environment-by providing adequate Physics classrooms as well as properly equipped Physics laboratories, with adequate ICT facilities including computers and projectors to enhance the students' acquisition of modern science learning using computer assisted instruction and improve science process skills.

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By

Blessing Solomon Dawal
Department of Science And Technology Education
University of Jos

&

Mary Erasmus Sulai
Department of Science Education
Gombe State University, Gombe

Abstract

The study investigated teachers' knowledge and usage of ICT for effective classroom delivery of basic science and technology curriculum content in primary schools in Plateau State. The study employed the descriptive survey design. Out of the population of 115 Science teachers (98 males and 17 females) from 115 Pilot Science Primary Schools in Plateau State, sample of 58 teachers (45 males and 13 females) purposively chosen to respond to the questionnaire. The instrument used in collecting the data was a four-point likert questionnaire developed by the researchers to draw out the information on teachers' knowledge and usage of ICT for effective classroom delivery of basic science and technology curriculum content in primary schools. Five research questions and three hypotheses guided the study. The instrument was validated by three experts and a reliability of 0.86 was obtained using Cronbach Alpha Coefficient (K-R20). Frequency counts, percentage and mean were used to answer the research questions, while Chi-square and t-test were used to test the hypotheses at 0.05 level of significance. The study revealed that only 22.5% of teachers have knowledge and use ICT in teaching basic science and technology in primary schools. The study also revealed that 82.7% of teachers from pilot science schools lack ICT skill acquisition. The study further revealed that most of the computers in schools are analog which are not functionable at all. Among other things that the schools lack are projectors for power-point presentation, e-library for learning and constant network. It was further discovered that 92.2% of primary schools lack the necessary ICT resources for classroom delivery of basic science and technology curriculum content. It was recommended among others that teachers should be trained on the use of ICT through workshops, seminars and conferences which will make them perform their teaching roles effectively.

Keywords: ICT, Knowledge, Usage, Classroom delivery, Basic science and technology

INTRODUCTION

Primary school level of education occupies a critical position in the educational system. The National Policy on Education (FRN, 2013) also stated that the aim of the primary education is to foster the proper development of the children, identify and address their problems, harness their potentials, mould their characters, enhance their learning, equip them for life, so that their actions are channelled towards positive personal, communal and global development in all ramifications of life with the effective use of ICT.

Basic science and technology is a compulsory subject for primary pupils but at other levels of education especially from senior secondary schools upward, it is optional. Basic science and technology is the first point of teaching children important skills and to solve simple practical problems, which they will meet later in life. In a similar affirmation, the National Policy on

Education (FRN, 2013) emphasized that basic science and technology helps children to develop their physical skills especially their ability to handle things. All these skills will be useful to them when they grow, most especially when their interest to further in sciences is well developed at the primary school level. Olatoun (2011), Kadir (2012), Mallam and Lawson (2014) stated that effective classroom delivery is so crucial to learning that the products of teaching such as knowledge, attitude and skills acquisition are much dependent on teachers' effectiveness. Teaching is said to be effective when the approach is used to bring about a desirable change in the life and behaviour of the learner. The knowledge and utilization of ICT by teachers in classroom delivery will serve in various capacities as an instructional tool to explore, investigate, solve problem, interact, reflect, reason, strategizes and learned concepts in the virtual classroom. It gives room for independent and individual study with orientation of making instruction more powerful, more scientific and subject centered.

According to Akanbi and Kolawole (2014) and Junco (2015) ICT includes the radio, television, videos, computers services, interface boxes, email, satellite connections, internet and all the softwares and materials which are employed by teachers for teaching and learning. Also Azuka (2013), Ikitde and Udoh (2015) and NTI (2015) stated that knowledge on ICT gives teachers the opportunities to handle texts and images, numbers and graphs, instructions, sound and music and to process information by organizing and recognizing, storing and retrieving, sorting and analyzing, presenting and communicating.

In order to prepare future generations to live in an emerging society, which is and will be highly technology oriented, Udoh, Ohaju and Agba (2016) stated that they need to be educated appropriately in accordance with the requirements of the information age which is to build a resource of people who are highly skilled in the use of ICT and to equip them for a future in which technological awareness and basic computer skills will be increasingly important for greater number of citizens and also to use technology to enhance existing curriculum, promote change in education by moving towards a more practical curriculum and a new definition of teachers role. This also calls for teachers to be knowledgeable and well tested in the manner these communication technologies could be utilized in lesson delivery for effective results.

Studies by Atomatofa (2014), Abimbola (2015) and Ikemelu (2015) have shown that ICT provides a new form of teaching and learning in science education, and its use in the classroom is very important because it provides opportunities for pupils to function effectively and operate in the present technology age. It is also important that primary school education remains vital in ensuring that future generations of young pupils are well prepared for adult life in a world strongly influenced by ICT, Hence the need to assess teachers' knowledge and usage of ICT for effective classroom delivery of basic science and technology curriculum content in primary schools in Plateau State.

Research Questions

The following research questions guided the study:

iv. What is the knowledge of teachers on ICT for classroom applications in teaching basic science and technology curriculum content in primary schools?

v. To what extent are teachers utilizing ICT resources for effective classroom delivery of basic science and technology curriculum content in primary schools?

vi. To what extent are teachers' competences in ICT skill applications for effective classroom delivery of basic science and technology curriculum content in primary schools?

vii. What are the problems encountered by teachers towards the utilization of ICT based instruction for effective classroom delivery of basic science and technology curriculum content in primary schools?

viii. What is the influence of gender on teachers' utilization of ICT resources for effective classroom delivery of basic science and technology curriculum content in primary schools

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference between teachers level of knowledge of ICT and the teaching of basic science and technology in primary schools.
2. There is no significant difference between teachers' utilization of ICT resources and classroom delivery of basic science and technology curriculum content.
3. Gender has no significant influence on teachers' utilization of ICT for effective classroom delivery of basic science and technology curriculum contents.

Methodology

The study employed a descriptive survey design. Nworgu (2006) in line with Akuezuilo and Agu (2003) described the survey research as one in which a group of people or item is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. This design was adopted because information collected were made available in their natural and normal school environment and also analyzed without any form of treatment. Five research questions and three hypotheses guided the study. The population of the study comprised all the 115 (98 males and 17 females) science teachers in 115 pilot science primary schools in the 17 Local Government Areas of Plateau State. A sample of 58 science teachers (45 males and 13 females) which is 50.4% of the population from 58 pilot science primary schools in 10 Local Government Areas. The instrument used in collecting the data was the four point Likert scale questionnaire developed by the researchers to draw out the information on teachers' knowledge and usage of ICT for effective classroom delivery of basic science and technology curriculum content in primary schools. The four options were strongly agreed (SA) Agreed (A) Disagreed and strongly disagreed (SD). The Instrument was validated by three experts, two in science education from the Department of Science and Technology Education and one in test and measurement evaluation from the Department of Educational Foundation, University of Jos. All their corrections and inputs were incorporated into the final form of the instrument. Reliability of 0.86 was obtained using Cronbach Alpha Coefficient (K=20).

Results

The results of the study are discussed as follows:

Research Question 1

What is the knowledge of teachers on ICT for classroom application in teaching basic science and technology curriculum content?

Table 1: Distribution of Respondents According to Knowledge on ICT

Variables	**Have knowledge**		**No knowledge**	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Interactive white Board	8	13.7	50	86.2
Electronic Bulleting	-	-	58	100
Video conferencing	-	-		
Skype	-	-		
Face book	29	50	29	50
E-Mail	5	8.6	53	91.4
Power Point	2	3.4	56	96.6
2go	-	-	58	100
Whatsapp	38	65.5	20	34.5
World Wide Web (www)				
Internet Surfing	13	22.4	45	77.6
Web blogs	-	-	58	100
Electronic books	-	-	58	100
GSM Conversation/ Messaging	58	100	-	-

Table 1 above indicated that 100% of teachers have knowledge on GSM conservation and messaging, 65.5% on Whatsapp, 50% on Facebook, 22.4% on world wide web (www) internet surfing, 13.2 on interactive white board, 8.6% on email, 3.4% on power point and 0% for electronic bulleting, video conferencing skype, 2go, web blogs and electronic books.

Research Question 2

2. To what extent are teachers utilizing ICT resources for effective classroom delivery of basic science and technology curriculum content in primary schools?

Table 2: Frequency and Percentage Responses of Pilot Science Teachers on Utilization of ICT Resources for Effective Classroom Delivery of Basic Science and Technology Curriculum Content.

S/No	Item Statement	Utilize		Not Utilize	
		Frequency	%	Frequency	%
1.	I use computer software programme available for teaching science concepts	20	34.1	38	65.6
2.	I always use computer applications in preparation for school work, classroom work and work with students	18	31	40	69
3.	I copy documents for lesson presentation into folders and files	12	20.6	46	79.4
4.	I always print documents for lesson delivery	19	2.8	39	67.2
5.	I use over head projector for lesson delivery	0	100	58	91.4
6.	I process data for lesson presentation				
7.	I use scanner for lesson delivery	8	13.8	50	86.2
8.	I use any internet facilities available for lesson delivery	14	24.1	44	75.9
9.	I use laptops/computers to download information for teaching science concepts	25	43.1	33	56.9
10.	I use internet or bluetooth to send information into pupils	0	100	58	100

The result in Table 2 showed that less than 45% of teachers utilize items statements of 1,2,3,4,6,8, and 9 while item statements of 5 and 10 which indicated 0% are not utilized at all. The results indicated that more than 50% of teachers do not utilize ICT resources for effective classroom delivery of basic science and technology curriculum content.

Research Question 3

To what extent are teachers' competences in ICT skill applications for effective classroom delivery of basic science and technology curriculum contents in primary schools?

Table 3: Frequency and Percentage Responses of Pilot Science Teachers on Extent of ICT Application in Classroom Delivery of Basic Science and Technology Curriculum Content in Primary Schools.

S/No	Item State	Agree		Not Agree	
		Frequency	%	Frequency	%

1.	I have skills on typing and saving of documents.	10	17.3	48	82.7
2.	I lack technical skills in using computers and accessories.	52	89.6	6	10.4
3.	I have skills on how to create new documents.	13	22.5	45	73.5
4.	I can copy text from one page to another page.	13	22.5	45	77.5
5.	I can not draw charts, graphs with computers.	54	93.1	4	6.9
6.	I can select microsoft word from the menu and sub-menu.	7	12.1	51	87.9
7.	I can not use computer simulation technique to teach pupils.	58	96.5	0	100
8.	I can not use logical operations in searching the internet.	56	96.5	2	3.5
9.	I can browse internet for information.	9	15.6	49	84.4
10.	I lack skills on the use of power point.	50	86.2	8	13.8

The results in Table 3 showed that teachers have low level of ICT skill applications. Only 22.5% of the teachers agreed that they have technical skills in typing and saving of documents and can copy text from one page to another, 17.3% can type and save document, 15.6% can browse internet for information, 13.8% can use power point, 12.1% select microsoft word from the menu and sub-menu, 10.4% can use computer and accessories, 6.9% can draw charts, graphs with computer, and 3.5% use logical operation in search of the internet, while 100% (all the teachers) can not use computer simulation teachnique to teach the pupils. This indicates that majority of the teachers are not competence in ICT skill application for effective classroom delivery of basic science and technology curriculum content.

Research Question 4: What are the problems encountered by teachers towards utilization of ICT based instruction for effective classroom delivery of basic science and technology curriculum content?

Table 4: Frequency and Percentage Response of Pilot Science Teachers on Problems Encountered Toward Utilization of ICT Based Instruction for Effective Classroom Delivery of Basic Science and Technology Curriculum Content

S/No	**Item Statement**	**Agree Frequency**	**%**	**Not Agree Frequency**	**%**
1.	Lack of computer in the school.	40	67	18	31
2.	Lack of personal laptops/ computer.	56	96.5	2	3.5
3.	Lack of adequate computer skilled personel in the school.	54	93.1	4	6.9
4.	Lack of computer discs.	57	98.2	1	1.8
5.	Lack of computer software programmes for teaching.	53	91.4	5	8.6
6.	Lack of access to the available ICT resources in the school.	52	89.6	6	10.4
7.	Lack of internet facilities in the school.	57	98.2	1	1.8
8.	Lack of functional micro projectors.	56	95.5	2	3.5
9.	Lack of overhead projectors in the school.	56	95.5	2	3.5

10.	Lack of regular power supply.	58	100	0	0

The results in Table 4 showed that 98.2% of the teachers lack computer discs and internet facilities in their schools, 96.5% lack personal laptops/computers, 95.5% lack functional micro projectors and overhead projectors, 93.1% lacked adequate computer skilled personel, 89.6% lack access to the available ICT resources in the school, 69% lack computers while all of the schools (100%) lack regular power supply. This indicates that all the pilot science primary schools are facing the problem of lack of ICT facilities in the schools for them to utilize for effective classroom delivery of basic science and technology curriculum content in primary schools.

Research Question 5: What is the influence of gender on teachers' utilization of ICT resources for effective classroom delivery of basic science and technology curriculum content in primary schools?

Table 5: Mean scores of males and females on teachers' utilization of ICT resources for effective classroom delivery of basic science and technology curriculum in primary schools

S/No	Item Statement	Mean (Males) $(\bar{x})$	Mean (Female) $(\bar{x})$
1.	I use computer software programmes available for teaching science concepts.	2.47	2.05
2.	I always use computer applications in preparation for school work, classroom work and work with students.	1.72	1.97
3.	I copy documents for lesson presentation into folders and files.	1.93	1.40
4.	I always print documents for lesson delivery.	1.85	1.23
5.	I always use over head projector for lesson delivery.	1.65	1.23
6.	I process data for lesson presentation.	1.42	1.00
7.	I use scanner for lesson delivery.	1.95	1.98
8.	I use any internet facilities available for lesson delivery.	1.60	1.77
9.	I use laptops/computers to download information for teaching.	1.90	1.74
10.	I use internet or Bluetooth to send information into pupils' phones.	2.33	1.47

The results in Table 5 revealed that all the items listed obtained a mean rating below 250 which is the cut-off point in all the column for both the male and female pilot science teachers. This is an indication that all the listed items were generally not accepted. Gender, as the results of the study have shown does not have any influence in teachers' utilization of ICT resources for effective classroom delivery of basic science and technology curriculum content in primary schools.

Hypothesis 1

There is no significant difference between teachers' level of knowledge of ICT and the teaching of basic science and technology in primary schools.

Table 6: Chi Square Difference in the Level of Knowledge of ICT Held Among Primary School Teachers.

Variable	Cal x^2	Table x^2	Significance	df	Decision
Level of Knowledge	.5	7.82	.05	3	Accepted

Since the calculated chi square (.5) value is less than the table chi square (7.82) the null hypothesis is therefore not rejected. Therefore there is no significant difference in the level of knowledge of ICT held among primary school teachers in Plateau State.

Hypothesis 2

There is no significant difference between teachers' utilization of ICT resources and classroom delivery of basic science and technology curriculum content.

Table 7: Chi Square Difference in the Use of ICT by Teachers During Classroom Delivery Process

Variable	Cal x^2	Table x^2	Significance	df	Decision
Use of computer	4.28	7.82	.05	3	Accepted

Table 7 showed that the calculated chi square 4.28 is less than the table value 7.82, the null hypothesis is therefore not rejected. Thus there is no significant utilization of ICT resources by teachers during classroom delivery of basic science and technology curriculum content in primary schools in Plateau State

Hypothesis 3

Gender has no significant influence on teachers' utilization of ICT resources for effective classroom delivery of basic science and technology curriculum content in primary schools.

Table 8: T-test of Gender Influence on Teachers' Utilization of ICT for Effective Classroom Delivery\

Gender	N	Mean score	S.D	Df	T-cal	T-crid	Decision
Male	45	54.1	11.94	248	0.985	1.96	Accepted
Female	13	47.53	11.21				

The result showed that the t-calculated (0.985) is less than the critical value of t(1.96) at 248 degree of freedom and 0.05 level of significance. This shows that gender has no significant influence on teachers' utilization of ICT resources for effective classroom delivery of basic science and technology curriculum content in Plateau State.

Discussion

The findings of the study in Tables 1 and 6 revealed that teachers of pilot science schools lack knowledge of ICT for effective classroom delivery as highlighted by their responses on item assessment. This finding reflects the absence of ICT knowledge in our primary schools and the society at large. This is in line with the finding of Olatoun (2011) who found out that teachers' in Secondary schools in Central Nigeria lacked knowledge on ICT utilization. The finding is also supported by Mallam and Lawson (2014) who found out that lack of knowledge on ICT by teachers in primary schools is one of the factors responsible for poor implementation of Universal Basic Education programmes in junior secondary schools in some educational zone of Delta State, Nigeria.

The findings of the study in Tables 2 and 7 revealed that teachers of pilot science schools do not utilize ICT resources for classroom delivery of basic science and technology. This is in agreement with the findings of Kadiri (2012), Azuka (2013) and National Teachers Institute (2015) who discovered that despite the significance of ICT in national development, most Nigerian schools still lack behind in the level of ICT use in science, communication, industry and many other fields.

Also the finding in Table 3 revealed that teachers of pilot science schools lack ICT skill applications. This collaborated with the findings of Ikeme in (2015) and Junco (2015) who found out that most teachers in Nigerian secondary schools lack skill application in teaching science subjects. Udoh, Ohaju and Ado (2016) also found out that a bigger proportion (90%) of teachers lack the necessary skills in ICT application like internet browsing. The authors further revealed that

science teachers in Primary and secondary schools in Nigeria are lagging behind in ICT skills application in teaching.

The findings in table 4 showed that one of the problems that teachers of pilot science schools are facing is lack of ICT resources in primary schools. The result revealed that 98.2% of primary schools lack the necessary ICT resources. Also the few that are available in some schools are analog and are not made available for teachers to utilize. This in agreement with the findings of Mallam and Lawson (2014) who found out that there are relevant ICT resources that would facilitate learning, but are not available and schools that have few lack the manpower to maintain them. It was further mentioned that there are relevant softwares that are appropriate and suitable for Nigerian schools to facilitate teaching and learning but these are not provided to schools by the appropriate authority. If ICT resources are not provided for classroom usage, damage is done to the students and nation because they cannot achieve basic skills which will help in national development.

The findings in tables 5 and 8 revealed that gender has no influence on teachers' utilization of ICT resources for effective classroom delivery on basic science and technology curriculum. The findings of Atomatofa (2014) and Abimbola (2015) is in line with this study where they discovered that gender has no significant influence on teachers' competence in the use of ICT. This is also in agreement with the findings of Akanbi and Kolawole (2014) who found out that gender has no significant influence on teachers' use of ICT in tertiary institution.

Conclusion

The findings of the study revealed that pilot science teachers in Plateau State do not have significant knowledge of ICT usage for effective classroom delivery of basic science and technology curriculum contents. Primary school is the first basic level for education and as such ICT resources should be made available at this stage because the world has become a global village and world educational system has made some tremendous changes and Nigeria educational system should not be left behind. Efforts should be made by teachers, school administration, and government to make teachers ICT literate. The utilization of ICT resources should be encouraged for a better motivation and development of interest for science at the younger age for children in primary schools.

Recommendation

The following recommendations are made based on the results of the findings.

1. Pilot science teachers should make concerted efforts to update their knowledge of ICT
2. Government and stakeholders should provide ICT facilities in schools to facilitate literacy in ICT and hence utilize same.
3. Government should improve the quality of pilot school science teachers by exposing them to pre-service, in-service teachers training in form of summer workshop and conferences on ICT skill application and restructuring teachers' education programmes to incorporate required skills in computer operations.

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EFFECT OF COMPUTER ASSISTED INSTRUCTION CAI ON JSS II STUDENTS' INTEREST AND ACHIEVEMENT IN BASIC SCIENCE IN GOMBE METROPOLIS, GOMBE STATE, NIGERIA.

By

Dr. M. D. Kala
Department of Science Education, Gombe State University
Email**mdkala@gmail.com**

Danjuma S. Ibrahim
Department of Science Education, Gombe State University
Email**tamas2007@yahoo.com**

Abubakar, Musa Maikamba
Department of Educational Foundations, Gombe State University,
Email**musaabubakar033@gmail.com**

Bibi Meshak
Department of Educational Foundations, Gombe State University
Email**bibimeshak@gmail.com**

&

Umar, Maryam Bacciji
Department of Educational Foundations, Gombe State University
Email**mairobacciji@gmail.com**

ABSTRACT

This study determined the effect of Computer Assisted Instruction (CAI) on students' interest and achievement in Basic Science. Two research questions were posed and two hypotheses were formulated and tested. A quasi-experimental design specifically the non-randomized control group design involving two intact classes was used. The sample for the study consisted of 97 junior secondary two (JS II) Basic Science students from two government owned secondary schools. The two government secondary schools were drawn using purposive sampling techniques from 63 government schools in Gombe State. One of the two schools used was assigned to the experimental group (CAI) and the other one to the control group. Two instruments: the Basic Science Achievement Test (BSAT) was adapted from JSSCE Basic Science past question paper and the Basic Science Interest Inventory (PII) was adapted from Stephen & Agommuoh (2017) and it was validated by experts. The internal consistency of BSAT was computed and found to be 0.82 using test-retest. Before treatment commenced, the BSAT was administered as a pre-test to the two groups. A pilot study was also conducted to ascertain the reliability of basic science interest inventory where a 0.82 alpha value coefficient was found. Means and standard deviations were used to answer the research questions. Hypotheses were tested using a t-test at 0.05 level of significance. The result of the analysis indicated that CAI had significant effects on students' interest and achievement in Basic Science, where students in the CAI group achieved more. Thus, it is recommended among others, that State Governments, Ministries of Education, and professional associations should organize workshops, seminars, and conferences to train teachers on the use of CAI techniques.

KEYWORDS: computer-assisted instruction, conventional method, interest, basic science, and academic achievement.

INTRODUCTION

It is a thing of concern that a significant number of students do not seem to understand some basic concepts in Basic Science at the junior secondary school level. Learning tends to be by rote and memorization and students find learning of Basic Science difficult, boring and uninteresting just like physics in senior secondary schools as an example which in turn affects their academic achievement negatively (Eyibe, 2010; Jegede, 2012; Salau, 2006). The quality of Basic Science teaching and learning has also been questioned over time by parents, science educators, the general public, and even the government (Adepoju, 2001; Ivowi, Okebukola, Oludotun & Akpan, 2002; Okebukola, 2007). Basic Science Teaching in Nigerian schools has not been encouraging because of the poor method used by teachers in teaching the subject. Research indicates that most Nigerian junior secondary schools have no science corner where they could practicalities what they have learned, which now affects their performance in Basic Science (Salau, 2006). For any nation to attain self-reliance, science must be an important component of the knowledge to be given to her citizens irrespective of tribe/ethnicity, creed, or gender (Ezenwa, 2011). Basic Science is a science which deals with the study of nature. Understanding science begins with understanding Basic Science. With every passing day, Basic Science has brought to us some levels of understanding of nature. Everything we know about the physical world and about the principles that govern its behaviour has been learned through observations of the phenomena of nature. Basic Science is one of the science subjects taught at the junior secondary school level of the Nigerian educational system. The study and application of Basic Science are essential to the scientific, industrial, technological, and social advancement of societies or nations. Basic Science education is aimed at

training students to acquire a proper understanding of Basic Science principles.Studies revealed some factors that affect the teaching of Basic Science to include but not limited to lack of motivation for most teachers, poor infrastructural facilities, inadequate textual materials, the attitude of students to learning, lack and inappropriate teaching method to meet the demand of the society in which we live and the yelling of the changing world, among others (Braimoh & Okedeyi, 2001; Folaranmi, 2002; Okebukola, 2007; Olaleye, 2002; Olanrewaju, 2004).

It is also aimed at developing in them appropriate scientific skills and attitudes as a pre-requisite for future scientific activities. To achieve these objectives, innovative teaching techniques, active participation, and collaborative learning activities become imperative and these would need functioning instructional media such as the use of CAI to make Basic Science instruction effective (Alebiosu & Mudasiru, 2008; Ogunleye, 2000).

Various literature revealed that the use of ICT to supplement traditional instruction is important because Computer-based teaching and learning produced positive effects in the classroom. Students seemed to be motivated by learning through this medium (Forcier, 2009). Educational technology had a large impact on student achievement (Muir, 2002). Traynor (2003) argued that CAI programs increase student learning by increasing motivation. Salau (2006) strongly believed in the push for change in educational learning through technology.

Computer-Assisted Instruction (CAI) is an interactive technique whereby a computer is used to present the material and also to monitor the learning that takes place (Iqbal, 2009). It is also known as Computer-Assisted Learning (CAL), Computer Assisted Education (CAE), and Computer-Assisted Training (CAT). Various modes of computer-assisted instruction exist. These include; Drill and Practice for repetitive exercise and rote skills, Instructional Games which Increase learners' motivation by adding game rules to the learning activity. Tutorials are delivered as instructional activities, quizzes, and feedback. Problem-solving software which present problems relevant to learning objectives, provide necessary directions, hints, and assistance to solve the problem according to the learners' need. Studies revealed that teachers using CAI can generally achieve the following results in more student-centered teaching: less lecturing, increased individual instruction, more time spent in coaching and advising students, increased interest in teaching, and increased productivity.

Studies indicate that research efforts have proposed various suggestions and recommendations for improving the quality of Basic Science teaching and learning in Nigerian classrooms (Ajewole, 2004; Busari, 2006; Igwebuike, 2006; Odubunmi, 2001). However, despite these various suggestions and recommendations for improvement, the quality of Basic Science teaching and learning and student achievement in junior secondary school continues to decline (Ikeobi, 2005; Ivowi, 2005). The current situation of Basic Science teaching and learning in Gombe State and Nigeria is a concern to all including the government and the society at large. Hence the need to explore the efficacy of Computer Assisted Instruction (CAI) method in teaching and learning of Basic Science at the junior secondary school level in Gombe State.

PURPOSE OF THE STUDY

The purpose of this study was to examine the effect of computer-assisted instruction (CAI) on JS II students' interest and achievement in Basic Science in Gombe Metropolis, Gombe State, Nigeria.

RESEARCH QUESTIONS

The following research questions were formulated to guide the study:

1. What are the mean interest scores of students taught Basic Science with Computer Assisted Instruction (CAI) and those taught using the conventional methods (CM)?
2. What are the mean achievement scores of students taught Basic Science with Computer Assisted Instruction (CAI) and those taught using the conventional methods (CM)?

RESEARCH HYPOTHESES

The following null hypotheses were tested at 0.05 level of significance.

Ho1: There is no statistically significant difference between the mean interest scores of students taught Basic Science with Computer-assisted instruction (CAI) and those taught using the conventional method.

Ho2: There is no statistically significant difference between the mean achievement scores of students taught Basic Science with Computer-assisted instruction (CAI) and those taught using conventional methods.

METHODOLOGY

This study adopted a quasi-experimental design using pre-test and post-test with control and experimental groups. The study was carried out in Gombe Metropolis. The population of this study comprised of 7,825 junior secondary two (JSII) Basic Science students in all the public junior secondary schools in Gombe metropolis. Purposive random sampling was adopted to obtain two junior secondary schools in the Gombe metropolis. The two sampled equivalent and co-educational/mixed schools were randomly assigned to experimental groups and control groups using a simple random sampling technique. One school was assigned to an experimental group with 50 Basic Science students and was treated with Computer Assisted instruction method (CAI), the other school was assigned to a control group with 50 Basic Science students and was taught using the Conventional methods (CM). Two instruments were used for collecting data. These are the Basic Science Achievement Test (BSAT) and Basic Science Interest Inventory (BSII). The Basic Science Achievement Test is a 30 item multiple choice type questions that were adopted by the researcher from the (2018) JSSCE. Test-retest was conducted to ascertain the reliability of the instrument with 40 students. Pearson correlation coefficient of 0.89 was found which shows that the instrument is reliable. The second instrument used for data collection was the Basic Science Interest Inventory (BSII). It was an adapted instrument from Stephen & Agommuoh (2017). The instrument is made up of two parts: Section A which deals with the background information of the respondents and section B which deals with the questions concerning students' interest in Basic Science in public secondary schools in Gombe State. The instrument was validated by experts and it was subjected to a pilot study where a reliability coefficient of 0.82 was obtained. Data generated from the pre-test and post-test were used for the analysis. Mean and Standard deviation was used to answer the research questions while the analysis of variance (ANOVA) and t-test were used for testing the hypotheses at 0.05 level of significance.

Results

Table 1. Mean Interest Scores of Students taught Basic Science with Computer-Assisted Instruction and those taught using the conventional methods

Group	**N**	**MEAN**
Conventional methods	50	14.40
Computer Assisted Instruction	50	26.08

Data in Table 1 shows that the students taught with CAI show more interest in learning Basic Science than those taught using the conventional methods as indicated by the mean interest scores of 26.08 (CAI), 14.40 (CM) with the mean difference of 11.68. This implies that the CAI method is more effective in teaching Basic Science than conventional methods with 11.68.

Table 2: Mean Achievement Scores of Students taught Basic Science with Computer-Assisted Instruction and those taught

Methods	**N**	**MEAN**
Conventional methods	50	10.72
Computer-assisted instruction (CAI).	50	22.52

The result in Table 2, shows that the students taught with CAI have more achievement scores in Basic Science than those taught using the conventional methods as indicated by the mean achievement scores of 22.52 (CAI), 10.72 (CM) with the mean gain scores of 16.62

Table 3: t-test Analysis of the Mean Interest Scores of Students taught Basic Science with Computer Assisted Instruction (CAI) and those taught using conventional methods

Variables	N	Mean	Df	T	p. value	Decision
Conventional methods	50	14.40	49	-14.82	.000	Rejected
Computer-assisted instruction	50	26.08				

Total	100

The result of the analysis in Table 3 revealed that there was a significant difference in the mean interest scores of students taught using computer-assisted instruction and those taught using conventional methods (t=-14.82, Df=49, p=.000). Since the computed value is less than 0.05 level of significance, the null hypothesis is rejected.

Table 4: t-test Analysis of the Mean achievement Scores of Students taught Basic Science with Computer Assisted Instruction (CAI) and those taught using conventional methods

Variables	N	Mean	Df	T	p. value	Decision
Conventional methods	50	10.72	49	-17.14	.000	Rejected
Computer-assisted instruction	50	22.52				
Total	100					

The result of the analysis in Table 4 revealed that there was a significant difference in the mean achievement scores of students taught using computer-assisted instruction and those taught using conventional methods (t=-17.14, Df=49, p=.000). Since the computed value is less than 0.05 level of significance, the null hypothesis is rejected. This means that there is a statistically significant difference between the mean achievement scores of students taught Basic Science with Computer-assisted instruction (CAI) and those taught using lecture teaching method as measured by Basic Science interest inventory BSII.

Discussion

Findings from table 1 revealed that students taught Basic Science with CAI had a higher mean interest score than those students taught using conventional methods in the Basic Science interest inventory. In the same vein, the results of Table 3 and 4 showed that the null hypothesis was rejected and state that there is a statistically significant difference between the mean interest scores of students taught Basic Science with computer-assisted instruction (CAI) and those taught using conventional methods as measured by Basic Science interest inventory items. This suggests that students exposed to CAI tend to have more interest in learning Basic Science than those taught with conventional methods since results show a significant difference between the two method studies. The implication of this finding therefore is that CAI is more effective than conventional methods in enhancing students' interest in Basic Science. This finding is similar to the finding of Olanrewaju (2004) who found that there was a significant difference in interest in the mathematics of the experimental group taught with CAI and control group taught with conventional methods in favour of the experimental group. The difference in the interest of students in Basic Science is similar to the studies carried out in other fields of learning on students' interest by Muir (2000). Table 2 revealed that students taught Basic Science with CAI had a higher mean achievement score than those students taught using the lecture teaching method in the Basic Science achievement test. The null hypothesis was rejected and state that there is a significant difference between the mean achievement scores of students taught Basic Science with computer-assisted instruction (CAI) and those taught using conventional methods as measured by BSAT. This suggests that students treated with CAI performed better than those in the control groups. The findings of this study revealed Computer Assisted Instruction (CAI) On Students' Interest and Achievement in Basic Science in Gombe Metropolis, that the use of computer-assisted Instruction method had a significant effect on students‟ achievement in Basic Science. The students taught using a computer-assisted instruction method achieved significantly better than those taught using conventional methods. This result is in agreement with the result of Dange and Wehb (2006). They found out that computer-assisted instruction enhanced students' achievement in Basic Science. This result is also in agreement with Chukwu and Igwebuike (2007), who investigated the effect of integrating concept mapping into computer-assisted instruction in chemistry achievement. Their findings revealed that the students in the experimental group who were treated with computer-assisted concept mapping achieved significantly better than those in the control group.

Conclusion

Based on the findings of the study it was concluded that CAI improved students' achievement and interest in Basic Science than the conventional methods. These results, therefore, revealed that CAI is a viable alternative to the conventional methods in teaching Basic Science. Moreover, CAI provides powerful tools to support the shift to student-centered learning and is capable of creating a more interactive and engaging learning environment for teachers and learners.

Recommendations

Based on the findings of this study, the following recommendations were made;

1. More attention should be accorded to computer literacy and operation in the secondary schools and relevant computer-assisted instructional packages should be developed for use within the Gombe state school systems.
2. Teachers of Basic Science in Gombe Metropolis and Nigeria in general should explore the use of the CAI in teaching Basic Science.
3. Further empirical studies should be carried out on why male students performed better than their female counterparts in Basic Science as was found by other studies.
4. Curriculum planners and other relevant stakeholders in education such as Nigerian Educational Research and Development Council (NERDC), science teachers association (STAN) should consider the review of the curriculum for Basic Science for secondary schools with a view of incorporating the use CAI method in our public secondary schools in Gombe Metropolis.

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TIME MANAGEMENT BEHAVIOURS AND UNDERGRADUATE STUDENTS' PERFORMANCE IN NIGERIAN UNIVERSITIES

By

Dr. Zakka G. Ayuba
Dept. of Science and Technology Education
University of Jos, Nigeria.

Prof. C. A. John

Dept. of Technology Education
Modibbo Adama University of Technology, Yola, Nigeria

Dr. S. S. Manabete
Dept. of Science and Technology Education
University of Jos, Nigeria.

Abstract

Time is the principle of order in nature's world. It is the commodity that is unbiased to all in equal amounts, does not cost anything monetarily and is completely at people's disposal. Because time is at people's disposal, it cannot be blamed for anybody's mistakes or laxity to carry out tasks as scheduled. Consequently, time must be managed. Time management deals with a set of principles, practices, skills, tools and systems that work together to help one get more value out of time. For students who are required to study and come out with good result, time management is absolutely necessary. These students will be required to develop some principles, practices and skills that will assist them to make use of time appropriately. Though certain factors determine the academic performance of students, studies have shown that time management is directly related to academic performance. Where school facilities are provided on time, students must utilize their time to study so that they will be able to achieve good success. Consequently, developing good study habit, prioritizing activities in school to meet datelines, getting rid of test anxiety and determination to achieve are effective in helping students to use their time appropriately to achieve good success.

Key words: *Time management, undergraduate students, academic performance*

Introduction

One fundamental problem bedevilling students, teachers and parents is how students can effectively utilize their time in school to study and come out with good results that will be to the pleasure of both teachers and parents. A number of factors are responsible for good academic performance, some of which may not be related to academic activities, one of which is time management as propounded by experts (Adams & Blair, 2019: Faisal, Abdalla, Mohammed & Nabil, 2014). Good time management is therefore an essential quality for good academic performance. For students in universities, time management becomes even more important as it may determine their success in their studies. Time management is critical to performance in the university because of the students independent of living, self-management and absence of restriction by parents. In the university, students have the latitude to control their learning, and many of them perform poorly because of poor time management skills (Hardy, 2003). For many beginning students in the university, there is the need to juggle between many activities and the importance of strategic plan for spending time in a way that enables them to make progress in their studies.

Time management is a concept that deals with the effective management of time (Kapur, 2018). With increasing use of communication gadgets, and other forms of detraction such as the social media, time management becomes even more important than ever for students to navigate the pitfalls of multiple activities in the university. The unpredictable academic calendar in Nigerian education means that time is a precious

commodity, hence students are expected to do more academic work within short time. Coupled with the short learning period in Nigerian universities and the menace of social problems associated with learning environment, the future of the Nigerian youth is at stake. It can be stated that students who have difficulty managing their time have difficulty in their studies Therefore, students must rise up, make use of time appropriately by undertaking functional studies that will lead them to undergo their studies effectively. Studies demonstrate that time management skills can be trained as found in MaCann et. al, (2012), hence a good opportunity for students to embrace it.

Indeed time management is a challenge that extends beyond student life because it is also a critical element in life. Harriot & Ferrari, 1996) reported that working adults equally have difficulties juggling work and family responsibilities. The authors further opined that time management goes beyond success in school, but it can equally be useful for success in life, because proper control of time leads to a successful management of life. In the same manner, the work of Myers (2000) reported that people who manage their time well are happier.

The purpose of university education in Nigeria is provide people with an opportunity to reflect on critical social, economic, cultural, moral and spiritual issues facing humanity (Adebisi, 2014). University education contributes to national development through dissemination of specialized knowledge and skills. University education is the highest level of manpower development in specialized areas, and it remains the engine room for developing manpower and ideas for economic development

Today, there are many challenges facing university education in Nigeria among some are poor infrastructure and learning environment, inadequate funding, which often lead to frequent strikes (Uwaifo, 2010). This has serious implications on the quality of graduates. Non-cognitive aspect of learning such as time management is a serious challenge in the learning process. Mastering time management therefore is an essential tool that can assist students to improve their performance. This paper therefore, looks at time and time management and sees that time is completely at peoples' disposal, hence the need for its proper management. It considers the fact that time and academic performance are positively related. The .paper deals with the factors that determine academic performance. Finally, the paper looks at the ways to make the best use of time in order to achieve academic success.

Time and Time Management

Time is an important personal resource that everyone need to gain control of it, which to a large extent can determine your life. According to Drucker (1996), while Plato perceived time as the principle of order in nature's world, Aristotle viewed time as the simplest measurement of motion. In the words of Furness (2006), time is the commodity that is unbiased to all in equal amounts, does not cost anything monetarily and is completely at people's disposal.

Suffice it to say that Furness' (2006) view of time as being completely at people's disposal is the concern of this paper. In other words, people are at will to use the time they have wisely or otherwise. A common saying goes that "Time waits for no one". If time waits for no one, the people are at liberty to "catch up" with time in its course. Time owes no one any duty and cannot be blamed for any one's failures. It is therefore, the duty of every well-meaning individual to cue into its "operations". This definitely indicates that time must be managed by people so that they can achieve goals they have set forth for themselves and for their organizations. In this connection, what then is time management?

According to Achunine (1998), time management is the effective and efficient utilization of a manager's corporate time to achieve organizational and personal goals.

Gerald (2002) viewed time management as a set of principles, practices, skills, tools and systems that work together to help one get more value out of time. Argarwal (2008) added that time management entails knowing what one needs to do and setting out to do it within the period desired. In other words, for any individuals or organizations to succeed, they need to set goals, have knowledge of what to do to achieve those goals and in record time. Time management therefore, refers to a set of principles and practices an individual or an organization sets forth to achieve assigned tasks within desired periods. It is a skill that is acquired whereby individuals undertake functions within set periods in order that goals are achieved and success recorded in the end. In other words, the goal of time management is actually to solve problems. These problems are meeting datelines, pressure, procrastination and distractions. (Quek, 2001). To be callous about meeting datelines, or to procrastinate and give in to distractions, is only the attitude attributable to the goal-less, non-ambitious individual for whom everything goes at will.

Time Management and Academic Success-Positively Related

Numerous research studies indicate that there is a strong relationship between time management and students' academic performance. For instance, Faisal, Abdulla, Mohammed and Nabil (2014) conducted a study on the relationship between time management and academic performance of students at the Petroleum Institute in Abu Dhabi, United Arab Emirates. The study considered the four variables in relation to time management, namely, procrastination, disorganization, interruption and workload stress. The study found that time management was highly related to students' academic performance. In another study, Abdul, Esuh and Mohammed (2014) considered time management, motivation and students' academic performance in a Malaysian Public University. This study found that there was a significant and a positive relationship between time management and students' academic performance. Further, Adebayo (2015) examined the impact of time management on students' academic performance in higher institutions in Nigeria. The study found that procrastination, prioritization and planning were among indices that affected students' academic performance in relation to time management. Similarly, the study by Abdul Kader, & Eisa, M. (2015), indicate that time management strategies instruction is an effective instructional strategy for improving academic time management and academic self-efficacy of students. It has also been established by McCann et, al. (20012) that time management may be influenced by cognition. This is in line with empirical findings in which high achieving students exhibit more self-regulated learning skills (Zimmerman, & Martinez- Pons, 1990). Some studies however show that women students have better time management skills than their male counterparts Truemans & Hartley, 1996). The same study also shows that older and matured students also have superior time management skills than younger students, although performance was only modestly predicted by age and scores on one component of the time-management scale. The study by Britton, & Teaser (1991), show that time management practices may influence university student's achievement. Perhaps of greater significance to this study is the work of Van der Meer (2010) in which they found that many first year students were realistic about having to plan their work independently, and having to spend a good amount of their time during the week on self-study time. However, many students find it difficult to regulate their self-study and keep up with their work. All of these point to the significance of time management by university students.

Factors that Determine Academic Performance

According to Yoyole in Babalola, Akpa, Ayeni and Adedeji (2007), when discussing students' academic performance, certain factors need to be taken into consideration, among which are quality of teachers, quality of facilities, quality of infrastructure, parental neglect and quality of evaluation procedures. Mass failure in WAEC and NECO examinations has earlier been reported (Dajal & Rinmak, 2002). Consequently, the poor academic background of the students, class size, and peer group influence and examination syndrome. A study by Nzeako (2008) discovered that insufficient facilities and lack of funds constituted serious constraints to the implementation of educational policies and the provisions of the curriculum. Peer group can influence the choice of course of study and subsequently the performance of boys and girls in examinations. In the words of Tormeti (2001), students in many cases make wrong subject choices out of peer group pressure and parental influence. For instance, a student who understands that arts students are often ridiculed by science students as being "low in intelligence", may decide to join a science class to escape this ridicule. Similarly, a student may decide to choose a course of study just because his tight friend has chosen that course of study. In such cases, parents, and especially the school, will have to make concerted effort to properly guide the students in their choice of courses. The consequence of peer group, according to Osarenren (2002), is that the trend encourages truancy and absenteeism from school and causes emotional disturbance as well.

Class size, occasioned mainly by inadequate planning, has also been identified to be a potential factor that contributes to students' failure in examinations (Bonnie, 2003). In national examinations like NECO and WAEC, because curriculum provisions are poorly implemented (Abdullahi, 1996), mass failure has been recorded and the trend is traced to large class size (Salam, 2002). In addition, large class size has hampered the effective utilization of available instructional facilities in workshops and laboratories in most schools in Nigeria. In fact, for effective skill training, students are expected to be exposed to various types of practical\al work. However, this has been hampered by large class syndrome.

Nowadays, many students that enter higher institutions appear to be poorly prepared for it. According to Jen (2002), one key factor that affects polytechnic education in Nigeria is the quality of candidates being admitted. Many of these candidates lack the essential academic background to pursue courses in engineering and in other fields. This is in spite of the fact that such candidates come in with very good WAEC and/or NECO results, with credits spread out. At the end of their training, these graduates are found not to be employable (Olaitan, Nwachukwu, Onyemachi, Igbe, and Ekong, 1999). This is because such graduates lack the essential skills needed by employers.

One key problem of the child of school age is parental neglect. According to Akpomuvie (2010), parental neglect occurs when a parent or guardian fails to fulfil his/her obligation to provide for, or care for, or adequately supervise and monitor the activities of their child. The needs of the child are physical, emotional and educational needs. In the words of Adebayo (2014), educational neglect which parents met out on children of school age include failure to enrol a child in school, permitting or causing a child to miss many days of school. It need be added that children's educational problem will also include refusal to pay children's school fees and fees for school facilities, books and other school needs. Most affected by this development are children from poor background and broken homes. Such children may be brilliant and desirous to pursue their education vigorously. In order to make it however, they are forced to undertake their studies between menial jobs to earn money to pay for their education.

Another factor responsible for students' failure in examinations is what is generally regarded as test anxiety. According to Olatoye and Afunwape (2003), test anxiety is a

psychological set of mind of a candidate concerning a test he is due to take, characterized by worry, fear and uncertainty as to whether he will make it. Buttressing this point, Olatoye (2007) said test anxiety is an experience which erupts in the mind and behaviour of a candidate which manifests in the form of fear of failure, negative self-evaluation and self-blame for perceived shortcomings. Consequently, according to Seddah and Ocansey (2010), "high test anxiety reduces working memory, impairs concentration and reasoning and increases mistakes". The A study by Lukman (2011) revealed a significant relationship between test anxiety and achievement. Students will therefore, need to be determined to erase the menace of test anxiety which has the propensity to affect their academic success.

Making the Best Use of Time

University students are expected to rely on their course syllabus to keep track of what they need to do. Unlike the secondary school, no teacher will be around to remind you about the classes to attend, upcoming tests, papers and assignments etc. to turn in. A university student is expected to spend more hours reviewing what has been taught during his/her free time. Applying out of class time appropriately is critical to attaining success in school. The student is expected to study without supervision. Keeping study schedule that can provide a review of class lectures independently is a good time managing strategy.

Students need to know that the university curriculum is time-based. That is, time is consciously structured for implementation within certain number of years. In other words, students' entry and stay is not endless. Based on the programme they are pursuing, they are required to graduate, having spent the required number of years on the programmes. However, the period between school entry and graduation is what is of concern here. The intention of policy makers and implementers of those policies is that after being adequately exposed to the learning experiences as outlined in the curriculum, students should be able to acquire relevant skills at the end of their training. There is no relevant authority that is interested in keeping students on a programme any longer than is necessary. In some cases, however, students may stay beyond their specified number of years. Several factors may be responsible for this, such as change in government policies, obstructions in school calendar, arising, in many cases, from industrial actions, and student related problems such as inability of a student to pass a course or courses and absenteeism What is important here is the inability of students to pass courses as expected and this has the tendency to keep students on a programme, thereby extending their school tenancy. Much of this problem is hinged on the performance of students due mainly to their inability to work hard as expected

A common saying goes that students need to allow the school to pass through them and not for them to pass through the school. To pass through the school simply means that a student has only wasted his time and that of his sponsors (parents or guardians) as well as the sponsors' resources. A student who allows the school to pass through him is one who avails himself of the opportunity provided by the school to study hard in order to pass his examinations very well. In other words, such a student will devote his valuable time to reading and practicing what he has been taught in the school. Consequently, there are certain ways a student needs to consider in order for him to study and record appreciable academic success.

First, a student needs to put his mind and soul into reading. If ever there is any human activity that is belabouring and difficult to achieve, it is reading. It must be made clear from the onset that any student who does not give his mind and soul to reading will hardly ever make it in his academic pursuit. This entails that a student must make up his mind and be determined to study so as to achieve. Secondly, a student needs to actually read and practice.

Reading without practicing does not take a student anywhere. After reading, a student needs to practice how he intends to answer questions should they come in an examination. Besides, certain equations or expressions need to be derived. No student can derive these equations or expressions without practice. Third, a student needs to read with understanding and be broad minded. Certain students cultivate the habit of cramming texts to reproduce them on examination day. Unfortunately; this method of reading has a short memory and does not pay if there is an intervening event like drunkenness or mishap or anything of the sort. In this case, retention becomes extremely difficult. Therefore, students must read to understand the texts correctly in their own way which becomes easier for reproduction. Again, students need to open their minds up to reading. If a student tries to close his mind against certain texts in the course of reading, he is doing himself great harm, for those texts he is putting off may be the very ones that will come in the examination. There is obviously need for students to try to assimilate all they read so that they have a wider view of what to expect in an examination.

To achieve the objective of reading for examinations, students need to cultivate effective study habits as to acquire study skills. According to Anameze (1999), study skills collectively mean the ability to make series of adequate choices to facilitate effective learning and success in examinations." Anameze held that the choices which students are expected to make relate to the areas of time, place, methods and techniques of learning. Anameze further held that study skills entail that students develop the habit of note taking, concentration, memory improvement and techniques of writing examinations. In other words, students are not likely to be successful in their examinations if they do not know the way and manner such examinations are set. One simple way to do this is to refer to past examination question papers for a number of years. This method enables students to look at the questions from a broad perspective in relation to the curriculum content. A critical look at the question papers will inform students that questions have been repeated year in year out, in addition to their being exposed to the techniques of setting the questions and the requirement of each question. In acquiring study skills however, Okoye, Adejumo and Achebe (1990) said that generally students have study habit needs which centre around time given to study, concentration during study, reading, take-home assignment, note-taking and examinations. In Awabils's (2002) study, it was found that study habit ranked first as the major concern of students of senior secondary schools. Consequently, Seddoh and Ocansey (2010) held that developing good habits by students is very necessary for success in their studies and examinations. In doing this, they need to draw their own study time table, have time allotted for each subject and as well take notes in the process.

The fourth thing a student needs to do to be successful in his study is to concentrate. If a student's mind keeps wandering away as he settles down to read, or is distracted by noise, he can easily lose concentration. In the words of Mancuso (1990), lack of concentration on one's studies can arise from several sources, such as a noisy fan, a high traffic, lack of focus on defined tasks, and overwork. Drowsiness arising from medication can also make a student to lose concentration. More so, handling assignment and meeting datelines can make students to lose concentration. It is however, understood that due to individual differences, some students abhor noise while others easily contain it while reading. On the whole, noise and other disturbances are potential factors for loss of concentration by a student in the course of his studies.

Fifthly, a student who wants to succeed in his studies should not read only when he or she has an examination to write. Some students engage in wild partying and travelling, or undertake very seriously activities of student groups and associations while on campus.

They have no time to settle down and read their books. Sometimes while coming back from weekend, they try to settle down to read against the test or examination the next day. Students need to cultivate the habit of reading. This way, reading becomes part and parcel of a student's life. Consequently, to use available time effectively one needs to plan his reading. There is no student who can record academic success without planning his activities. What this entails is that there is need for a student to plan his reading time table and other activities. In doing this, the student allots time to those activities, with reading taking the centre stage. This is because the aim of enrolling in a school is undoubtedly to study and obtain a degree, a diploma or a certificate. It will be a misplacement on priority for a student to devote much of his time to other activities in the school to the detriment of his studies. Even extra-curricular activities must never occupy a centre stage in a student's life in the school. Extra-curricular activities are expected to refresh students and make them to think better as they face their studies. Therefore, such activities must never be carried out to the detriment of one's studies. Consequently, time management, according to Achunine (1998) involves identifying tasks to be performed, planning and scheduling of activities, and prioritizing such activities and allotting time to the tasks…", adding that in doing this, interruptions and frivolities are minimized.

Sixth, be mindful of what you are reading. Is it related to your course offering? Can any question be expected from it? Students sometimes make the mistake of trying to read any material that comes their way. Some of them read what they read for the beauty and pleasure of the story. It is common for students to go to the library to look up relevant materials to do an assignment. Unfortunately however, such students may spend three to four hours reading some "nice" materials they have located and at the end not have the time to do the assignment. Therefore, it is very important for students to be focused and be mindful of what materials they consult in their studies.

Conclusion/Recommendations

Managing time for academic success requires planning (Jackman, 2009). Many students want to excel in their academic pursuits. However, they are careless about planning their time. Time, we have seen, waits for no one. It has a well-structured course and does not play jokes. Time is like a just judge which proves events right or wrong. A common saying goes that "Time shall tell". In other words, events begin to unfold and prove themselves with the passage of time. A student therefore, must understand that should he play around while in school, procrastinating about his future, he may wake up one day to discover that he does not have the time. As there is time for everything, according to the Holy Book, so is there time to be born and time to go school and pursue an academic course of study.

To achieve success, students must use their time wisely. Nowadays, boys and girls make a lot of mistakes. Instead of engaging in structural reading, they just "sit and gist" about the latest news in town. Such students may even decide to go and visit friends or relations during weekends only to turn up on Monday morning and struggle to submit one doped assignment or the other. To visit a friend or to chat with course mates may not be bad in itself. However, when such is done at the expense of one's studies, then caution needs to be exercised. This clearly indicates that students need to prioritize their activities. They need to avoid distractions so as to meet datelines. Furthermore, there is the need for students to personally have aspirations and expectations. Aside from this, students need to know that their parents and guardians who sponsor them to school have high expectations from them. To meet those expectations, students need to aspire. Aspirations deal with the value a student

attaches to his or her educational pursuits as being worthy of achievement (Iheonu, 2008). If a student aspires to be a lawyer or banker, all he should set out to do is direct his academic effort towards becoming a layer or banker by reading and performing successfully in the subjects required for such an academic achievement.

The challenges identified in this paper should never be exclusive reasons why a student is unsuccessful in his academic pursuits. It is clear that Nigeria's education system appears to be in shambles and is bedevilled by problems which are multifaceted. But be that as it may, every serious minded student needs to view his academic problem beyond its current level. Consequently, this paper recommends that to utilize time effectively so as to achieve good academic success, the following measures are necessary:

1. Government needs to increase funding to schools, and make the school environment conducive for students to vigorously pursue their studies. This can be done by providing infrastructure and other instructional facilities in their adequate number and type.
2. Students should follow the injunction that says, "Work before pleasure". No student should expect to come out with good grade if, instead of utilizing the time he has in the school to pursue his academic work, he instead engages in wild partying and other pleasure-giving activities.
3. Growth is natural. To leave primary school and enter a secondary school or to leave a secondary school and enter a tertiary institution is growth in itself. And this growth is time-based. In other words, there are stages of development in life. At whatever stage students have found themselves, they need to utilize that stage properly so as to achieve the educational goal of that level.
4. Students need to set goals for themselves. It is not out of place for a student to set the goal to be a scientist, an engineer, or a lawyer. This serves to propel a student towards hard work.
5. Students need to develop the reading culture. This trend leads to developing reading skills in students. It enables students to not only read when they have a test or examination to take but to read all the time.
6. It is rewarding to develop interest in studying. Students need to have pleasure in studying.
7. Students must get rid of test anxiety, be focused in their studies and develop confidence in answering examination questions.

The need for students to properly make use of tine in school cannot be overemphasized. Every parent or guardian who sends his ward to school expects this ward to make use of his time while in school, work hard and achieve good academic success. A student with an ambition or a life goal will manage time effectively in school, in spite of poor working conditions. It is hoped however, that stakeholders in the education enterprise will provide the environment conducive for students' time management towards good academic success. This way, the standard of education will be improved.

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EFFECTS OF COOPERATIVE LEARNING STRATEGY ON SENIOR SECONDARY THREE STUDENTS' ACHIEVEMENT IN NERVOUS SYSTEM IN JOS NORTH, PLATEAU STATE, NIGERIA

Amaka Anulika Modebe & Prof. Felicia Onyemowo Agbo
Dept. of Science and Technology Education
University of Jos, Nigeria
Email: Amaka4jc2015@gmail.com, dronyemowo@gmail.com

ABSTRACT

This study seeks to examine the effects of cooperative learning strategy on senior secondary III students' achievement in nervous system in Jos North, Plateau State, Nigeria. A quasi-experimental design, specifically, the non-randomized control group, pre-test-post-test design was used for the study. Simple random sampling technique was used in selecting two intact classes with 50 students each out of the population of 272 students from two senior secondary schools in Jos North. A 30-items Nervous System Achievement Test for students (NSATS) was used in collecting the data. A table of specification provides content validity for the NSATS, with the validity index of 0.83 through a logical appraisal of experts in test and measurement and biology. The instrument also obtained a reliability index of 0.84 when it was administered to thirty students and was analyzed using Pearson correlation coefficient. The treatment group was taught with cooperative learning strategy for five weeks while the control group was taught with conventional lecture method in the same number of weeks. Two research questions were answered by the use of mean and standard deviation while t-test statistics was used to test the hypotheses at 0.05 level of significance. The findings from the study revealed a statistical significant difference between the mean achievement gain scores of students taught using cooperative learning strategy and those taught using conventional lecture method in biology. It was concluded that cooperative Jigsaw learning strategy enhanced students' academic achievement in biology since it involved students learning together from each others' experience in a small group. Hence the researcher recommended among others that Ministries of Education should ensure to help teachers create a conducive environment for the use of cooperative learning strategy in secondary schools.

Keywords: Cooperative learning, students' achievement, Biology, Nervous system, effects

INTRODUCTION

Science is an important field of study that plays a big role in national development. A scientifically literate society enhances rapid economic growth in all sectors, thus promoting national development and national productivity. In the world today, science and its concomitant technology have become such an integral part of our lives and as such generalized science literacy is needed to form a basis for society to make informed decisions (Teng, 2012). It has developed into one of the greatest and most influential field of human endeavour in recent times. This needs to be taught by the teachers and learnt by the students so as to equip them with the science skills and attitude needed to meet up with several challenges in their natural environment. Therefore it is necessary that the teacher has a knowledge of effective teaching and learning approaches for effective learning to occur in biology as a science subject.

Most of the teaching approaches practised in Nigeria schools are mainly conventional lecture method which is expository and fact oriented, assigning a passive role to learners, (Nwagbo and Chikelu, 2011). Adegoke (2011) observed that the Conventional lecture strategy adopted by most biology teachers is not interactive and students are not actively involved in developing knowledge. From experience, teachers usually act as the dispensers of knowledge while learners listen and try to understand and remember. This is against the idea that teaching ought to be learner-centred. In view of the lapses inherent in conventional lecture strategy of teaching biology, and subsequent low achievement by students, researchers in biology education are continually making efforts towards proffering ways of improving students' achievement in biology and cooperative learning strategy could be one of such.

Igboanugo (2013) defines Cooperative learning strategy as an instructional strategy which deliberates on instructional use of heterogeneous small groups of students who work together to maximize each other's learning.

It is obvious that in spite of all the efforts towards achieving success generally in science subjects and particularly in Biology has seriously failed. A highlight of the achievement mean score of biology students in WAEC examination between 2010 and 2018 is as follows; 19, 19, 16, 25, 18, 16, 31, 31 and 30. From the foregoing results in biology, the achievement of students in biology has not been encouraging. Science teachers are making diverse efforts towards adopting new teaching methods that are relevant to the challenges of the time. The researcher has observed that teachers are still deeply involved in the use of the conventional, old fashioned and bored lecture method in secondary schools. Today, emphasis is now placed on inquiry based learning strategy and processes in which the learner is actively involved in the learning process. There is therefore need in biology as a science subject which involves a lot of practical works for students to demonstrate and learn interactively by cooperating with one another in the laboratory. Students are provided with opportunity to collectively and cooperatively perform activities and experiments in the laboratory. Based on these the researcher want to find out the efficacy of cooperative learning strategy on students' achievement when taught nervous system in biology. It is against this background that the researcher intended to investigate the 'Effects of Cooperative learning Strategy on Senior Secondary Three Students' Achievement in Nervous System in Jos North, Plateau State.

PURPOSE OF THE STUDY

The purpose of the study was to examine the effects of cooperative learning strategy on senior secondary school students' achievement in nervous system in Jos North L.G.A of Plateau State. The specific objectives of the study are to:

i. Determine the level of biology students' achievement in central nervous system.
ii. Determine the mean score of students taught central nervous system using cooperative learning method and those taught using lecture method.

RESEARCH QUESTIONS

In order to elicit a clearer understanding of the effects of cooperative learning strategy and conventional lecture method on secondary school students' academic achievement in biology in Jos North local government Area of Plateau state, this research seeks to provide answers to the following questions:

xv. What is the level of biology students' achievement in central nervous system before treatment?
xvi. What is the level of biology students' achievement in central nervous system taught using cooperative learning method and those taught using conventional lecture method?

RESEARCH HYPOTHESES

The following null hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the pre-test students' achievement mean score in central nervous system before treatment.

2. There is no significant difference between the post-test students' achievement mean score of the control group and experimental groups when taught central nervous system using cooperative learning method.

REVIEW OF RELATED LITERATURE

The nervous system is a highly complex part of an animal that coordinates its actions and sensory information by transmitting signals to and from different parts of its body. The nervous system detects environmental changes that impact the body, then works in tandem with the endocrine system to respond to such events (*Tortora & Derrickson, 2016).*Nervous tissue first arose in wormlike organisms about 550 to 600 million years ago. In vertebrates it consists of two main parts, the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS consists of the brain and spinal cord. The PNS consists mainly of nerves, which are enclosed bundles of the long fibres or axons, that connects the CNS to every other part of the body.
Nerves that transmit signals from the brain are called motor or efferent nerves, while those nerves that transmit information from the body to the CNS are called sensory or afferent. Spinal nerves serve both functions and are called mixed nerves. The PNS is divided into three separate subsystems, the somatic, autonomic, and enteric nervous systems. Somatic nerves mediate voluntary movement. The autonomic nervous system is further subdivided into the sympathetic and the parasympathetic nervous systems. The sympathetic nervous system is activated in cases of emergencies to mobilize energy, while the parasympathetic nervous system is activated when organisms are in a relaxed state. The enteric nervous system functions to control the gastrointestinal system. Both autonomic and enteric nervous systems function involuntarily. Nerves that exit from the cranium are called cranial nerves while those exiting from the spinal cord are called spinal nerves.
At the cellular level, the nervous system is defined by the presence of a special type of cell, called the neuron, also known as a "nerve cell". Neurons have special structures that allow them to send signals rapidly and precisely to other cells. They send these signals in the form of electrochemical waves traveling along thin fibres called axons, which cause chemicals called neurotransmitters to be released at junctions called synapses. A cell that receives a synaptic signal from a neuron may be excited, inhibited, or otherwise modulated. The connections between neurons can form neural

pathways, neural circuits, and larger networks that generate an organism's perception of the world and determine its behavior.

However, over the years, achievement of students has not been very impressive from the West African Examinations Council (WAEC) and National Examinations Council (NECO) results in the sciences especially Biology, according to WAEC Chief examiner's report (2015). A highlight of the achievement mean score of biology students in WAEC examinations between 2010 and 2018 is as follows; 19,19,16,25,18, 16, 31, 31 and 30. From the foregoing results, the achievement of students in biology has not been encouraging (Table 1).

Table 1: Summary of Reports of WAEC Result 2010- 2018

S/No.	Year	Mean Score	Standard Deviation
1	2010	19	10.05
2	2011	19	9.54
3	2012	16	0.96
4	2013	25	10.30
5	2014	18	10.45
6	2015	16	9.50
7	2016	31	11.76
8	2017	31	11.92
9	2018	30	9.00

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This can be traced to as far back as 1986 where the then Minister of Education, Professor Jubril Aminu expressed his utmost disappointment over students' poor performances in WAEC examinations. The situation has not changed appreciably as Olotu (2015) also expressed the same view but attributed these failures to ineffective or inappropriate teaching methods. In the same vein, Okafor and Okeke (2010) noted that students' lack of understanding of difficult concepts, such as Nervous System among others in Biology results in poor achievement of students at SSCE and backwardness in scientific and technological advancement of our nation. Umeh (2012) revealed that the nonchalant attitude of students and teachers in the Senior Secondary Schools towards certain concepts in the Biology curriculum like nervous system are also responsible for poor achievement.

In spite of effort through research on strategies to improve achievement in Biology, researcher reports and the WAEC chief examiners annual reports have continued to highlight students' weakness in answering questions relating to difficult concepts in the areas such as of Nervous system, Genetics, Ecology and Evolution. Such weaknesses continue to induce students' inability to comprehend or represent concepts in tables, graph and diagrams. These repeated reports of constant poor performance in SSCE Biology have attracted a lot of concern from science educators. Thus, research in science education in Nigeria has continued to seek better ways of teaching Biology in order to maximize meaningful learning and to identify causal variables for the repeated failures in examinations at the SSCE (Ajaja & Kpangban, 2010).
The researcher, as one of the WAEC assistant examiner observed that nervous system is one of the topics in which students failed in their external examinations. This motivated the researcher to find out what aspect of nervous system posed conceptual problems to learners?
Cooperative learning strategy has been well emphasized as a method that can enhance achievement in Biology and other related subjects.

Cooperative learning (Jigsaw group) is a set of teaching strategies used to promote face-to-face interaction among students and help them reach specific learning and inter-personal goals in structured groups (Johnson & Johnson 2014 ; Samba, 2014). This concept of cooperative learning strategy was first of all conceived by Johnson and Johnson at the University of Minnesota in 1966. Akinbobola (2009) reported that cooperative learning involves the use of variety of learning activities to improve students' understanding of a subject. Students in group interact with each other, share ideas and information, seek additional information, and make decision about their findings to the entire class. It has been evidenced that students, via engaging themselves in promotive interactions and constructive negotiations, tend to achieve more and better academically, socially and psychologically than they do in competitive and individualistic modes (Johnson & Johnson, 2013, 2015). But according to Kolawole (2008), cooperative learning is a teaching method in which small group of learners, each with students of different level of ability use a variety of learning activities to improve their understanding of a subject. Cooperative learning refers to a small group of students that learn together and take advantages of each other's experiences to achieve a common goals or group goal. This learning concept allow small group of students to work together to help themselves and their team mates to learn. Cooperative learning is also a model of learning in which students of different level of ability work in small groups to achieve a purpose.

In cooperative class, learners are at the centre of learning and they learn together. Learners will endure learning if it happens in isolation (Kala, 2010). Learners improve their critical thinking and their intellectual skills by learning from one another (Kala, 2010). Cooperative learning is student centred versus teacher's centred learning with strong emphasis on the goals of learning instead of achievement goal. It encourages teachers to use alternative assessment techniques further reducing the emphasis on competitive examination.

Kolawale, (2008) opined that cooperative learning helps improves student's achievement and retention, increase self-esteem and develop more positive attitudes towards learning skills and social skills. In a comprehensive cooperative learning class the instructor guide learners to manage their group accordingly. According to Kala, (2010) teacher teaches learners the procedures of learning together and how to manage group activities. Cooperative learning with computer meditated learning tools makes the group learns more efficient and enjoyable. Direct instructions using visuals will benefit learners from looking at pictures of the brain and spinal cord, or watching how impulses or information are transmitted from one nerve cell to another on video, graphic organizers will help learners organize notes and process new information. This Technology can be integrated in cooperative learning environment and be helpful in achieving a common goal of group learner (Kala, 2010). In cooperative learning environment, there is a concept called bearing knowledge and authority among students and teachers, were a student is picked from each of the cooperative group and those selected students forms an expert group. The teacher then teaches the expert group the task to be carried out before sending them back to their individual groups to teach other group members and the teacher evaluate their learnings (Kala, 2010). Cooperative environment is where the students freely mixed with each other without any racial discrimination, share and exchange useful thoughts. The condition is based on mutual support, respect to one another and benefit from one another in a friendly and professional manner (Kala, 2010). The first principle underlying cooperative learning is respect for students regardless of their ethnic, intellectual, educational or social background and benefit in their potential for academic success.

Cooperative learning (Jigsaw) can also be defined as "an instructional method in which students work in small groups to accomplish a common learning goals" (Lin, 2010), students working together "to help each other learn" (Slavin, 2011). The success of cooperative activities does not occur automatically by grouping students, a teaching design that considers the conditions for cooperation are necessary (Gillies & Boyle, 2010). It encompasses numerous teaching strategies, such as "think-pair share", "jigsaw" and "numbered head", each student is assigned a particular task

to aid in the formation of the group product; in "Jigsaw" each student in the group becomes an expert in one aspect of the assignment and is responsible for teaching the rest of the group that material (Cavanagh, 2011). This strategies, give structure to group activities; the teacher explains and models the particular strategy, and then it can be used again throughout the school year with different curriculum.

Research by Johnson and Johnson (2009) reviewed that cooperative learning demonstrated "overwhelming positive" results and confirmed that cooperative models are cross-curricular. Cooperative learning requires student to engage in group activities that increase learning and add other important dimension. The positive ones includes academic gains, improved race relations and increase personal and social development. Students' retention increases through personal experience during cooperative learning. That is they practiced what they had learned or taught the information to another student, reinforcing their own understanding.
There is also a philosophical rationale. The philosophical rational behind the use of cooperative learning is based on Dewey's believe. Dewey believed that student develop knowledge and social skills that could be used outside the classroom, and in the democratic society. This theory portrayed student as active recipients of knowledge by discussing information and answer in groups. Through this, grouping, leadership skills are developing in students.
According to Slavin (2012), Cooperative learning increase students' achievement and social need. Cooperative learning was based on ideas of establishing relationships between group members in order to successfully carry out and achieve the learning goal. David & Johnson (2009) also observed that cooperative learning promote mutual liking, better communication, high acceptance and support, as well as demonstrated an increase variety of thinking strategies among individual in the group.

This study employs Vygotsky social constructivist theory and Jean Piaget's cognitive development theory for effective understanding of cooperative learning strategy. Vygotsky (1978), who is the proponent of Social constructivist theory argues that individuals can learn best when they actively construct knowledge and understanding through interaction with others. He emphasizes on interactions rather than actions of individuals. This theory supports the idea that teaching in small groups helps for proper interaction and participation by every members of the group because the success of everyone depends on the contribution of each person. In a small group, concepts would be elaborated and more examples would be provided.

Vygotsky (1978) advocated the dominant influence of social interactions, as well as language and culture on promoting cognitive growth. His view is well known as socio-cultural theory. The theory believed that interactions with peers or knowledgeable adults initiate the process of developing understanding. His activity theory states that learners are socio-culturally embedded actors in the process not processors or system component, and hence there exist in activity hierarchical analysis of motivated human action which is determined by the level of activity. Vygotsky believed that students have two levels of development; the actual developmental level that refers to already mature mental abilities which enable the student to solve problem independently, and the potential developmental level that refers to higher mental functions that are not yet matured.

METHODOLOGY

Research Design

The research design that was employed in this study was the quasi - experimental design. Specifically, the non-randomized control group, pre-test-post-test design was used. This design was chosen because intact classes were used as experimental and control groups.
The design is represented in figure1 as follows:

Experimental group	0_1	X	0_2

Control group	0_1		0_2

Where 0_1 0_2 = Pre-test scores for experimental and control groups.
0_1 0_2 = Post-test scores for experimental and control groups.
X = Treatment for experimental group.
------ = Dotted lines indicating that there will be no randomization in selecting the sample for the study.

Figure 1: Illustration of the Non-randomized Control group, Pre-test-Post-test Design

Therefore one arm of the SSIII class each from the two schools were used for the study, since the design allows for measurement of similar traits when participants are available in classes.

The experimental design was chosen because it has to do with seeing the effects of cooperative learning strategy (an independent variable) on students' academic achievement (a dependent variable). In this study the participants were compared on academic achievement. The experimental group was manipulated by placing them in small groups and taught nervous system using cooperative learning strategy but the control group will not receive such treatment but was rather taught with the conventional lecture method.

The pre-test provided the baseline information regarding participant's academic achievement. In addition, the outcome of the pre-test was used in making comparison with the post-test to see how effective or otherwise the treatment has been. There was teaching for five weeks and two research assistants were used.

Population

The population of the study consist of all the Senior Secondary three biology students in Government Senior Secondary Schools in Jos North. There are 20 public secondary schools in Jos North Local Government Area of Plateau State. The choice of public schools is because of their homogeneity. In other words, the schools share similar characteristics in terms of sitting for the same WAEC and NECO examinations and both are government schools using the same criteria for recruiting staff and admitting students.

Sample

The sample of the study consists of two public co-educational senior secondary schools in Jos North Local Government Area, with a total number of 272 biology students. The sample size for this study from two intact classes consists of 100 SS III students. Therefore there were 50 students in experimental group and 50 students in control group.

Table 2: Distribution of students from the two schools in Jos North L.G.A of Plateau State

	Name Of School	Male	Female	Total
1	School A	20	30	50
2	School B	20	30	50
Total		**40**	**60**	**100**

Sampling of Schools

The sampling technique was conducted in two stages. First, purposive sampling procedure was adopted to obtain two senior secondary schools with comparative characteristics in Jos North L.G.A of Plateau State. The schools were purposefully sampled based on the following criteria: school type (public schools), school composition (co-educational schools), adequate enrollment of students

into SSIII, having qualified biology teachers with at least B.Sc. Ed. Or B.Sc./PGDE in biology, availability of biology laboratories and the willingness of the school administrators and staff to participate in the study. Secondly, the two schools sampled were randomly assigned experimental and control group.

Due to intact class arrangement, one arm of the SSIII class out of the three arms from each of the two public schools selected for the study were randomly chosen using the hat and draw method with replacement (where each arm of the class was written on a piece of paper, shuffled and picked by the teacher) so that each arm of class had an equal opportunity of being chosen. 100 students were used as sample size, comprising of 50 students from each school. Also, the control and experimental groups was from the same school, meaning that the same school was used for experimental and control groups.

Instrument for Data Collection

The research instrument used for data collection in this study was Nervous System Achievement Test For Students (NSATS) which was adapted from Senior Secondary Certificate Examinations (SSCE) standard questions by the researcher. The instrument consists of two sections, namely, sections A and B. Section A was on personal data of students and section B consists of 30 multiple choice question items on nervous system with each item having a four-option response mode of A, B,C and D. The questions were selected bearing in mind the Bloom's taxonomy of educational objectives covering the cognitive, psychomotor, and effective domain and validated by experts. Face and content validity of the instrument (NSATS) was carried out by three experts.

The reliability of the instrument was determined through test-retest method of determining the stability of the instrument. The computations were done using Pearson correlation coefficient and Spearman Brown; the value obtained +0.84 was high enough to give the confidence about reliability of the instrument.

Method of Data Analysis

The method of data analysis was based on the research questions and hypotheses. The scores obtained from the administration of pre-test and post-test was analysed using the Statistical Packages For Social Sciences (SPSS) Version 23. Research questions 1 and 2 were answered by computing the mean scores and standard deviation of student' responses, while

Hypotheses 1 and 2 were tested by using the t-test for independent samples at 0.05 level of significance.

These data were analysed to acquire statistical evidence and are diligently presented under research questions and hypotheses to examine the effect of cooperative learning method on student's achievement in nervous system. The results are presented under:

Research question one

1. **What is the level of biology students' achievement in central nervous system before treatment?**

   The pre-test scores of students in both experimental and control group were collected and used for answering this research question. SPSS was used for data analysis to obtain the result. The surveying of the mean and standard deviation of the achievement of students in the two groups is depicted in table

   Table 3:

   Mean pre-test and post-test scores of Control and Experimental Group Students

T test

Group Statistics

Group	N	Mean	Std. Deviation	Std. Error Mean	Level of Achievement

Pretest	control group	50	6.8800	2.35294	.33276	Low
	experimental group	50	6.7200	2.40781	.34052	Low
Posttest	control group	50	11.8600	2.97616	.42089	Moderate
	experimental group	50	18.2200	4.78215	.67630	High

Source: Field Survey 2019 by the Reseacher

The results in table 3 showed that the pre-test mean scores of students in control group (taught with lecture method) was 6.88 with a standard deviation of 2.35, also the pre-test mean scores of the students in the experimental group (taught with cooperative learning method) was 6.72 with a standard deviation of 2.41.Table 4 also showed a mean score difference of 0.16.However, it could be seen from the data in table 3 that the two groups are below average in their pre-test performance, this simply means that the two groups are poor in their performance and knowledge of nervous system before the treatment.

Research Question Two
What is the level of biology students' achievement in central nervous system taught using cooperative learning method and those taught using conventional lecture method?

The mean and standard deviation of the post-test achievement scores of students in both control and experimental group is presented in Table 3.
The post-test scores of students in both control and experimental group were collected and used for answering this research question. SPSS was used for data analysis to obtain the result. The surveying of the mean of the achievement of students in the two groups are shown in table 3. Results in table 3 showed that the post-test mean scores of students in control group (taught with lecture method) is 11.8600 with a standard deviation of 2.9762 , also the post-test mean scores of the students in the experimental group (taught with cooperative learning method) was 18.2200 with a standard deviation of 4.7822.Table 4 also showed a mean score difference of -6.36000 . From the above result, the students taught nervous system using cooperative learning strategy performed better than students taught using the conventional lecture method.

Hypothesis Testing

Hypotheses were tested using the t-test for independent samples at 0.05 level of significance. These hypotheses was accepted if the significant level is greater than 0.05 level of significant but was rejected if the significant level is less than 0.05 level of significance.

Null Hypothesis 1
There is no significant difference between the pre-test students' achievement mean score in central nervous system before treatment.
To test the null hypothesis 1, the mean scores for control and experimental group from the pre-test were compared using t-test (separate variance t-test). SPSS version 23 was used to obtain the result in table 4.

Table 4: **Two tailed t-test of Difference between Mean Scores from pre-test and Post-test scores of Students in Experimental and Control Group**

	Independent Samples Test	
	Levene's Test for Equality of Variances	t-test for Equality of Means

		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	.150	.699	.336	98	.738	.16000	.47611	-.78482	1.10482
	Equal variances not assumed			.336	97.948	.738	.16000	.47611	-.78482	1.10482
Posttest	Equal variances assumed	9.892	.002	-7.984	98	.000	-6.36000	.79657	-7.94078	-4.77922
	Equal variances not assumed			-7.984	82.006	.000	-6.36000	.79657	-7.94464	-4.77536

Source: SPSS Output

The result on students' achievement in table 4 above revealed that the significant level (0.74) is greater than 0.05 at 98 degree of freedom, therefore we accept the null hypothesis.
Indicating that there is no significant difference between the pre-test students' achievement mean score in central nervous system before treatment. Thus, the hypothesis was accepted.

Null Hypotheses 2
There is no significant difference between the post-test students' achievement mean score of the control group and experimental group.
To test the null hypothesis 2, the mean scores for control and experimental group from the post-test were compared using t-test (separate variance t-test). SPSS version 23 was used to obtain the results in table 4.
The results presented in table 4 shows that the significant level (0.00) is less than 0.05 at 98 degree of freedom, therefore we reject the null hypothesis. Indicating that there was a significance different in the post-test mean scores of students in the control group and those in the experimental group. Meaning that the students in the experimental group achieved higher scores than those in the control group.

DISCUSSION OF FINDINGS

The first hypothesis states that there is no significant difference between the pre-test students' achievement mean score in central nervous system before treatment. The result of the tested hypothesis from this study revealed that there is no significant difference found in the pre-test students' achievement mean score in central nervous system before treatment. This finding agrees with the null hypothesis earlier formulated by the researcher.

The second hypothesis states that, there is no significant difference between the post-test students' achievement mean score of the control group and experimental group. The null hypothesis was rejected showing that significance difference exist between the post-test students' achievement mean score of the control group and experimental group. This finding agreed with the view of Kolawale, (2008) that cooperative learning help to improve student's achievement and retention, increase self-esteem and develop more positive attitudes towards learning skills and social skills. This is also supported by Ikechukwu (2011) that using cooperative learning helped to boost students' achievement and interest in the subject.

CONCLUSION AND RECOMMENDATIONS

Based on the data collected, analysed and findings derived in the present study on the effects of cooperative learning strategy on senior secondary three students' achievement in biology, the conclusion that has been drawn is that, students taught nervous system using cooperative learning strategy performed better than their counterparts taught nervous system using the conventional lecture method.

Based on the findings of this study, it is recommended that the Ministries of Education should ensure to help teachers create a conducive environment which will foster the use of cooperative learning strategy in secondary schools.

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THE PLACE OF ELECTRICAL INSTALLATION TECHNOLOGY IN TRANSFORMING SCIENCE EDUCATION IN NIGERIAN TECHNICAL COLLEGES

By

Dung Choji Joseph
Department of Science and Technology Education
University of Jos
dung_choji@yahoo.com

NwauziKirianKelechi
Department of Electrical/Electronic Technology
Captain ElechiAmadi Polytechnic, Rumuola Portharcourt
kkirian@yahoo.com

&

Fittoka Benue Sepeda
School of Technical Education
Plateau State Polytechnic, BarkinLadi
fittokasepeda55@gmail.com

Abstract.
Transformation of electrical installation technology in science education means changing completely the method of teaching and learning electrical installation technology so that the process is enhanced. This paper looks into the concept of science education, electrical installation and transformation, requirement for electrical installation transformation and learning goals for electrical installation. Also discussed are the challenges to electrical installation transformation, problems encountered in the teaching of electrical installation, constraints to transformation of electrical installation, prospect of electrical installation transformation and lastly, why electrical installation have failed to produce skilled human resources needed for transformation into economic growth and stability.
Keywords: Electrical Installation, Science Education, Technology and Transformation

INTRODUCTION

Science has brought development both within and outside man. The term science has to do with nature. It is derived from the Latin word "scientia," meaning "knowledge". Science is the study of natural phenomena and is distinguished from other fields because it relies on the hypothetical deductive, experimental approach. However, Mbjiorgu (2003) perceives science as an act of doing and it's more concerned with various investigative processes and activities with regards to developing, acquiring and controlling knowledge, skills capacity and altitude about the natural factors of the environment.

In the view of Onah (2003) science is the bedrock upon which many nations can be build. Science education can be described as the field concerned with sharing science content and processes with individuals that are not traditionally considered part of the scientific community. Science education encourages students to think and act as responsible scientist by providing opportunities for them to acquire knowledge and understand relevant concepts.

Electrical installation technology is one of the trades in technical colleges. It is made up of the following components; domestic and industrial installation; cable jointing, Battery charging/repairs and winding of electrical machines, National Board for Technical education (NBTE, 2014). In the

view of Nwachukwu, Bakare and Jika (2011) electrical installation is a vocational course offered by students in technical colleges in order to produce electrical craftsmen and technicians.

Electrical installation student is a person who is learning vocational course offered in technical colleges in order to become electrical craftsman. Nwachukwu (2006) opined that electrical installation students learn the basic skills required to operate, maintain, install and repair electrical installation equipment and appliances technical colleges.

Technical colleges according to Okoro (2009) are principal vocational institutions in Nigeria which are designed to prepare the individuals to acquire practical skills, knowledge and altitude at sub-professional level, they are also established to train craftsmen in various occupations. Okorie (2001), also saw technical college as institutions where craftsmen are trained to obtain the craft certificate of West African Examination Council and advance craft certificate. Students who have completed the first three years of secondary school education are legible for admission into technical colleges. Technical colleges are therefore, schools or training institutions where trades are being taught.

The place of electrical installation in science education transformation is very important. It equips student with current trends in technological advancement and economic growth.

Due to increasing number of industries (especially Electrical/Electronic industries) in Nigeria, the need for technical man-power becomes imperative. Since this man-powerworks with machines, there is the need for student to be trained with those equipment and facilities using the appropriate teaching and learning methods.

SCIENCE EDUCATION IN NIGERIAN TECHNICAL COLLEGES

Science education it is a scientific field of study which is solely concerned with the teaching and learning of science or a specific science discipline. Examples of areas which are found within science education in technical colleges as sub field are basic electricity, electrical installation, technical drawing, chemistry education and physics education.Science education cultivates students' curiosity about the world and enhances scientific thinking. Through the enquiry process, students will develop scientific knowledge and skills to help them evaluate the impacts of scientific and technological development. This will prepare students to participate in public discourse in science related issues and enable them to become life-long learners in science and technology.

According to Bransford and Donovan (2005), the practice of science education has been increasingly informed by research into science teaching and learning. Research in science education relies on wide variety of methodologies, borrowed from many branches of science and engineering such as computer science, cognitive science, cognitive psychology and anthropology. Science education aims to define or characterize what constitutes learning in science and how it is brought about.

ELECTRICAL INSTALLATION TECHNOLOGY

Electrical installation can be seen as the connection of different electrical fittings such as distribution board, socket, bulbs, switches etc for the purpose of proper usage of electricity either at homes or industries from the supply (NBTE, 2014).It can also be referred to as a tactical way of assembling different electrical component together through cabling for the purpose of allowing the free flow of electrical current from the supply to various locations at homes or industries through the cables or accessories.

An electrical installation comprises all the fixed electrical equipment that is supplied through the electricity meter. It includes the cables that are usually hidden in the walls and ceilings, accessories (such as sockets, switches and light fittings), and the consumer unit (fusebox) that contains all the fuses, circuit-breakers and, preferably residual current devices (RCD.

The development of new technologies and investments in new infrastructure to modernize the electric power system is largely a private-sector responsibility. Utilities, power providers, consumers, and technology developers make investment decisions in complex and changing

regulatory and market conditions. This may cause decision makers to seek locally optimized solutions based on regulatory and economic constraints.

Far-reaching changes in technologies, markets, and public policies are transforming electricity delivery which leads to the transformation of electrical installation

CHALLENGES OF ELECTRICAL INSTALLATION TRANSFORMATION

An increasing reliance on electricity presents significant challenges for utilities, state-level decision makers, and other stakeholders, who must improve reliability and resilience while cost-effectively managing the fundamental changes required to meet the needs of a low-carbon, digital economy. The electric power system is currently undergoing significant changes in the sources we rely on to generate electricity, the means by which we receive electricity, and even in the ways we consume electricity.

The electric power system is facing increasing stress due to fundamental changes in both supply and demand technologies which always leads to changes in the kind of accessories use in the electrical installation. On the supply side, there is a shift from large synchronous generators to lighter-weight generators such as gas-fired turbines and variable resources (renewable). On the demand side, there is a growing number of distributed and variable generation resources, as well as a shift from large induction motors to rapidly increasing use of electronic converters in buildings, industrial equipment, and consumer devices. The communications and control systems are also transitioning from analog systems to systems with increasing digital control and communications; from systems with a handful of control points at central stations to ones with potentially millions of control points.

All this while, the system is being asked to perform in ways and in a context for which it was not designed. The result is a system that is under increasing stress from these and other factors and requires much greater flexibility, agility, and ability to dynamically optimize grid operations in time frames that are too fast for human operators. Fundamental advances in the power system are needed to address these changes and ensure system reliability.

PROBLEMS OF ELECTRICAL INSTALALLATION TEACHING

Teaching is an interaction that exists between a teacher and learner(s) in a given context (classroom/workshop). A technical teacher cannot teach effectively without the use of functional, required tools, equipment and machines in the workshop. The environment in which the teaching/learning would take place must also be conducive.

It is a known fact that a technical teacher cannot teach effectively without functional tools, equipment and machines. The environments in which the teaching/learning takes place must be conducive. Most of the facilities (tools, equipment and machines) in the workshops of the colleges are not functional. A poor maintenance culture on the side of the workshop is always involve, which serve as a great problem in electrical installation teaching.

Puyate (2004) pointed out that effective vocational and technical training would not be possible without adequate arrangements for the provision of required instructional facilities. This indicated that the availability and effective utilization of facilities for training in any technical college enhances the vital process of the skills to be acquired. Effective training also empowers trainees/students to be productive and contribute positively to the development of every nation. Inadequate facilities for teaching/learning technical trades have been observed by a number of scholars/researchers in technical and vocational education: some of them noted the gross inadequacy, unavailability and non functional state of the facilities (Okorie, and Ezeji, 1998; Bassey, 2000) respectively. Others observed the out dated nature of the installed machines and the lack of proper maintenance culture to promote life expectancy of the workshop facilities (Puyate, 2004; Bello, 2004). This could however be attributed to the fact that most of the essential tools, equipment and the heavy machines used for instructional purposes in technical colleges are imported product and consequently apart from being scarce are certainly very expensive.

Technical and vocational education facilities in this study involve all the infrastructural and physical facilities in the workshops, laboratories, studios, this includes all the tools, equipment, machines, and the consumable materials that are being used from time to time for teaching/learning the trade.

These facilities are required to be available, adequate and functional in order to satisfy the needs of the curriculum. While these needs cannot be over emphasized for effective teaching/learning to take place, Chado (2004) observed that many institutions that are offering technical and vocational education programs in Nigeria are experiencing gross inadequacy of facilities for teaching/learning and those that are available are either outdated, broken down or out of use due to one reason or the other. Some of these reasons are attributed to lack of consumable materials and electricity supply for operating the machines and equipment. In a similar vein, Emah (2005) observed that the expendable materials required to be used together with the equipment and machines for practices and for carrying out students project in technical and vocational programmes are lacking in schools thereby denying students and teachers the opportunity to use the facilities as at when due.

The global trends in teaching and learning of technical and vocational education most especially electrical installation now requires the use of computers for printed circuit and installing electrical fittings in building plans and other related communication facilities which are not available in adequate quantity and quality for use by the teachers, administrators and the students in most Nigerian schools. This non availability and/or inadequacy of appropriate facilities have restricted technical and vocational education teachers from meeting the desired goals of the educational system.

Efforts made by successive governments in the past to promote technical education such that teachers could impart the necessary skills to learners without much difficulty have been crippled by lack of necessary courage on the part of the leadership to back up words with action. Most vocational/technical institutions involved in preparing students to become self reliant operate using damage, obsolete tools, equipment and machineries coupled with inadequate qualified teachers, inadequate funding, poor maintenance culture and the likes. This poor state of facilities negatively impacted skills acquisition and competencies of the students. The adverse effect is the production of half-baked engineers, technicians, craftsmen, and vocational and technical education teachers (Oluteju, 2007).

Basu (2010) pointed out that most problems associated with teaching of electrical installation at technical colleges hinges on manual skills possessed and the teachers' ability to teach effectively. These problems undoubtedly had given rise to in efficiency and inadaptability of technical college education graduates in the world of modern Electrical installation Technology. Due to the lack of electrical installation teachers in technical colleges the products of the colleges are being restricted in skillfulness efficiency, proficiency and productivity. This scenario had further contributed to the rising rate of unemployment in the society. If teachers keep their competency up to date through progressive learning in the world of work they could teach effectively. In this way, students would acquire saleable skills that would enable them adapt to the modern world of electrical installation. It is therefore imperative to ascertain the skills needed and possessed by electrical installation teachers for improvement and effective delivery of their professional duties in the Technical colleges.

TRANSFORMING SCIENCE EDUCATION IN NIGERIAN TECHNICAL COLLEGES

One of the problems of electrical installation in technical collages is that teaching has not been interesting, practical or real life in nature. This makes some students to drop half way from classes. According to Ali (1998), the kind of science education activities required by these beginners should be those that are interesting, practical and real life in nature, probably to arouse their interest and prepare their minds for intensive science training in the second phase - the senior secondary school. So if electrical installation is to be transformed, practical activities should be adequately introduced in technical school to make the learning interesting and real life in nature.

According to Okebukola (1985), the free education policy of the 1970 resulted in education explosion to the extent that many communities started secondary schools they could not maintain and service therefore, for electrical installation to be properly transformed, those poorly equipped schools with respect to science laboratories should be well equipped and many old school which have no workshop should be provided with at least one. In some technical colleges, there are no specialist teachers to teach electrical installation subjects which are the foundation of electrical

engineering. Therefore, teachers assigned to teach those subjects should be specialist and well qualified. Government should intensify her effort in training more teachers so as to have more specialists in that subjects area. Similarly, the new challenges of electrical installation technology in science education such as computer illiteracy should be addressed as teachers and students need to be equipped with technological equipment such as computers, internet and video automated teaching materials.

CONCLUSION

Electrical installation in science education can only be transformed by designing and implementing the curriculum properly to encourage creativity, independence and adoption in the use of new teaching approach. Science culture have not been developed in Nigeria, neither is the uses of technology known. Electrical installation encourages students to think and act as responsible craftsmen by providing opportunities for them to acquire knowledge and understanding of relevant concepts. Education through the study of science produces economic benefits and contributes to a country`s future wealth by increasing the productive capacity of its people. The problem of teaching electrical installation in Nigeria is that it`s taught as other conventional courses. At all levels of schools in Nigeria, the performance of science teachers are below expectation, therefore the need for transformation.

SUGGESTIONS

If science education in Nigeria is to be transformed, the following points should be noted and urgently applied:

1. Teachers of science should be adequately trained and motivated in order to make them committed to the job for efficient delivery of their lecture.
2. The science education curriculum should be improved upon from time to time to meet modern challenges most importantly in technology.
3. More emphasis should be placed on information, communication and Technology (ICT)to meet new challenges of electrical installation. This can be done through exposing both the students and teachers to technological equipment such as computer internet and video automated teaching.
4. Government and stake holders should give more allocation for the procurement of science facilities, equipments and materials needed for teaching and learning of science education in technical colleges.

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EFFECTS OF MULTIMEDIA INSTRUCTIONAL PACKAGE ON PHYSICS STUDENTS'ACADAMIC ACHIEVEMENT AND MOTIVATION IN SENIOR SECONDARY SCHOOLS IN JOS METROPOLIS, PLATEAU STATE, NIGERIA

By

David Davou Tyos, Prof. Mankilik Mangut &**Isa Shehu Usman (PhD)**
Department of Science and Technology Education, Faculty f Education,
University of Jos, Nigeria
Email: davoudavid20@gmail.com

ABSTRACT
The study was carried out to determine the effects of Multimedia Instructional Package (MIP) on Physics Students' Academic Achievement and motivation in Senior Secondary Schools in Jos Metropolis, Plateau State, Nigeria. The True experimental research design was used in this study. Two research question and two hypotheses were formulated and tested at 0.05 level of significance. The purposive sampling technique was used to select two secondary schools in Jos metropolis. Eighty (80) senior secondary school two (SSS II).Physics students were sampled for the study. Forty (40) from the experimental group were taught Physics using multimedia while their counterparts in the control group forty(40) students' were taught Physics using the conventional lecture method. The two teaching strategies were used to teach the concept of waves and simple harmonic motion for three weeks. The instruments used for data collection is the Physics Achievement Test (PAT) and the Physics Multimedia motivation Questionnaire (PMMQ). The reliability index for the physics achievement test and the physics multimedia motivation questionnaire weres 0.94 and 0.86 respectively. Findings revealed that students' taught Physics using Multimedia Instructional Package performed better than students taught Physics using the conventional Lecture Method ($t = 14.60$, $df = 78$, $p = 0.00 < 0.05$). There is significant positive strong relationship ($r = 0.946$, $P < 0.05$) between motivation and their academic achievement in Physics when exposed to multimedia instruction. Based on the these findings, it was recommended among others that Multimedia Instructional Package should be used to supplement conventional methods for the purpose of increasing the performance of students in secondary school physics in Nigeria.

INTRODUCTION

Physics is a pure science that deals with the study of matter, energy and their interactions. It is an international enterprise, which plays a key role in the future progress of humankind. The support of physics education and research in all countries is important because it is an exciting intellectual adventure that inspires young people and expands the frontiers of knowledge about nature (science) (International Union of Pure and Applied Physics [IUPAP], 1999).

Physics is the fundamental base for science and technology. The knowledge of physics enhances economic, industrial and technological development in aspects as small as the laser which have revolutionized into the development CDs, DVDs, scanners, cell phones and printers which are few among consumer products; pains free laser surgeries, voice communication, internet service, video through laser-based fiber optics, among other. Also the knowledge of physics brought about the development of solar energy which is applied in the preservation, storage and the utilization of sun light for generating of electricity, food preservation and processing purposes.

The study of physics has helped students to develop an art of critical thinking, pose questions, and solve problems, equipping students mathematical and information technological skills. Upon all the contributions physics has offered to man and his society, sadly today in our secondary schools, statistics from WAEC (2015) have shown that there is a declined in the performance of secondary school physics.

Despite the importance of physics to the scientific and technological development of any nation, yet students' Performance in the subject is not encouraging. This revealed that all the research efforts towards the teaching and learning of physics to improve students' performance have not made much difference. The low performance of students in school certificate examination has deprived many of them the opportunity to pursue science and technology-oriented careers in higher institutions. It is therefore imperative to proffer ways of minimizing low performance of students in physics so that they can have more opportunities to pursue career in science and technology.

Prior to the introduction of the new physics curriculum, teaching in our secondary schools has been based on the convectional lecture method, until now where the newly introduced curriculum is to promote the use of guided discovery method. As observed by Abanbi (2013) that the trend in the enrolment and performance of secondary school students in science subjects, especially physics assumed threatening and frightening dimension. Due to the trend in the performance and national development concerns, the Nigerian government has made efforts towards the promotion of science in our secondary schools, through the development of new universities, launch of Nigeria SAT 1 and 2 and so on.

Wolfgram (1994) in Ayiwulu (2015) states that, people only remember 15 percent of what they hear and 25 percent of what they see, but they remember 60 percent of what they interact with. Multimedia in this study will include the use of images, linear and non- linear animations, voice narration, and arrow indicator high lightening current focus point and placed interaction self-check exercises. Specifically, this study focuses on the use of interactive animation to raise learners' interest, enhances understanding and increase memorability in learning secondary school physics. The multimedia instructional package (MIP) is use to show real life example of concepts, using pictures and motion pictures in the classroom. In school, multimedia instruction can become a tool to make radical changes in education, its introduction into the classroom unveil its potential to improve the motivation and standard of performances in secondary school physics.

Motivation is a force that account for the arousal, selection, direction and continuation of behavior. Motivation has several effects on students' learning and behavior. First, motivation directs behavior towards particular goals. Motivation determine the specific goals toward which people strive, thus, it affects the choices students make.

Multimedia instruction, according to Mayer and Moreno (2003), can be defined as the presenting both words and picture that are intended to foster learning. The word can be printed (for example on-screen text) or spoken (narration). Worldwide, the use of multimedia as an attractive channel for education is gradually embraced in many education systems as a tool for effective teaching and learning, as studies indicates it increasingly offer a rich environment for learning, motivating, changing students attitude and a chance to improve achievement in students.

STATEMENT OF THE PROBLEM

Despite notable change in the Nigeria Educational system, the WASSCE chief examiner report (2014 - 2019) shows inconsistency in the performance of candidates. In 2014, candidates recorded a raw mean score of 16 and a standard deviation of 8.77. In 2015, the performance was slightly better than 2014. The candidates recorded a raw mean score of 19 and standard deviation 9.90. In 2016, the performance remain the same as that of 2015 with a raw mean score 19 and standard deviation 9.90. In 2017, there was a declined in the performance of the candidates. The candidates recorded a raw mean score of 15 and standard deviation of 8.43. In 2018, the performance was higher than 2017. Candidates recorded a raw mean score of 26 and a standard deviation of 9.80. In 2019, the performance was comparable to WASSCE of 2018. The candidates recorded a raw mean score of 26 and standard deviation of 9.59 instead of increasing.

Based on the observed weaknesses of the candidates, the chief examiner report (2019) recommends among others that teachers should upgrade their teaching skills to embrace modern methodology. The research work seeks to use multimedia instructional package on physics students' academic achievement and motivation in senior secondary schools in Jos metropolis, plateau state, Nigeria.

The average performance of students in science subjects particularly in physics is being attributed to poor teaching methods in our schools taking from the verbalism, note copying and rote learning adopted by most secondary schools teachers thereby conveying physics as boring, uninteresting thus affecting students attitude and motivation towards considering enrolment and taking up career in physics. Biggs (2003) says the diversity of

learning style which characterizes students' population makes it necessary for teachers to constantly look for variety in the method they use. There is a need to employ new and enticing teaching techniques that provide equal opportunity for participation of all students in a class, therefore addressing motivation and poor performance in physics.

PURPOSE OF THE STUDY

The purpose of the study is to determine the Effects of Multimedia Instructional Package (MIP) on Physics Students' Academic achievement and Motivation in senior secondary schools in Jos Metropolis, Plateau State. The study was specifically guided by these objectives, to:

ix. Investigate the effects of multimedia instructional package on Physics students' academic achievement and motivation in Jos metropolis.
x. Find out the motivation level and achievement of students toward learning of physics in secondary schools in Jos metropolis.

RESEARCH QUESTIONS

The study used the research questions stated as follows.

1. What is the achievement level of SS II physics students in Jos metropolis?

2. What is the motivational level of SS II physics students in Jos metropolis taught physics using multimedia instructional package?

HYPOTHESES

The following research hypothesis was tested at the level of significance 0.05.

1. There is no significance difference between the post-test mean achievement scores of students' taught physics using multimedia instructional package and those taught physics using lecture method instruction.

2. There is no significant relationship between students' motivation and their academic achievement in physics when exposed to multimedia instructional package

METHODOLOGY

The study utilized the true experimental research design to determine the effects of multimedia instruction on the motivation and academic achievement of secondary school physics in Jos metropolis Plateau State, Nigeria. The experimental design was made up of two groups namely; the experimental and the control group in which the experimental group received the multimedia instruction treatment while the control group were taught using the lecture method. The population of the study comprised of all senior secondary schools 2 (SS II) in Jos metropolis of Plateau State.

A sample of eighty (80) senior secondary school Two physics students (SS2) out of one hundred and twenty (120) students from two schools in Jos metropolis were selected for this study. These secondary schools fulfilled the requirements in terms of physical facilities, equipped science laboratory, availability of electricity and registered science students selected for this study. The sample will comprised of 60 male and 20 female students. A non-probability sampling technique called purposive sampling technique was used to select schools from the target population.

The instrument for the collection of data used in this study were the Physics Achievement Test (PAT) and the Physics Multimedia Motivation Questionnaire (PMMQ) with the reliability index of 0.94 and 0.86 respectively, which were developed and validated as reliable tool for data collection. These instruments were carefully designed and use to

measure senior secondary students (SS2) level of motivation and academic achievement when exposed to different instructional methods for learning physics.

The mean and standard deviations of the Physics Achievement Test (PAT) for the pre-test and post-test scores was computed and used in the comparison of the control and experiment groups. The parametric test, (t-test for independent samples) was used to analyze the first hypothesis and answers the research questions. The second hypothesis for the questionnaire (PMMQ) was analyzed using the correlation coefficient (Pearson- moment correlation). The hypothesis were tested at $\alpha = 0.05$ level of significance. The analysis was done using the Statistical Package for Social Science (SPSS) software version 22.

RESULTS

Table 1: Descriptive Statistics for mean achievement level of Pre-Test and Post-Test levels of SS2 Physics Students'

	Pre-Test		Post-Test			
Groups	**Mean**	**Std Deviation**	**Mean**	**Std Deviation**	**Mean achievement**	**Mean Diff.**
Experimental	26.28	3.994	62.35	9.922	36.07	4.40
Control	26.70	6.052	57.95	8.019	31.25	

Table 1 shows the pre-test and post-test mean achievement scores and standard deviation of the experimental and control groups to determine the achievement level. From the table, the pre-test of the experimental group had 26.28 and 3.994 as mean and standard deviation respectively. The post-test of the experimental group had the mean and standard deviation as 62.32 and 9.922 respectively. From the table, the pre-test mean level between the groups shows that the difference in the entry level of the students' is negligible indicating that the students are almost at equal level before experiment. While the post-test mean achievement level of the groups shows the difference of 4.40 in favour of the experimental group students taught physics using multimedia instructional package.

Table 2: Descriptive Statistics for the Multimedia Instructional Package on SS2 Physics Students' Motivational Level

		N	Minimum	Maximum	Mean	Std Deviation
Motivation		40				
Valid	N		57	97	78.85	8.204
(Likewise)		40				

Table 2 shows that the mean achievement scores and the standard deviation of students' taught physics using multimedia instructional package is 78.85 and 8.204 respectively.

Based on the motivational ranking 0 – 49 mean score motivational level is low, 50 – 69 mean score motivational level is moderate and 70 mean score and above, indicate that the motivational level is high. The result shows that the motivational level of students taught physics using multimedia instructional package is 78.85, this implies that it is high at the range of 70 and above level.

Table 3: Showing the t-test for Independent Sample for Post-Test Scores of the Experimental and Control Groups

Table 4: Showing Pearson Correlation between PAT Post-test Scores and PMMQ of the Experimental Group

		Motivation	Academic Achievement
Motivation	Pearson Correlation	1	.946**
	Sig. (2-tailed)		.000
	N	40	40
Academic achievement	Pearson Correlation	.946**	1
	Sig. (2-tailed)	.000	
	N	40	40

**. Correlation is significant at the 0.05 level (2-tailed).

Groups	**N**	**Mean**	**Std Deviation**	**Df**	**t**	**P-Value**	**Decision**
Experimental	40	62.35	9.922	78	14.634	.000	Rejected
Control	40	40	8.019				

The result in Table 3 shows that the t-value ($t=14.6$, $p<0.05$) was significantly different at 0.05 alpha level. This indicates that there is a significant difference in the post-test mean achievement scores between the students taught physics using multimedia instructional package and those taught physics using lecture method of instruction. Thus, the null hypothesis is rejected. The result shows that there is significant difference in the post-test mean achievement scores of students taught physics using multimedia instructional package and those taught physics using lecture method of instruction.

Table 4 shows that r = 0.946, P < 0.05. Indicating a strong significant relationship, hence the null hypothesis is rejected. Indicating that here is a significant relationship between students' motivation and their academic achievement in physics.

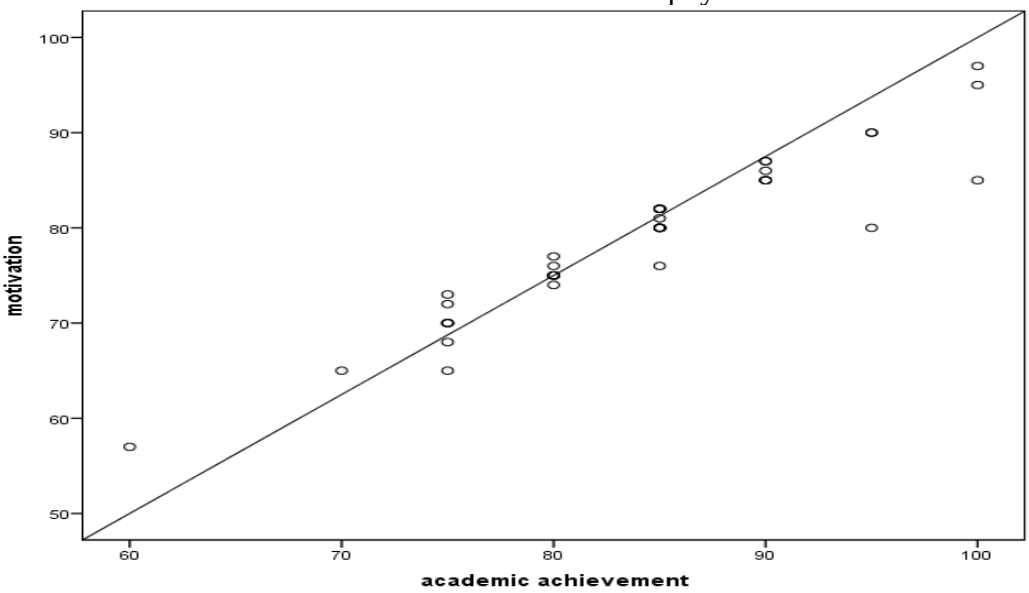

Figure 1: Scattered Diagram Showing the Relationship between Motivation and Academic Performance.

DISCUSSION

This research set out to investigate the effect of Multimedia Instructional Package on the motivation and academic achievement of senior secondary students in Physics in Jos metropolis, Plateau State. The findings of the study on the effect of Multimedia Instructional Package on the motivation and academic achievement of senior secondary students in physics revealed that the students taught physics using multimedia instructional package (MIP) performed significantly better than their counterparts taught Physics using lecture method of instruction. This finding agreed with the earlier findings of Krishnasamy (2007). Which support the positive effect of multimedia constructivist environment on the learning of "Chemical Formulae and Equations.

The result is also in agreement with the findings of Adegbija (2014) which revealed that students taught physics using Animation-Based Cam-Studio Physics Instruction Package (ACPIP) performed significantly better than those taught using conventional lecture method. Thus it becomes clear that Multimedia Instruction is more effective than the conventional instruction perhaps because of the assumption that it is Multi-sensory in the sense that it stimulate both the visual and the auditory senses of the learner and help the teacher turn the classroom into a dimension of sight and sound. The findings in this research work lays credence to the idea that Multimedia has properties that can aid learning particularly the learning of abstract subject.

The result of the second hypothesis which measured the motivation of students' shows that the students' are highly motivated to learn physics using multimedia instruction, students feel excited and desire to put their best in learning once they are motivated. This finding is in agreement with the study by Nwekeet.al, (2012), the multimedia motivates students interest to learn and have positive effects on their academic performance and so also with Patrick, (2005) which state that science students will achieve better when one form of motivation or the other is given. This also agrees with Mayer (1997), cognitive

theory of multimedia learning, deeper understanding occurs when students mentally connect pictorial and verbal representation of explanation of concepts.

RECOMMANDATIONS

Based on the findings of this study, the following recommendations were made:

xvii. Policy makers in Nigeria should define the frame work for appropriate and effective inclusion of Multimedia Instructional Packages into the classrooms by looking at the overview of its potential benefits in science education as it motivate students to learn sustain student attention and expand their knowledge of physics concepts.

xviii. Teachers training and retraining programmes on multimedia instruction should be developed. It is in the age of information technology and therefore training teachers to adapt to the new technological method of instruction will sprout confidence and competence in Physics teachers and also increase the enthusiasm in learners who can stand the test of any educational challenge encountered.

xix. To improve the standard of education in Nigeria schools, there should be provisions by government for funds, infrastructural facilities in terms of equipping secondary classrooms with electronic computer system (ICT) which are connected to internet, well equipped laboratories, workshops, instructional materials and highly qualified personnel's that can effectively utilize these resources for effective academic achievement in the secondary schools.

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IMPROVING QUALITIES OF TEACHING AND LEARNING OF SCIENCE AND HEALTH EDUCATION THROUGH INTEGRATION OF ICT IN CLASSROOM ACTIVITIES

By

Eje Ede Godwin
Biology Department
College of Education Oju, Benue State
@godwinejen890@g.mail.com

Enuma Alice Ogbene
Integrated Science Department
College of Education Oju, Benue State
aliceenum@gmail.com

Audu Marklinus Oseni
PHE Department
College of Education Oju, Benue State
audumarklinus@gmail.com

Abstract
This paper focused on improving the quality of teaching and learning of health and science education through integration of ICT tools in classroom activities. The world is changing all over time has come when and unskilled person will not be relevant to the society. This is the reason why this paper advocated for ICT integration in our classroom so as to equip students with these necessary skills. Various ICT that are revenant to science and health in the classroom instruction

were health with such as computer, website microphones, digital video, digital games, pod cast etc. the paper noted among other things that if ICT tools are properly integrated in science and health educations. Therefore, government should fund ICT integration in our schools, and teachers should be encouraged to be computer literate compulsorily.

Introduction

The world is changing every day; science and technology education which are the vehicles for technological advancement and national development have to change too. This found a place in (Denga & Ekoja 2014) when they said time will come when there will be little or no place for the unskilled; This is evident everywhere that the labour market for the unskilled is almost non-existent. There are changes in the area of information technology, computers are used virtually in every facet of life. They are used in surgery, in business and airports to display information. Engineers use computers to design air craft. Immigration Department uses computer to process applications, Traffic Lights are controlled by computers. At home, computers are used as washing machines and for playing games, they are also used in school for recording scores, marking examination papers, time-tabling and other schedules. The internet has brought the world to a closed unit that one can obtain information from any part of the world. Computer has brought revolutionary changes in the state of the world giving us a new form of civilization in all aspect of life.

In view of all these changes there is an urgent need for our science educators and curriculum planners to make contemporary society science Education functional to meet the needs of the hour. This is in line with the observation of Nedosa & Esseyin (2001), that computers have now invaded Nigeria and almost all activities are now being computerized. To cope with these changes, our teachers and students need to be computer literate to be more specific, medical students have not been able to find out the cause of cancer or how to cure the various viral diseases including HIV, which have infected a lot of our people, man in face with multifarious environmental problems and challenges that man himself or science has introduced into the environment. Atmospheric pollution brought about by burning fuels has changed the face of the world. There is an increase of carbon monoxide gas in the atmosphere leading to global warming. i.e the constantly increasing mean temperature of the earth manifested in the high rate of degradation of the Arctic and Antarctic regions of the world. Our water bodies are polluted by heavy metal from mining activities, sewage and industrial wastes emptied into water ways have done a lot of damages to aquatic life in these water bodies. Many more changes and challenges are still on the way because the world is not static. It is only through will planned science education programmes and effective delivery in classrooms that could equip our youth in line with these challenges and it is then we may have hope to make the world a better place to live in.

The Concept of Science

Science is both a body of knowledge and a process. The word science comes from a Latin word “Scientia” which means knowledge.

Mbajiorgu as cited in Okoli, Obiagulu and Ella (2013) views science as an art of doing things and is more concerned with various investigative processes and activities with regards to developing, acquiring and controlling knowledge, skill, capacity and attitude about the natural factors of the environment.

To study science is to acquire a particular type of knowledge in specific areas as physics, chemistry biology, astronomy or health. Science and technology go hand in hand as technology taken the discovers and inventions of scientists and makes them available in practical form for mankind as seen by Adakole (2014).

Goal of Science Education

The goal of science education at school lord is that of making students acquire the knowledge of science and understanding of nature as well as appreciating science as a field of disciplined inquiry. This gained support from lawal (2011) who said that when science is taught purely for acquisition of knowledge or as a dogma, would mis-represent the facts about the nature of scientific enquiry.

In other words it would hold to the development of passivity, docile-learning and dependence on teachers and textbooks instead of an active learning using ICT tools.

In the same vein Udeotuk and udofia (2014) opined that at the rate science is developing. It seems impossible to teach students all the science information they will need. This suggests that students should be given opportunities to discover, invert and get caught up in the rapid expansion of scientific and technological information.

Implications of the Goal of Science Education for Teaching.

According to Eje (2019), The goal of science education aimed at all ages of learners of all abilities and interests will affect many changes that are needed to be made in classroom teaching, take for instance, course to be taught need to include content and process towards problem resolution using appropriate value sanctity in other words, science teachers need to apply multiple teaching strategies, focusing on learners needs towards making what is learned relevant to the learners in question.

The Concept of Health Science

Health according to world Health organization (WHO) (2010), is a state of complete physical, social and mental well being and not merely the absence of disease or infirmity.

Akor and imarde (2019) saw health as the quality of life which enables are to live most and serve best, that is it is a condition in which the body and the mind are in good state with the body tissues and organ functioning well.

Challenges in Health Education among Learner's

One of the paradoxes of modern era is that when the whole world is making concerted effort towards industrialization and advanced technology to improve quality of teaching and learning in classroom this same progress or advance appears to confront making with a growing number of acute public health challenges. This advance has never seemed brighter, instead several cult of narcotic drugs is still gaining ground among young people especially our athletes all over the world.

The world Health Organization (WHO) 2009) asserted that the fermented juice of the grape has been used since written history began, whether as a social lubricant or deliberately to lower inhibitions and create a cheerful mood. Also today alcohol is still a social lubricant for thousands of our yours learners.

Implication of Problems Arising from Drug use for Learning

Although the problem of drug use and abuse are complex and affect all strata of our society. Unfortunately, our reactions to the problems are based more on emotional responds that on factual information. Take for instance smith and Meyers (2012) pointed out that the actual smoking of Marijuana or cigarettes is misdemeanor but possession of unlighted Marijuana or cigarette is a felony.

With the advent of modern technology, physical fitness is the capability of the heart, brain, blood vessel, lungs and different parts of the body to function at optimal efficiency should be ascertained. In line with this, Samuel (2013) observed that physical fitness is the ability of an individual to perform his daily activities /tasks without undue fatigue and has ample reserve of energy to cope with emergencies.

Musa (2014), also stressed that ICT could boost students' agility by constant use in classroom activities. Consequently, effective utilization of health education could lead learners to develop individual qualities of self-realization, self-sufficiency, self-control and self-discipline,

Eke (2003), in other words health science in general compared to ICT play a significant role in character building through transfer of learning.

Concept of Biological Science

Knowledge of Biology is intrinsically connected to building a sustainable interaction between nature and human society. Teng (2012) opined that Biology education is a pivotal

knowledge component to meeting technological requirements due to the facts the three domains of learning are frequency use and the right types of attitudes are developed.

According to Araoye (2015) Biology Education is a typical education which aims at training and marketability of essential skills for the will-being of man. Adeniyi (2012) asserted that technology and productivity are key factors in human resources development. To improve productivity therefore requires an adequate conceptual approach and positive in centive to inculcate the right attitude in learners.

Relevance of Biology Education in Improving Qualities of Learning

As put by Teng (2012), Biological literacy has the potential of specific training and meeting the needs and challenges of the learners, in that the acquired literacy skills are immediately applied to improve learner. Livelihood. Human society has tapped biological knowledge since ancient times to produce food and other human needs for survival. This is so because Biology is an applied field of study built upon many disciplines for the purpose of achieving and maintaining the will-being of individuals in an ever charging society. The discipline of biology therefore promotes technological product generally in the learners as it enables the individual to discover, create, innovate, build skill and generate ideas. In addition, a biology laboratory instruction enables the learners to inculcate team work spirit which in turns develop in these students' skill in group dynamics, persuasion, organization leadership and management skills.

From experience of teaching in schools and college in the precious years, teaching and learning process of laboratory practical in science was not an easy task. For one thing, the misconceptions of students in science devotes the energy, on the other hand, lack of laboratory experience, exposure and science process skills hinders students from attaining the objectives of laboratory practical designed. Achor (2019), explained in his study that although laboratory practices enhance the students learning experiences, it has also been criticized for the fact that it is unproductive and confusing unless clear through are used. It was suggested that cultivation of students' intellectual skills should be given attention to enhance learning rather than following "cookbook" approach. Hence poorly involved and experienced students developed poor or no experience of laboratory management even for lowly expensive chemicals and apparatus. This is due to lack of well-organized laboratory, large size of class, students' science background, poor skills of application of IT for laboratory practical's.

Also Odunisi (2000)), exerted that student initial understanding and preconception about topics should be addressed so that they students do not come into classroom as "tabula rasa". They are not blank sheets to be written on. Each students comes into the classroom with ideas that often limit what a student can learn. It is critical that students' preconceptions be identified, confronted and resolved.

The Concept of Information and Communication Technology (ICT)

Information technology used in both textual and audio-visual modes of transmission of information is easy and fast. It has opened new avenues like online learning, e-learning; virtual university, e-coaching, e-education, e-journal etc. The ICT brings more rich material in the classrooms and library for teachers and students. It has provided opportunity for the learner to use maximum senses to get the information. It has broken the monotony and provided variety in the teaching-learning process (Ajashe, 1995)

This gained support from Senthilkuma (2014), who said that computers have brought technological advancement to developed countries like USA, Britains, India and Indonesia. The same revolution could be repeated in Nigeria if teachers and students start using computers for teaching and learning purpose through computer assisted instruction (CAL), computer managed instruction (CML), and Computer Based instruction (CBI),

Uses of ICT in Schools

The use of ICT in education has enhanced teaching, learning and research in Nigeria, education system especially in terms of improvement of access and delivery of education. In recent times, online courses have proven to be very effective because it provides a low cost alternative to higher education for Nigerian teeming youths. ICT has also provided researcher with access to research materials and opportunities for international comparative research work. Although electronic technology and internet access is still very expensive and not accessible to low income earners the middle class citizen of Nigeria have been able to access the benefits of ICT and other forms of technology in education, e-commerce, e-agriculture and other sectors. Technology is an enabler in leap frogging Nigeria and providing opportunities to all in the area of education and science.

Teachers from experience now here opportunities to relevant teaching materials from other developed parts of the world which can be adopted and adapted. It is not uncommon to find teachers and students in both private and public schools demonstrate exceptional skills with the latest ICT gadgets that they can lay their hands on.

According to Ajayi (2014), there are no functional internet facilities in most of the schools in Nigeria which the student could access. This appears to hinder the extent of teachers' exposure to the use of ICT tools in teaching.

Challenges of ICT in Nigeria

Also Yusuf (2017), identified irregular power supply, inadequate funding and reluctance to change as some of the challenges facing the effective use of ICT in teaching – Learning process in schools.

Cost and Duplication

The cost of acquisition of ICT gadgets and its attendant installation of soft ward drill, a hole into the pocket of an average Nigeria. The practice of capitalism within the nation and the could as a whole has led to proliferation and duplication of gadgets and soft ward. Telephones for instance come in different makes and models – such as Techno, Samsung, Nokia, Gionee, Itel, Huawei, Lenovo, Infinix and others, and each of these makes have several models to their names. Computer also have duplications such as, Acer, HP, Dell, Lenovo and Samsung. Televisions are not left out, they ranged from sonny, LG, Hi sense All these come with different installations, packages and software's therefore leaving the buyer in the slate of confusion as to which is the best.

Brain Drain Syndrome

Technology transmission is inversely proportional to human receptive capacity. Humans in general are now so dependent on technology for the collections and recollection of data and information that the brain seems to be in a state of inertia. It seems the hard drives and flash drives have replaced the store keeping function of the brain, the computer does virtually everything the brain does.

Cyber Crime

In the aspect of crime, Nigeria has a reputation for being cybercrime experts. These are popularly known as Yahoo boys. The internet providers make it possible to forge and fake one details and pictures, this deceives unsuspecting victims into parting with their money with the behalf of either purchasing an item or supporting a course.

Loss of Identity

Youth have attached their sense of identity to their passion of the latest gadgets and are gratified when they have a gone number of views and lives on the various social media. Not achieving these goals has led to depression and other desperate action such as posting nude and seminude pictures.

Roles and Application of ICT in Service Education

ICT has increasingly played a critical role in all fields of human endeavours. it is being used globally to translate ideas into realizable goals and develop same into concrete achievement. ICT is readily useful in the area of agriculture, engineering, medicine, law, architecture, aviation, commerce,

insurance, banking and finance as well as marine activities. ICT has contributed to substantial improvements in the educational system (Moursured, 2015).

ICT provides a lot of services for students including distance education, inexpensive printing, cell phone plans, internets, connection, free dial-up, technology equipment, etc. lecturers and students get relevant material needed through the internets.

Moursund (2015), stated that ICT brings some very powerful aids to translating theory into poetic. Two of these aids are computer-assisted learning and distance learning or education.

Adjaiho, (2006) in Okeh and Opone, (2007), it is endent that ICT incorporated an d extends some of the power of reading, writing and arithmetic. It facilitates the automation of many mental activities.

The science of Teaching and Learning (SOTL) has made great progress in recent times, Braise ford (1995) in Bamigboye Adenbigbe and Buraimo (2017), described four important components of SOTL to include: constructivism, situated learning, motivation and Transfer of learning. Each of these is important to all teacher and students at all levels of academic discipline. In other words, ICTS, provides knowledge based system that in include knowledge acquisition, knowledge incubation, knowledge amplification, and knowledge dissemination. From this one can see that information is a key resources which permeates teaching, learning, research and publishing, to this end Okeh and Opone (2017), stated that the use of new information's technology can serve three functions such as.

a. Deliver all or part of the learning experiences to learners (b) Supplement and extend contest provided in different forms other them printed (hard copy) and (c) provides a two-way channel of communication for exchange between teachers and students to get feedback solve problem, advice, debate or report

Classroom Integration of ICT

Computer is a device that improves teaching/learning processes. It is an essential tool for integrating ICT in the classroom. Here teachers are able to demonstrate a new lesson, illustrate and show new websites.

Class Biogs and Wikipedia

There are verity of these in use but the 2.0 we tool are commonly and currently being used in classroom, this is the kind of website that allows multiple members to edit single document.

Microphones

In a large class say above 100 to 1000 of learners a wireless microphone could help for student clear understand, to control the class and for wide distance coverage

White board interaction: This helps to given teachers and teacher the opportunity to touch control of computer applications. Teaching-learning experiences in health and science education in the classroom is enhanced through computer screen it also aids visual learning. It is interactive in nature and learners may draw, write or manipulate images on the interactive white board.

Digital Video: As stated by choline (2005), LCD projector-like equipment's aided our teaching-learning process as far as possible DVD player on prepared topic in sciences could be played to students in classroom where LCD projections are not available

On line media: Streamed video websites can be used to improve a classroom lesson by using eg united streaming Teacher Tube (USTB).

On Line Study Tools: Lessons in health and science education could be developed in a motivate manner by making studying more fun or individualized instruction for the students eg the life cycle of any of our domestic animals.

Digital Games: Educational games in science-related course could help student learning of health and science education very well, this is because, many children life to play games even on computer devices. Also digital cameras, video cameras on animals, plants, human physiology etc could be additional sources of motivation to learning science education in our classrooms,

Podcasts: Podcasting is a relatively new invention that allows anybody to publish files to the internet where individuals can subscribe and receive new files from people by a subscription like

lectures on science matters could also be transmitted through this medium between teaches and students.

Information on IVF (In-vitro fertilization) could be packaged for students on podcast especially the five main stages of IVF such as.

- Stimulation of the ovaries with fertility drugs to produce several eggs.
- Collection of the mature eggs.
- Fertilization of the eggs in laboratory,
- Culturing of the pre-embryo and
- Embryo transfer and lot more could help students easy access to useful scientific information.

CONCLUSION

Science and technology advancement is directly proportional to the development of nation. ICT stands as the best medium to convey information to student because of its easy understanding, attraction and practicability. With ICT integrated instruction a traditional classroom could be changed into a smart classroom.

From the above statement, it is therefore necessary for Nigerian government, institution and individuals alive to develop a society and culture that places a high value on information and communication technology (ICT) because it is by so doing that Nigeria can fit into the new scientific order.

RECOMMENDATIONS

Based on the discussion in the study, the following recommendations are made:

1. Government and policy makers should prioritize teacher training and retaining in ICT.
2. Government in partnership with organizations should strive to equip schools with adequate ICT facilities.
3. Government and school authority should reward any teacher who tries his/her hands on innovation ideas in ICT tools usage in classroom.
4. Existing technology particularly the internet can widely convey information less expensively and so it should be encouraged in schools.
5. Financial sustainability should be provided for ICT development initiatives.

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