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ARTICLES AND RESEARCH REPORTS ON SCIENCE

DEVELOPMENT OF A MOBILE MATHEMATICAL EXPERT SYSTEM (MMES)

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Abstract
Mathematics being an established discipline has provided methods of solving all forms of mathematical problems. However, the ubiquitous advantage brought by Information Technology (IT) can be extended to Mathematicians. This drives motivates the researchers in this work to develop a Mobile Mathematical Expert System (MMES) capable of solving some mathematics problems using the mobile phone. Having specified the algorithm for the selected mathematical problems, J2ME is used to develop the system.

Keywords: Mobile, Mathematical, Expert, System, J2ME, Algorithm

Introduction
Mathematics is an abstract study of number, quantity, and space. It is also the study of the measurement, properties, and relationships of quantities and sets using numbers and symbols. This is the systematic treatment of magnitude, relationships between figures and forms and relations between quantities expressed symbolically. The branch of mathematics includes Arithmetic, algebra, geometry, and calculus.

Algebra: This treats the representation and manipulation of relationships among numbers, values, vectors, etc.

Geometry: This treats the measurement, relationship, and properties of points, lines, angles, and figures in space.

Calculus: This treat the measurement of changing quantities, determining rates of change and quantities under changing conditions.
Mathematics Expert this is the collection of formulas out of mathematics, which is ready to gives the user immediate help.

The first mobile telephone calls were made from cars in 1946. Bell System's Mobile Telephone Service was made on 17 June in St. Louis, Missouri, followed by Illinois Bell Telephone Company's car radiotelephone service in Chicago on 2 October. The MTA phones were composed of vacuum tubes and relays, and weighed over 80 pounds (36 kg). There were initially only 3 channels for all the users in the metropolitan area, increasing later to 32 channels across 3 bands. This service continued into the 1980s in large portions of North America. Due to the small number of radio frequencies available, the service quickly reached capacity. In 1956, the world's first partly automatic car phone system, Mobile System a (MTA), was introduced in Sweden (Heeks, 2008).

John F. Mitchell, Motorola's chief of portable communication products in 1973, played a key role in advancing the development of handheld mobile telephone equipment. Mitchell successfully pushed Motorola to develop wireless communication products that would be small enough to use anywhere and participated in the design of the cellular phone. Martin Cooper, a Motorola researcher and executive, was the key researcher on Mitchell's team that developed the first hand-held mobile telephone for use on a cellular network. Using a somewhat heavy portable

handset, Cooper made the first call on a handheld mobile phone on 3 April 1973 to his rival, Dr. Joel S. Engel of Bell Labs.

All mobile phones have a number of features in common, but manufacturers also try to differentiate their own products by implementing additional functions to make them more attractive to consumers. This has led to great innovation in mobile phone development over the past 20 years (Khurana, Kundi & Murphy, 2009).

Mobile phones are used for a variety of purposes, including keeping in touch with family members, conducting business, and having access to a telephone in the event of an emergency. Some people carry more than one cell phone for different purposes, such as for business and personal use (Saylor, 2012).

The future of mobile computing is becoming even more exciting. Mobile devices are continually growing more capable, especially with the advent of cleverly integrated phone capabilities. With better and better wireless networks capable of transferring media in real time, an entirely new breed of applications is now possible. Riding this new wave may be extremely profitable for organizations positioned to take advantage of it (Murphy, 2009), (Burnette, 2008).

There is a flood of interest in software development revolving around J2ME (Java 2 Micro Edition). J2ME is a slimmed-down version of Java targeted at devices that have limited memory, display, and processing power.

There will be a specific focus on application development for mobile devices using an application programming interface (API) known as the Mobile Information Device Profile (MIDP). Applications written for this API are affectionately referred to as MIDlets.

A MIDlet is an application that uses the Mobile Information Device Profile (MIDP) of the Connected Limited Device Configuration (CLDC) for the Java ME environment. Typical applications include games running on mobile devices and cell phones which have small graphical displays, simple numeric keypad interfaces and limited network access over HTTP (hypertext transfer protocol) (Topley, 2002).

The user downloads the .jad file and installs the MIDlets they require. Local deployment requires that the MIDlet files be transferred to the device over a non-network connection (such as through Bluetooth or IrDa, and may involve device-specific software). Phones that support microSD cards can sometimes install .jar or .jad files that have been transferred to the memory card.

Material and Method

The programming language used in this paper is java 2 Micro Edition (J2ME). to develop mathematical library, capable of solving selected mathematical equations such as Quadratical equation, Simultaneous equation, Arithmetic progression, Geometrics progression. J2ME combines a resource constrained JVM (Java Virtual Machine) and a set of Java APIs for developing applications for mobile devices.

The most popular profile and configuration that Sun provides are the Mobile Information Device Profile (MIDP) and Connected Limited Device Configuration (CLDC), respectively. As the name suggests, CLDC is for devices with limited configurations; for example, devices that have only 128 to 512KB of memory available for Java applications. Consequently, the JVM that it provides is very limited and supports only a small number of traditional Java classes. (This limited JVM is actually called the *KVM*.) Its counterpart, the Connected Device Configuration (CDC) is for devices with at least 2MB of memory available and supports a more feature-rich JVM (but still not a standard JVM).

Java emulator is a tool that helps for java-based software can run on your computer's operating system. So that we can play a variety of applications java example games, music, videos etc as in mobile phones. Because it is, a java emulator so application must have the extension Jar or Jad and computer must be installed java platform: Java SE/*JRE* (*Java Runtime Environment*).The reason is JRE, which runs the file API of each platform java program.

Mathematical Model Formulation

In order to develop a mobile expert library, there is a need to inculcate some mathematical formulae which are: Area of Rectangle, Area of Triangle, Area of a Circle, Volume of a cube, Perimeter of Rectangle, Circumference of a Circle, Volume of a Cone, Quadratic Equation, Permutation and Combination, Volume of a Sphere, Curved Surface of an Sphere, Simple Arithmetic, Arithmetic Progression, Geometric Progression.

Assumptions in the Model

To develop a reasonable model which compresses series of formulae some assumption need to be made which are:

(i) The Measurement is taken in centimeter (cm).
(ii) Any length and breadth value can be choosen.
(iii) The model is restricted to selected formulae mentioned above.
(iv) The model is executed both on personal computer (P.C) and Mobile Phone.

L (cm) * B (cm) = A (cm) 1
Where L is the Length, B is the Breadth and A is the Area of Rectangle.

½ * B * H = A 2
Where B is the Base, H is the Height and A is the Area of Triangle.

TI * R = A 3
Where TI is Pie, R is Radius and A is the Area of Circle.

L * B * H = V 4
Where L is Length, B is Breadth, H is Height and V is the Volume of a Cube.

Perimeter of Rectangle: 2 x (length + height)
2 * (L + H) = P 5
Where L is length, Height is Breadth and P is the Perimeter of Rectangle.

2 * TI * R = C 6
Where TI is Pie, R is Radius and C is Circumference of a Circle.

1/3 * TI * R = V 7
Where TI is Pie, R is Radius and V is the Volume of a cone.

- B +- Sqrt (B^2 – 4*A*C)/ (2*A) = X 8
Where A, B, C are the Variable in (cm) and X is the root of Quadratic equation.

N! / (N-R)! = nPr 9
Where N and R are the variables in (cm) and nPr is the Permutation of a number.

N! / (N-R)! R = nCr 10
Where N and R are the variables in (cm) and nCr is the Combination of a number.

Simple Interest: (P * R * T) / 100
P * R * T/ 100 = SI. 11
Where P is Principal, R is Rate, T is Time and SI is the Simple Interest.

A^2 + O^2 = H^2 12
Where A is the Adjacent, O is the Opposite and H is the Hypotenuse.

4/3 * TI * R ^ 3 = V 13
Where TI is the Pie, R is the Radius and V is the Volume of a Sphere.

4 * Pie * R ^ 2 = C 14
Where TI is the Pie, R is the Radius and C is the Curved Surface of a Sphere.

A+ (N-1) * D = Tn 15
Where A is the first term, N is the Number, D is the common difference and
Tn is the number of A.P term.

AR^N-1 = Tn 16
Where A is the first term, N is the Number, R is the common ratio and
Tn is the number of G.P term.

Results and Discussion

These figures below show the output of mathematical software library that was developed for mobile phone.

Computation and output of area of a rectangle

Once you run the jar file on your phone, the list of mathematical problems will be displayed, based on what the developer develop. This particular phrase computes the area of a rectangle by entering the value of length and breadth in the text field and select compute or menu before compute depending on the configuration of your phone. This is described in Figure 3.1.

Fig. 1: The result of Area of a rectangle with length 7cm and breadth 9cm

Discussion on the Area of a Circle by enter the radius

This section display the area of a circle by entering the radius in centimeter (cm), then the compute button will be pressed in order to achieve our aim. In order to compute the result on these types of phone you will need to select menu and then click the compute label, by doing so the area of a circle will be displayed in the area textfield. The type of phone used is any java phone.

Fig. 2: The result of area of a circle with radius 9

Compute the area of Triangle

To compute the area of a triangle will need the base and the height of that triangle. Here you will be required to enter the base and the height in a textfield and the result will be generated for you by clicking the compute button.

Fig. 3: The result of area of a triangle with base 7.2cm and height of 9.5cm

Discussion on the Volume of a Cube

All the paper work, analysis and manipulation has been hidden from the user with just a simple program, what the user need to do is to enter the length, breadth and height and the solution will be given in a blink on an eye.

Fig. 4: The volume of a cube with Length 4.5cm, breadth 3.7cm and height of 8cm

Discussion on the Volume of a Cone

This is another area of mathematics that bothers the students in calculating, but with the help of this software, the student will be able to calculate this easily.

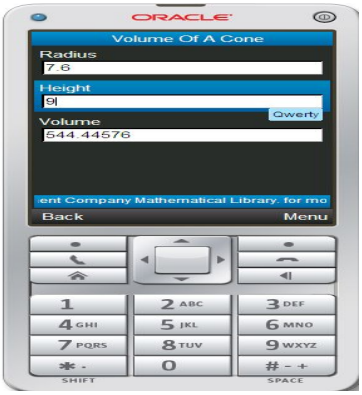

Fig. 5: The result of a volume of a cone with a radius of 7.6 and height of 9

Computation of the roots of Quadratic Equation

This is another segment of mathematical problem that is made simpler. This part consists of 6 text fields which include A, B, C, output (D) and the root1 and root2, pertaining to the almighty formula. In which the output will be display if D<= 0 else the roots will be displayed.

Fig. 6(a): The Figure above display the Complex Root in the output box because D < 0. The textfield A, B and C was entered to be 2, 1 and 3 respectively

Fig. 6(b): Computation of Quadratic Equation Roots when D > 0 (D is greater than Zero)

Fig. 6(b): The Root1(X1) and Root2(X2). A, B and C are inputed to be -3, 2 and 3 respectively. The Figure describes Computation of Quadratic Equation Roots when D = 0 (D is equal to Zero).

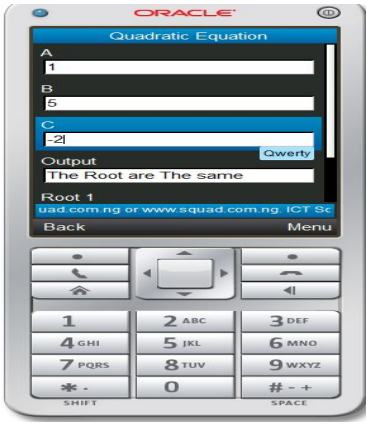

Fig. 6(b): The Root of the Equation is the same. A, B and C are inputed to be 1, 5 and -2 respectively

Fig. 6(c): The Root of the Equation is the same. A, B and C are inputted to be 1, 5 and - 2 respectively

Solution to the value of X and Y in Simultaneous Equation

This session require the user to input series of value inform of the linear equation. For instance if the problem to be solve is 2x + 3y=15 .... (Equ. 1) and the equation 11 is 3x – 4y = 10... (Equ. 2). Now do this using this software, you will enter 2 to field X1, 3 to Y1, 3 to X2, 4 to Y2, 15 to C1 and 10 to C2 then click compute button, the result will be display kin X and Y textfield.

Fig. 7: Shows the value of X and Y used in solving the simultaneous equation

Discussion on Simple Arithmetic

The figure below shows the use of mathematical arithmetic operator such as Addition (+), Subtraction (-), Multiplication (x), Division (/) and modulus (%). you will be prompt to enter

numbers in the text fields and then click on menu to select any arithmetic operator of your choice. The modulus gives operator provides you with the remainder of divided number.

Fig. 8: How to perform some simple arithmetic operations

List of others Mathematical Solution

The figure below shows the list of some other mathematical solution such as Permutation, Combination, AP, GP, and Simple Interest and so on.

Fig. 9: List of others mathematical Solution

Conclusion and Recommendation

This research work has a lot of benefit to the students at all level of academic stages. Especially where objective questions are require to be answered. It is recommended for use for the following reasons.

(i) It makes it easy to solve any objective based questions.
(ii) It eliminates the time consumed in solving the solution on the paper.
(iii) It makes it easy for any phone user to provide solution to some mathematical problem.
(iv) It enhances student's performance to objective part of mathematics.
(v) It can serves as alternative when calculator is not in use.
(vi) It can be used in confirming results from other alternative source of calculations.

Further Research

This paper can also be developed further by not concentrating only the Mathematical Functions, but also catering for solving general calculations in Physics on Mobile Phone, Brain Test and Mobile Phone Encryption.

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ANALYSIS OF TEMPERATURE TRENDS AND ITS IMPACT ON RELATIVE HUMIDITY OVER LOKOJA LOCAL GOVERNMENT AREA, KOGI STATE, NIGERIA

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Abstract
Temperature is an important variable which affects man both directly and indirectly. This paper focused on the trends analysis of mean minimum temperature (^oC) and its impact on the mean relative humidity (%) at 0900 hours over Lokoja Local Government Area (LGA), Kogi State, Nigeria; 1971 – 2010 (40 years). The aim of the study was to look at the trends of mean minimum temperature (^oC) and its impact on the relative humidity (%) at 0900 hours, while the objectives include: to analyze the mean minimum temperature (^oC) of the study area, to determine the level of change in the mean minimum temperature over time, and to examine the impact of mean minimum temperature (^oC) on the mean relative humidity (%) 0900 hours. The data were obtained from the Nigerian Meteorological Agency, Lagos. The temperature data were subjected to analysis using the Statistical Package for the Social Sciences other wise called Statistical Product and Service Solutions (SPSS) 16.0 version to obtain mean, minimum, maximum, skewness, skewness std error, kurtosis, kurtosis std error, significant level, Pearson correlation coefficient (r), deviation from mean, variance, standard deviation (std) and range, while the coefficient of variability (CV) was also calculated. On the other hand, the relative humidity data (%) were used to calculate the lowest and highest annual and long – term mean as well as the lowest and highest decadal values. The results were shown in graphs and table. The results revealed that although, the mean minimum temperature over the study area is increasing; but it does not have any positive impact on the relative humidity (%) at 0900 hours. It was therefore recommended that other components of temperature such as the mean maximum temperature and the mean temperature be studied in relation to the relative humidity at 1500 hours and the entire relative humidity.

Keywords: Temperature, minimum temperature, relative humidity, global warming, harmattan

Introduction
Temperature, which is controlled by sunshine, rainfall, cloud cover and wind flow pattern over an area, is an important variable of weather and climate. For instance, Audu and Rizama (2012a) observed that rainfall moderates temperature. This explains why temperature reduces at the peak of wet season as rains, especially heavy and frequent rains serve as a coolant to the atmospheric, environmental and body temperatures. Temperature determines the heat and comfort of living things especially man in an area. Temperature is simply described as the extent to which a place is hot, warm or cold (Audu, 2012d). According to Audu (2012b), among the climatic variables, only temperature probably has short, medium and long term effects on both living organisms and the environment. Audu (2012d) also opined that in Nigeria; diurnal, minimum, maximum, mean, monthly, annual, seasonal and decadal temperatures are not static. The dynamic nature of weather with temperature inconsistency which at present has been confirmed to be increasing not only across Nigeria, but globally is a major source of concern to mankind. For instance, Audu (2012d) observed an increase of 0.34^oc in the mean decadal temperature of Lokoja, 1971 – 2010. According to Audu (2012b), reports of heat waves across the globe are on the increase. Temperature is a natural phenomenon, but controlled by a lot of physical and human factors. However, in recent time; man's activities are influencing the temperature of an area – local, regional and global positively. Audu (2012a), Ojoye and Yahaya

(2008) indicted gas flaring, use of generating sets, numerous vehicular movements and deforestation as contributing to a rise in temperature across Nigeria. Although, the study of macro temperature is very important, but the fact remains that the micro temperature of an area is more important because of its immediate and direct impact on living organisms (of which man is at the focal point) and the environment. Micro temperature is mostly affected by poor town planning, use of generating sets, heavy vehicular movements, high population concentrated in a small and enclosed area and so on, while the macro or global temperature is mostly affected by the atmospheric circulation of wind and ocean currents.
The alteration of temperature upwardly has culminated in what is known as global warming which is one of the global topical issues today thereby leading to climate variability and climate change. The implication is that, all the environmental factors, namely; hydrological system, atmospheric system, ecological system and carbon cycle among others are under going alteration because they are either directly or indirectly or even both controlled by temperature. The study of temperature is therefore important in relation to other atmospheric variables in order to abreast man with the impacts of its dynamism. It is on that note that this research tends to look at the mean minimum temperature (^{o}C) and its impact on mean relative humidity at 0900 hours over Lokoja Local Government Area (LGA), Kogi State, Nigeria.

Aim and Objectives of the Study

The aim of this study is to look at the trends of mean minimum temperature (^{o}C) and its impact on the mean relative humidity (%) at 0900 hours, while the objectives include:

(i) to analyze the mean minimum temperature (^{o}C) of the study area,
(ii) to determine the level of change in the mean minimum temperature over time, and
(iii) to examine the impact of mean minimum temperature (^{o}C) on relative humidity (%) 0900 hours.

Description and Geographical Location of the Study Area

The study area, Lokoja Local Government Area (LGA) is located between longitudes $6^{o} – 7^{o}$ east and latitudes $7^{o}14^{1} – 9^{o}$north. Lokoja derived its name from two (2) Hausa words, a tree and a colour. “Loko”, which means “Iroko” and “ja”, which means red. So, the name Lokoja means, Red Iroko (tree). Kogi is also a Hausa word which means a flowing river (Kogi Local Government Area brochure, 1993 cited in Audu, 2001; Neil, 1965). Lokoja is the administrative capital of Kogi state and the confluence town of not only Kogi state, but also Nigeria. The study area enjoys both wet and dry seasons with the total annual rainfall between 804.5mm – 1767.1mm, range is about 962.6mm while mean is about 1216.86mm (Audu, 2012c). Mean annual temperature is about 28.03^{o}c (Audu, 2012d) and a relative humidity of 30% in the dry season and 70% in the wet season (Audu, 2001; Yusuf and Agabe, 2010). Average daily wind speed is 89.9 km/hr. Wind speed is usually at its peak in March and April. The average daily vapour pressure is 26 Hpa (Kogi state statistical year book, 1997 cited in Audu, 2001). The most important hydro – geological feature at Lokoja is the River Niger and the confluence of Rivers Niger and Benue (Kogi LGA brochure, 1993 cited in Audu, 2001). At Lokoja, there is a wide flood plain along the lower Niger, which is more than 1,600m wide. The relief rises from about 300m along the Niger valley to between 300 – 900m above sea level in the uplands (Ajibade, 1993 cited in Audu, 2001; Yusuf and Agabe, 2010). The rocks fall within the Precambrian age as well as the various sedimentary rocks. The study area is found in Guinea Savanna with the presence of gallery forest along water courses (Iloeje, 1976 cited in Audu, 2001, Yusuf and Agabe, 2010). The dominant primary activities in the study area are fishing, farming, trading, hunting with low percentage of tertiary activities (Yusuf and Agabe, 2010). The area is another tourist haven in Nigeria, but only little attention is paid to this at present. The major means of transportation is by road. Although, the largest river in Nigeria is found here; but under – utilized for transportation. Due to the hilly nature of the area, cable car is also another possible means of transportation. In terms of population, the study area had a total population of 82, 483 in 1991 (NPC, 1991), while in 2006, the population stood at 196,643 (National Population Commission, 2006). Between 1991 and 2006, the study area observed an increase in population of 114, 160.

Lokoja LGA of Kogi State comprises of many indigenous ethnic groups such as the Hausa, Egburra, Nupe, Kupa, Kakanda, Ganagana, Oworo and Bassa.

Methodology

The data used were the mean minimum temperatures (^{o}C) and relative humidity (%) at 0900 hours of Lokoja LGA from 1971 – 2010 (40years) obtained from the Nigerian Meteorological Agency, Oshodi, Lagos. The temperature data were subjected to analysis using the Statistical Package for the Social Sciences other wise called Statistical Product and Service Solutions (SPSS) 16.0 version to obtain mean, minimum, maximum, skewness, skewness std error, kurtosis, kurtosis std error, significant level, Pearson correlation coefficient (r), deviation from mean, variance, standard deviation (std) and range, while the coefficient of variability (CV) was calculated using the formula:

$$\frac{\bar{X}}{SD} \times \frac{100}{}$$

Where:

$\bar{x}$ = mean

SD = standard deviation

100 = percentage

On the other hand, the relative humidity data (%) were used to calculate the lowest and highest annual and long – term mean as well as the lowest and highest decadal values. The results are shown in graphs and tables, while discussion of results was done with useful suggestions offered.

Results and Discussion

According to the results, the lowest annual mean minimum temperature in the study area occurs in December (19.37^{o}c), while the highest occurs in March (25.55^{o}c). The mean annual range is 6.18^{o}c which indicates moderate variability of mean minimum temperature. Figure 1 shows the mean annual minimum temperature (^{o}c) and relative humidity (%). The graph shows an increasing temperature from January to March with a little decline in April following the onset of the rains and continues to decline as the rains become more regular and intense until October when it increases a little due to the cessation of the rains and starts declining from November due to the advent of harmattan until it gets to its lowest ebb in December when harmattan becomes more intense. Both the mean annual and long term mean is 22.85^{o}c. On the other hand, the lowest relative humidity is observed in February (59.20%), while the highest is recorded in September (81.63%). Therefore, annual mean minimum temperature (^{o}C) has no positive impact on the annual mean relative humidity (%) at 0900 hours.

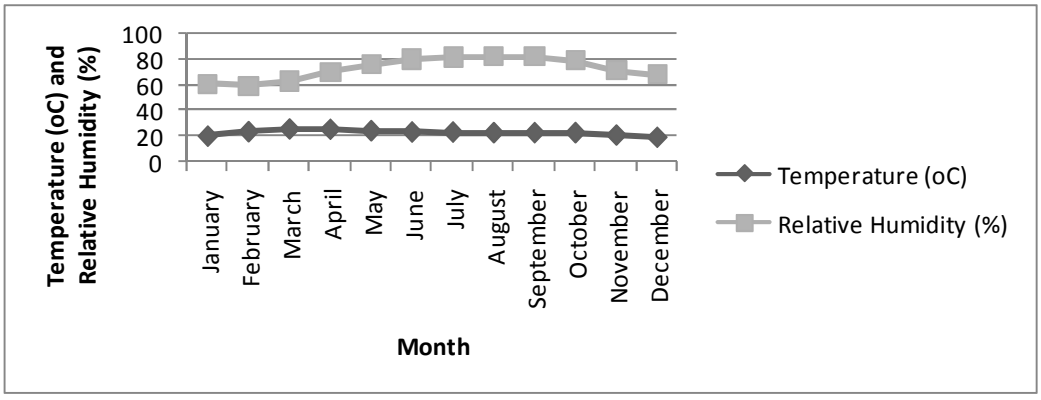

Figure 1: Mean annual minimum temperature (^{o}c) and Relative Humidity (%) of Lokoja from 1971 – 2010

Source: Authors' computation (2013) from NIMET data

Further, the long term lowest mean minimum temperature is about 21.38^{o}C recorded in 1989, while the highest is 24.26^{o}C and occurred in 2001. The long term range is as small as 2.88^{o}C which indicates low variability over a long period of time. The linear trend also confirms that for the greater part of the year, temperature is above the trend.

The variance is 0.33, std is 0.57; skewness is 0.092; skewness std error is 0.374; kurtosis is 0.534; kurtosis std error is 0.733; CV is 2.45%; the correlation coefficient (r) is 0.47 meaning medium relationship and 2 – tailed significant (at 0.01 level) is 0.002. The model summary results show that r is 0.47; r^2 is 0.22; adjusted r^2 is 0.20 and std error of the estimate is 10. 466. These values are small so confirmed medium variability in the mean minimum temperature of the study area. Figure 2 confirms low variability over time series with a decline in 1989 when the long term lowest mean was recorded and a peak in 2001 when the highest was recorded. Again, from 1971 to1989, temperature values were mostly between 22^{o}c and 23^{o}c; but from 1990, the values were between 22.5^{o}c and 24^{o}c except for the sharp decline in 2007. There is also an upward trend in long term mean minimum temperature mostly from 1991 to 2010 attributable to human activities which are on the increase. The relative humidity (%) attributes show that 1992 recorded the lowest of 62.33%, while 2009 recorded the highest of 76.50 (%). These analyses have also shown that the long term mean minimum temperature (^{o}C) has no positive influence on the relative humidity (%) at 0900 hours over the study.

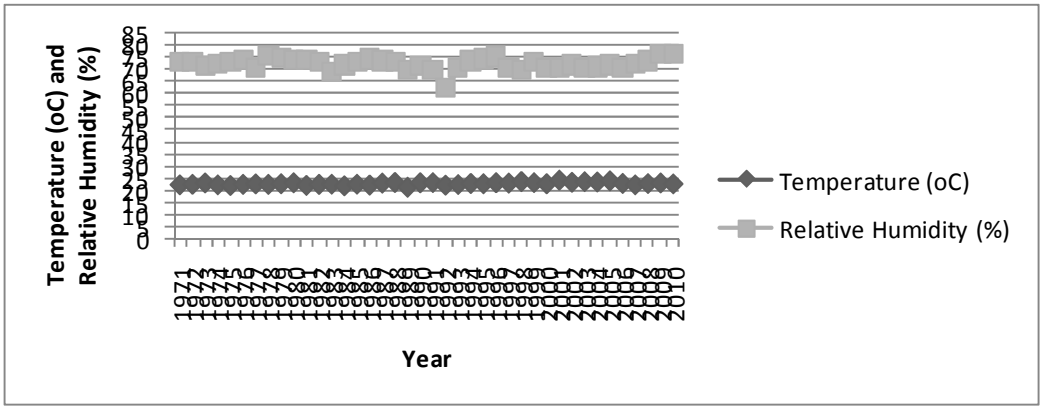

Figure 2: Time series of mean minimum temperature (^{o}C) and relative humidity of Lokoja, 1971 – 2010

Source: Authors' computation from NIMET data.

The annual deviation from mean temperature shows that March has the highest positive value of 2.69^{o}C meaning that, it is the hottest month; October's value is 0^{o}C meaning indifference; while December has the lowest negative value of -3.49^{o}C signifying the coldest month considering only the mean minimum temperature. On the other hand, the relative humidity shows that September has the highest positive deviation from mean while February has the lowest (Figure 3). Hence, there is no positive relationship between these two (2) variables.

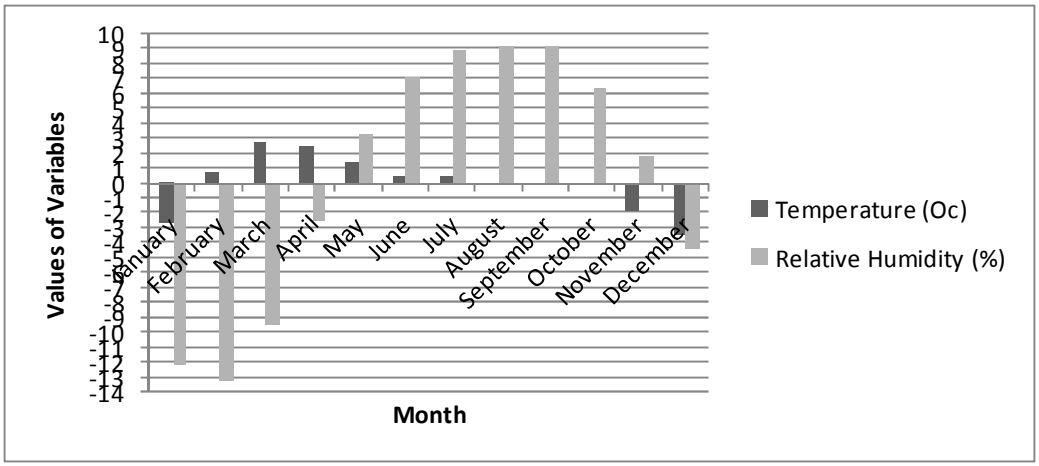

Figure 3: Annual Mean Temperature Deviation from Mean in Lokoja, 1971 – 2010
Source: Authors' computation from NIMET data

The highest temperature (^{o}C) long – term negative deviation from the mean which is -1.48^{o}C was recorded in 1989, while the highest positive deviation of 1.40^{o}C was recorded in 2001. From these two (2) values therefore, the value for the highest negative deviation from mean is higher by -0.08^{o}C than the highest positive deviation. Further, within the series, twenty – two (22) years had negative deviation from the mean, while eighteen (18) years had positive deviation from the mean. Also, years of negative deviation from mean seems to occur in sequence in most cases but broken by positive deviation. In other words, the negative and positive deviations occurred alternately over few years depicting variability in mean minimum temperature (Figure 4). From 1994 to 2010, the deviation is mostly positive. For instance, out of seventeen (17) years (1994 - 2010), thirteen (13) years experienced positive deviation from the mean while only four (4) years had negative deviation. On the other hand, the highest long term negative deviation from mean for relative humidity occurred in 2009 with the value of 4.01%, while the lowest occurred in 1992 with the value of -10.16%. Within the forty (40) years of study, only 1977, 1983, 1984, 1989, 1992, 1993, 2000 and 2007 recorded negative deviations in both variables, but even at that; the values are not close at all. Further, 1978, 1980, 1987, 1994, 1995, 1996, 1999 and 2009 recorded positive deviations in both variables and again the values are not close. Other years have their positive and negative deviations differently with their values varying considerably. This again confirms that the minimum temperature of the study area has no positive influence on it's the relative humidity at 0900 hours.

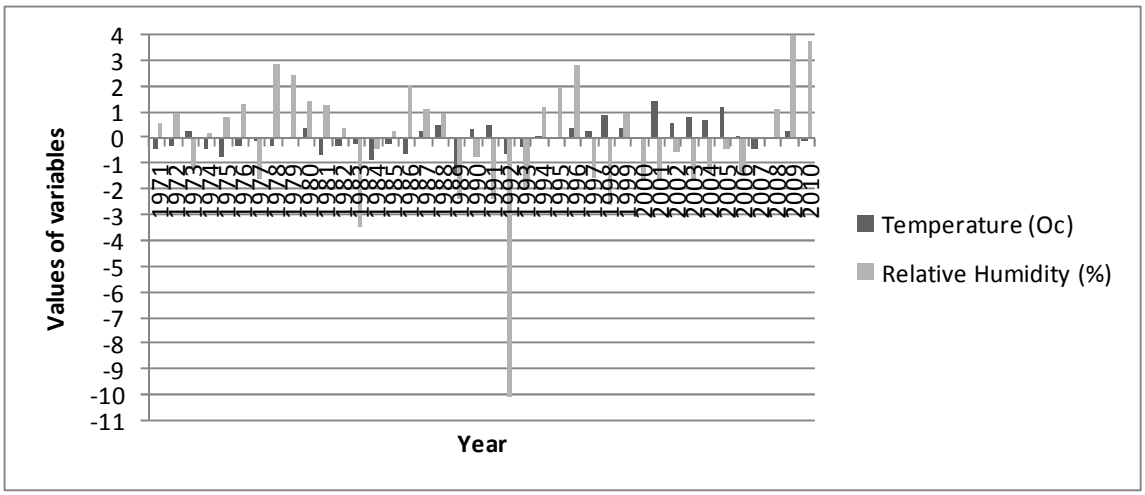

Figure 4: Long – term deviation from mean Temperature (^{o}C) and Relative Humidity (%) of Lokoja, 1971 2010.
Source: Authors' computation (2013) from NIMET data

Table 1: Mean Decadal Minimum temperature (^{o}C) and Relative Humidity at 0900 hours for Lokoja, 1971 - 2010

Decade	Range	Temperature (^{o}C)	Relative Humidity (%)
1st	1971 – 1980	22.65	73.23
2nd	1981 – 1990	22.51	72.38
3rd	1991 – 2000	22.98	71.13
4th	2001 - 2010	23.29	72.63

Source: Authors' computation (2013) from NIMET data

From table 1, it could be observed that the decadal mean minimum temperature is increasing especially from the 3nd decade which is attributable to human activities such as rapid urbanization, heavy vehicular movement, diminishing vegetation, massive road construction among others occasioned by the creation of Kogi State in 1991 with Lokoja as the Capital. The highest decadal mean temperature was recorded in the 4th decade, while the lowest occurred in the 2nd decade. On the contrary, the highest decadal mean relative humidity was recorded in 1st decade, while the lowest was recorded in 3rd decade.

Conclusion

In conclusion, it has been established that the mean minimum temperature (^{o}C) of Lokoja LGA, Kogi state, does not have any positive impact on the mean relative humidity (%) at 0900 hours because both the increases and decreases recorded in both variables occurred at different times.

Recommendations

The increase in temperature across Nigeria is expected to influence weather variables. Hence, it is highly recommended that further researches should be conducted on the impact of mean maximum temperature (^{o}C) of the study area on the mean relative humidity (%) 1500 hours to observe if there is any positive relationship. Also, studies should look at the influence of mean temperature of the study area and its impact on the mean relative humidity. It is only through this holistic approach that a perfect conclusion can be drawn on which components of temperature has positive impact on relative humidity.

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STUDIES ON CHEMICAL COMPOSITION AND STORAGE STABILITY OF CUBED *Okpehe*

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Abstract
Prosopis africana seeds were fermented (*okpehe*) and cubed (whole and ground) with the addition of 20% corn starch as a binder. The chemical composition of the products was studied for a period of 4 weeks. The proximate composition, pH, Titratable acidity (TTA), sensory assessment and total bacterial count were studied. The proximate composition of whole and ground cubed *okpehe* decreased slightly with increase in the storage period. Whole cubed *okpehe* had a range of (11.90 - 11.96%) for moisture content, (33.12 - 33.17%) for protein, (14.11 - 14.19%) for fat, (3.94 - 3.99%) for fibre, (2.67 - 2.71%) for ash and (33.98 - 34.26%) for carbohydrate, while ground cubed *okpehe* had a range of (10.52 - 10.55%) for moisture content, (32.52 - 32.56%) for protein, (12.39 - 12.44%) for fat, (3.74 - 3.78%) for fibre, (2.58 - 2.62%) for ash and (38.05 - 38.75%) for carbohydrate. Generally, ground cubed *okpehe* had relatively lower pH and TTA values than whole cubed *okpehe*. Bacterial count ranged between (4.6 - 4.8×10^4) cfu/g) and (4.5 - 4.6×10^4 cfu/g) for whole and ground cubed *okpehe* respectively. Sensory evaluation revealed that whole cubed *okpehe* was more preferred since it had higher ratings for aroma, appearance, texture and overall acceptability than ground cubed *okpehe*. This study has shown the possibility of improving the quality and extending the shelf life of *okpehe* through cubing for increased utilization.

Keywords: *okpehe*, fermentation, cubing, chemical composition, stability

Introduction
Okpehe is a condiment derived from the fermentation of *Prosopis africana* seeds (Balogun and Oyeyiola, 2012). It is popular among the Igala people as *okpei* (Musa *et al.*, 2011) and Idoma people as *okpehe,* both of North Central Nigeria. The trees of *P. africana* are found growing in Northern, Eastern and Southern parts of Nigeria (Aremu *et al.*, 2006). The seeds are one of the lesser-known legumes used as food condiments (Oguntoyinbo *et al.*, 2010). Balogun and Oyeyiola, (2011) reported that the condiment can serve as a low-cost source of protein especially for the rural populace. They serve not only as nutritious non-meat protein substitutes, but also as flavor enhancers in soups and other dishes (Achi, 2005).

Literature abounds on the processing of *Prosopis Africana* seed into *okpehe*. Balogun and Oyeyiola, (2012) reported changes in the nutrient composition of *okpehe* during fermentation, with the essential amino acid profile of the fermented seeds increasing steadily throughout the period of fermentation. Calcium, iron and copper contents also increased while potassium and manganese decreased. *Bacillus subtilis, Bacillus licheniformis, Bacilus megatarium, Bacillus pumilus, Staphylococcus aureus, Escherichia coli and Saccharomyces cerevisiae* were all isolated during the fermentation of *P. africana* seeds (Balogun and Oyeyiola, 2011). Although residual fungal contaminations were present during the fermentation of *P. africana* seeds, there was no risk associated with its consumption (Musa *et al.*, 2011).

Protein malnutrition is a major problem in many parts of Africa and productions of fermented vegetable proteins have been used in recent times to increase the protein intake of many people particularly the rural dwellers because it is cheaper than animal proteins. Despite research efforts to increase the utilization of *P. africana* seed in a variety of ways, there is paucity of information on the cubing of *okpehe*. Therefore this study was carried out to evaluate the effect of milling on quality parameters of cubed *okpehe* stored for 4 weeks at ambient temperature.

Materials and Methods

Fresh matured fruits of *P. africana* seeds were obtained from the Main campus of the University of Ilorin, Ilorin, Nigeria and identified at the herbarium of the Plant Biology Department of the University of Ilorin.

Fermentation process

The hot plate method described by Balogun and Oyeyiola (2011) was adopted for the preparation of *okpehe*. The seeds were removed from the fruits by beating the fruits with a club on a concrete surface to break the tough fruit coats. Subsequently the seeds were obtained from the pod. One thousand grams of seeds were boiled at 100^{o}C for 6hrs in a stainless steel pot on a hot plate until the seed coat became soft and the seeds swollen. Seeds were allowed to cool and the seed coat removed by pressing them between the palms. Clean cotyledons were rinsed with sterile water and cooked on the hotplate set at 60^{o}C for 30 minutes. Cooked seeds were drained through a sieve, wrapped with pawpaw leaves (disinfected with 70% alcohol and rinsed with sterile water). The seeds were covered in three layers of sterile aluminium foil and left for 72 hrs in the laboratory at ambient temperature (28±2^{o}C).

Cubing Process

Preliminary studies revealed that for every 100 g portion of *okpehe*, 20g of binder (corn starch) was appropriate. The fermented seeds were divided into two portions. The first portion was milled (ground) while the other portion was not milled (whole). Corn starch (25g) was weighed into 125ml of boiled distilled water at 95 ± 5^{o}C the mixture was then stirred thoroughly for 10 minutes until homogenous paste was obtained. The corn starch paste was added to the samples, mixed thoroughly with string rod to obtain the final products of the samples which were then transferred to the Department of Agricultural Engineering, University of Ilorin for cubing. The cubed samples (ground and whole *okpehe*) were further dried in the oven at 60^{o}C for 24 hrs and stored in aluminium foil (28±2^{o}C) for a period of four weeks. Storability test was carried out at an interval of one week for four weeks.

Quality Evaluation

Chemical Analysis: pH, titratable acidity, moisture, crude protein, ash, crude fat, crude fibre and carbohydrate contents were determined using methods described by AOAC, (2000).

Total Bacterial Count: The total bacterial count of the ground and whole cubed *okpehe* was determined using methods described by Fawole and Oso (2004).

Sensory Evaluation: A semi-trained twenty member panel consisting of students and staff of the University of Ilorin who are accustomed to the consumption of *okpehe* was selected for sensory evaluation. The panelists were instructed to evaluate the coded samples for taste, aroma, appearance, texture and overall acceptability. Each sensory attributes was rated on a 9-point hedonic scale (1 = dislike extremely while 9= like extremely) (Iwe, 2007).

Statistical Analysis

Data were analyzed by analysis of variance using statistical package for social sciences (SPSS). The difference between mean values was determined using Duncan's multiple range test. Significance was accepted at 5% probability level. Data reported are average values of duplicates

Results and Discussion

Proximate Composition: The proximate composition of whole and ground cubed *okpehe* as affected by storage period is presented in Table 1. The proximate composition of the samples was influenced by storage time. Protein content of both whole and ground *okpehe* decreased slightly with storage period. The protein content of both whole (33.17%) and ground (32.56%)

okpehe at 0 week of storage were lower than values (36%) reported by Gberikon *et al.*, (2010) for *okpehe* produced during a 118hrs fermentation period and Balogun and Oyeyiola, 2011 (38.40%) for *okpehe* produced during a 72hrs fermentation period. This observed difference may be attributed to the use of starter cultures by those researchers. The use of starter cultures may account for better protein profile of fermented *P. africana* seeds since it has been reported as the best approach for obtaining a safe product with better nutritional and sensory properties (Ouoba *et al.*, 2007).

Similarly, the ash and carbohydrate contents of whole and ground cubed *okpehe* were lower while crude fat and crude fibre contents were higher than those reported by Balogun and Oyeyiola, (2011). The moisture, protein, fat, fibre and ash contents of the whole cubed *okpehe* were higher than that of ground cubed *okpehe*. This is due to the milling of the ground *okpehe* where some nutrients might have been lost during the processing.

Total Bacteria Count of *Okpehe:* The total bacterial count of whole and ground cubed *okpehe* is presented in Table 2. The bacterial count of whole and cubed *okpehe* obtained ranged from 4.6 to 4.8×10^4 cfu/g and 4.5 to 4.6×10^4 cfu/g respectively. The total bacterial count of whole and ground cubed *okpehe* was constant throughout the storage period until the 4^{th} week of storage. This observation suggests that the microorganisms present in the *okpehe* did not multiply during the storage period and is probably due to reduction in water activity of the samples caused by drying. The slight reduction noticed at the 4^{th} week was probably due to competition among the organisms which may arise because of the reduction in the nutrient content of the samples with time.

Titratable Acidity and pH: Figures 1 and 2 shows the changes in pH and TTA of whole cubed and ground cubed *okpehe.* Whole cubed *okpehe* had a pH range of 6.86 to 6.91 while ground cubed *okpehe* had a range of 6.70 to 6.76. The TTA values decreased from 1.21 to 1.15 for whole cubed *okpehe* and 1.35 to 1.3 for ground cubed *okpehe* as the period of storage increased. Although the pH and TTA values did not vary significantly ($p\leq0.05$), ground cubed *okpehe* had relatively lower pH and TTA values than whole cubed *okpehe*. This is probably due to the effect of increased surface area which may have led to the loss of some of the volatile acids produced during fermentation.

Sensory Evaluation: The mean sensory scores for whole and ground cubed *okpehe* are presented in Table 3. There were significant differences ($p\leq0.05$) between whole and ground cubed *okpehe* for all sensory parameters measured except for taste. Whole cubed *okpehe* had higher ratings for aroma, appearance, texture and overall acceptability than ground cubed *okpehe*. The higher ratings observed for whole cubed *okpehe* may be due to the fact that flavor compounds produced during the fermentation period were better retained in the whole cubed *okpehe* than the ground cubed sample due to higher surface area in the latter. This finding corroborates previous observations from sensory assessment of condiments as panel members and consumers prefer to have the condiments in the soup in the whole form rather than when milled.

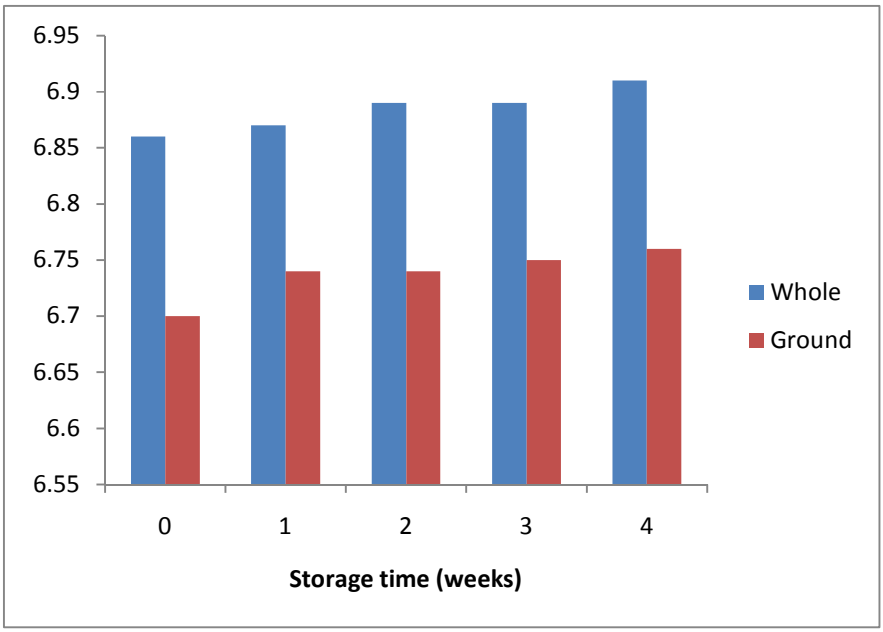

Figure 1: Changes in pH during storage of whole and ground cubed *okpehe*

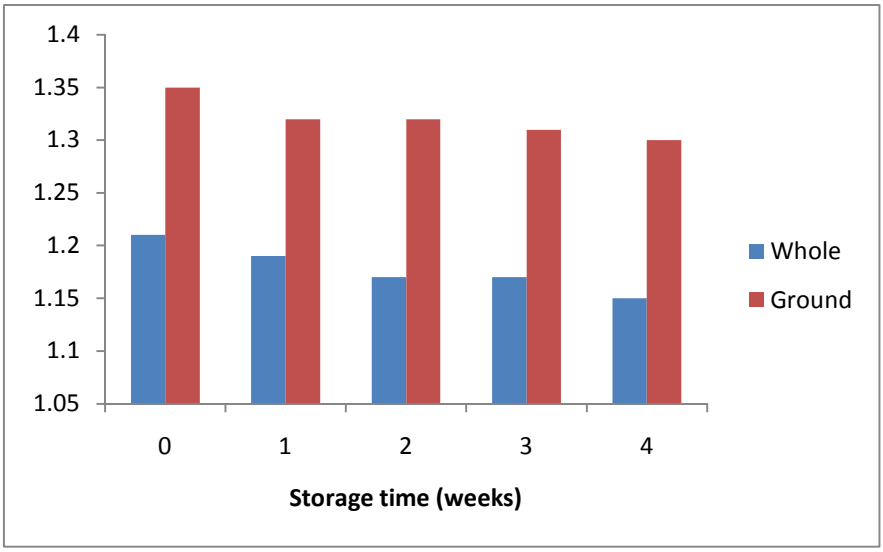

Figure 2: Changes in titratable acidity during storage of whole and ground cubed *okpehe*

Table 1: Proximate Composition (on wet basis) of Whole and Ground Cubed *okpehe*

Storage time (weeks)	Moisture (%)		Protein (%)		Fat (%)		Fibre (%)		Ash (%)		CHO(%)	
	Whole	Ground	Whole	Ground	Whole	Ground	Whole	Ground	Whole	Ground	Whole	Ground
0	11.96±0.5^{a}	10.55±0.1^{a}	33.17±0.1^{a}	32.56±0.1^{a}	14.19±0.5^{a}	12.44±0.5^{a}	3.99±0.5^{a}	3.78±0.1^{a}	2.71±0.1^{a}	2.62±0.1^{a}	33.98±0.1^{a}	38.05±0.5^{a}
1	11.95±0.5^{a}	10.54±0.1^{a}	33.15±0.5^{a}	32.55±0.1^{a}	14.19±0.1^{a}	12.44±0.1^{a}	3.98±0.5^{a}	3.77±0.1^{a}	2.70±0.1^{a}	2.61±0.1^{a}	34.03±0.1^{b}	38.09±0.5^{a}
2	11.94±0.5^{a}	10.53±0.1^{a}	33.15±0.1^{a}	32.55±0.1^{a}	14.17±0.1^{a}	12.42±0.1^{a}	3.97±0.1^{a}	3.76±0.1^{a}	2.69±0.1^{a}	2.60±0.1^{a}	34.08±0.5^{c}	38.14±0.1^{b}
3	11.91±0.5^{ab}	10.52±0.1^{a}	33.13±0.1^{ab}	32.53±0.1^{b}	14.12±0.5^{b}	12.41±0.1^{ab}	3.96±0.5^{ab}	3.75±0.1^{a}	2.68±0.1^{ab}	2.59±0.1^{ab}	34.15±0.1^{d}	38.20±0.1^{c}
4	11.90±0.5^{b}	10.52±0.1^{a}	33.12±0.5^{b}	32.52±0.1^{b}	14.11±0.5^{b}	12.39±0.1^{b}	3.94±0.5^{b}	3.74±0.1^{b}	2.67±0.1^{b}	2.58±0.1^{b}	34.26±0.1^{e}	38.75±0.1^{d}

Means with the same superscript along a column are not significantly different ($p \leq 0.05$)

Table 2: Total Bacteria count of Whole and Cubed *okpehe*

Storage time (weeks)	Bacteria Count (Cfu/g) x10^{4}	
	Whole	Ground
0	4.8	4.6
1	4.8	4.6
2	4.8	4.6
3	4.8	4.6
4	4.6	4.5

Table 3: Mean Sensory Scores of Whole and Cubed *okpehe*

Samples	Taste	Aroma	Appearance	Texture	Overall Acceptability
Whole	5.5^{a}	6.2^{a}	6.2^{a}	6.4^{a}	6.1^{a}
Ground	5.5^{a}	6.1^{b}	6.0^{b}	5.9^{b}	5.7^{b}

Means with the same superscript along a column are not significantly different ($p \leq 0.05$)

Conclusion

Results from this study have shown the potential of producing whole and ground cubed *okpehe* from *P. africana seeds* with comparable quality attribute with other food condiments. Similarly, this study provided an alternative way of improving the quality and shelf life of o*kpehe.* Based on the results obtained from the proximate composition and sensory evaluation, whole cubed *okpehe* is therefore recommended.

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STRATEGIC COLLECTION DEVELOPMENT MANAGEMENT FOR EFFECTIVE INFORMATION DELIVERY

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Abstract
This study explored strategic collection development management for effective information delivery. It detailed the theoretical framework for collection development and collection policy. It presented strategies to actualize collection development viz: budgeting, selection of library information resources, assessment, preservation and conservation. It recommended collection development to be a planned, continuous cost effective activity to meet the need of users and corporate objectives of libraries and their parent institutions.

Keywords: Library Automation, Universities, Appraisal, TIN LIB Software, Nigeria

Introduction
Different kinds of libraries have different objectives, but all exist to provide the services, which users need. Library exists only for the satisfaction of users needs, which may include usefulness and comprehensiveness, currency, speed, validity, practicality and effectiveness (Bhatti, 2013). Libraries acquire and preserve the knowledge that is available in different documentary formats-printed and electronic forms. Contemporary libraries are concerned with provision of information/documents to satisfy the demands/requirements of users (Adomi, 2008).

Library resources, services, and operations have been greatly influenced by rapid technological innovations over the years. The way information is disseminated, captured, collected, stored and transferred has provided a new impetus to library functions and services (Saddiqui, 2003, and Adomi 2008.) The wide adoption of computers and the Internet as tools for communication requires libraries to adapt to new demands from their users to make collection accessible from outside the Library building (Mutula and Makando, 2003). With developments in Information Technology (IT), Libraries can now provide broad access to global information and become less dependent on printed collections (Edem, Ani1, & Ocheibi,2009). Adomi (2008) and Haddow (2013) posit that Libraries must be able to be an “access organization” providing access to an array of information resources. This means having access as the right of use and not ownership of the resources.

Operational Definitions
Strategy: Strategy refers to the formulation of basic organizational missions, purposes and objectives; policies and programme strategies to achieve; and the methods needed to ensure that strategies are implemented to achieve organizational ends (Robson, 1997). In other words, strategy is the pattern or plan that integrates an organisation's major goals, policies and actions sequences into a cohesive whole.

Literature Review
Collection development is one of the fundamental functions of the Library and Information Profession. It involves selection and acquisition of information resources that will enable Library and Information Practitioners to perform their myraid functions to the users effectively (Aina, 2004). Corroborating Aina (2004), Olaojo and Akewukereke (2006), averred that collection development includes everything that goes into acquiring materials which includes selection, ordering and payment. Collection development serves as a foundation upon which other Library services are built. It is a planned, systematic development of a collection based on the objectives of the Library. Collection development and collection management are terms that have often been used almost synonymously though they differ. Distinguishing between collection

development and collection management, Singh (2004) posits that collection development involves the selection and acquisition of Library materials. Considering users current needs and future requirements; while collection management is much more than collection building alone. It involves managing the use of the collection, its storage, Organisation and making it accessible to Library users.

Pryterch (2000), sees collection development as the process of planning a stock acquisition programme not simply to cater for immediate needs but to build a coherent and reliable collection over a number of years; to meet the objectives of the services; the term demands a depth and quality of stock and includes related activity towards exploitation of the collection through publicity. Emphasizing the element of exploitation of Library stock, Adewuyi (2005) posits that while collection development places emphasis on just ownership of information material, collection management goes beyond that by placing emphasis on effective exploitation of information materials.

It is clear from the foregoing concepts that collection management is more embracing than collection development. Collection development is concerned with planning for acquisition through users assessment and design of collection development policy, as well as selection and acquisition of information resources to meet the needs of the users community. On the one hand, while collection management incorporates these activities of collection development, organizes, and maintains Library information resources. It is therefore more appropriate to use the terms “Collection development” and management together.

Meneses (2005), states that collection development and management involve development policies, users' needs assessment, selection of information materials, acquisition, collection evaluation and assessment, de-selection or weeding, intellectual freedom, conservation and preservation of Library and information resources. Basically, this paper focuses on these issues in discussing Strategic Collection Development/Management for Effective Information Delivery.

Theoretical Framework for Collection Development

The theoretical framework for collection development in Libraries is based on Ranganathan's five laws of library science, namely:

- Books are for use
- Every book its reader
- Every reader his books
- Save the time of the user
- A library is a growing organism

Service is the major philosophy on which library and Information Science is premised and the attendant accessibility of relevant educational materials. Consequently, Ranganathan's laws (1964) are germane to the provision, accessibility and use of information materials in Nigerian University Libraries (Ogunrombi, (2005).

Strategies for Actualizing Virile Collection Development/Management:

To actualize virile collection development/management, adequate collection development policy needs to be attainable. A collection development policy establishes ground rules for planning, budgeting, selection, and acquisition of library materials. These factors provide the framework for coordinated collection development programme in libraries. Collection development policy helps the library to serve the user community better (Olaojo and Akewukereke, 2006). Collection development policy explains the content and intent of collection development which include the definition of the scope of a library's existing collections, plan for the continuing development of resources, identify collection strengths, weaknesses, and outline the relationship between selection philosophy and the institution's goals, general selection criteria, and intellectual freedom (The American Library Association, 1987; IFLA, 2001; and Arizona State library, Archives and Public Records, 2003). Accordingly, collection development policy guides libraries

on issues and processes of selecting information materials to satisfy users needs. It also provides criteria for monitoring and evaluating the effectiveness of a developed collection, in meeting the needs of the library patrons. It spells out issues related to content of the collection, format, responsibility for selection and acquisition of library information resources. A collection development policy should not only concern itself with selection, planning, public relations and cooperation and resource sharing (consortia); it should also address the following elements to be effective:

- Community profile
- Community Needs Assessment
- Collection Goals
- Selection Responsibility
- Selection Criteria.
- Acquisitions
- Collection Evaluation and Assessment.

It is imperative to have a written policy. A clear acquisition policy should be formulated in line with the objectives of the library and needs of the users.

Adequate budgeting is another factor for strategic collection development/management for effective information delivery. Collection development is a function of funds. This means that library can only build its collection based on available funds. According to Stacey (1993), strategy implementation is held to depend upon an effective budgeting system. The budget converts strategy into a set of short-term action plans and sets out the financial consequences of those action plans for the year ahead. For a library budget especially in relation to collection development to be successful, it must be directional and must be based on a plan so that there is value for the money spent. Money available for collection development is always limited and heads of libraries go cap in hand to the chief executives of their institutions or establishment, almost on their knees to ask for more funds. Acquisitions/Collection development should not be at the mercy of heads of institutions. Therefore realistic budget should be made for collection development in libraries if they (libraries) must procure, organize and make available to their numerous users both current and adequate information resources.

Another factor necessary for strategic collection development/management is selection of library information resources. The selection of library stock should obviously reflect and be geared towards the information needs of the users. These library/information service-be they the general public, the staff and student of an academic institution, the members of the professional body etc. Bakewell (1997) opines that in order to qualify for purchase, a book must (a) be relevant to the organization's interest, (b) fill a gap in coverage or provide a significant extension of current knowledge.(c) justify its cost, bearing in mind such matters as the importance of the item, size, price, state of the budget etc. According to Bakewell (1997) those who select should consider such criteria as accuracy, clarity of expression, board coverage and appeal when evaluating those materials. In the case of academic libraries, selection should be based on the courses offered in the institution and the needs of staff and student, not forgetting part-time students.

Furthermore, acquisitions of information materials are another factors necessary for strategic collection development/management for effective information delivery. Acquisition is the implementation of selection decisions: ordering, receipt, and payment. These must be done according to a procedure that is guarded by the collection development policy (Olaojo and Akewukereke, 2006) Acquisition forms a vital link in the circle of publishing, selection, request and providing materials for use. The imperatives for acquisitions staff are to acquire information materials as quickly and as economically as possible, while offering an efficient and responsive service.

Acquisition and collection development focuses on methodical and topical themes pertaining to the acquisition, purchase, de-selection of print, other traditional format of library materials (by purchase, gift, exchange, legal deposit), and electronic information resources. Specialized interests include collection development policies, collection development methods, techniques and practices for collection assessment, usage statistics, and pricing ownership vs. access issues, the open access, format duplication, scholarly communication and librarian relations with publishers and vendors. As access to materials becomes an increasingly viable, alternative to ownership, acquisition staff should work closely with serials, cataloguing and circulation section, and any advisory committees that facilitate discussions between libraries and publishers and/producers of electronic resources. Of critical importance to acquisition department should be cooperative collection development (consortia) and application of information technology (IT) to acquisition and collection development process. In formulating its goals, the acquisition section should be flexible and responsive to changing condition in the professional environment as well as in the information industry (IFLANET, 2006).

The Internet and Acquisition in Libraries is another factor in strategic collection development/management for effective information delivery. The internet, especially its graphical world wide web (www) has become one of the most potent tools of information storage, retrieval and dissemination of information in the contemporary society (Adewuyi 2005). Access to Internet includes electronic mail (email), UseNet, www, remote login (telnet), file transfer protocol (FTP), online chat and e-conferencing, which provides those connected to it with an unprecedented amount of information that can be used to their advantages. The information on the net is seemingly limitless as massive volume of information is added to it every day. As information providers, libraries of all types, and documentation and information centers should be the main beneficiaries of the massive amount of internet resources that can be used to noticeably enhance the quality of services and at the same time to save time and money. Internet enhances library cooperation's and services, especially when budget cut by many parent bodies or institutions, fluctuations in exchange rate of currencies, and rapidly growing cost of periodicals; and on the contrary, information needs of users are increasing and diversified. In addition, information explosion has become a dilemma for libraries as they need to be more selective than to be comprehensive when acquiring library resources (Adomi, 2008; Hundie, 2003)

The Online Public Access Catalogue (OPAC) that is gradually replacing the traditional Card Catalogue has been appreciated as the easiest and most effective way of communicating Library stocks to users. Webb and Grimwood (2004), stated that if “Information is to be a widely available resource, it must be organized so that it is easily accessible physically without too many imposed restraints”. Ifidon (1997) earlier postulated that “beautiful buildings, well trained staff and modern information storage and retrieval system can only be appreciated if excellent services are given to users. These services cannot be given without live collections”. This means that a live collection is the one that has been procured, processed, organized and maintained.

Collection Assessment is another factor for strategic collection development/management for effective information delivery. It is not enough to procure, process and organize information resources for meeting the needs of users, it is imperative to periodically assess library resources to determine their relevance and utility now. According to the Arizona State Library, Archives and Public Records (2003), collection assessment (also known as collection evaluation) is an organized process of analyzing and describing a library's collection systematically. It is the assessment of the extent to which a collection meets the library's objectives. As professionals, librarians should try to build and maintain collection development goals that are appropriate for their information seekers. Agee (2005) sees collection assessment as one important measure of collection development and management. As important as this function is in libraries, Librarians are hardly engaged in it. How else do librarians ensure that they are building useful collections that would provide a good return on their financial investments (Adomi, 2008).

Weeding of resources is another factor for strategic collection development/management for effective information delivery. Weeding has to do with the process of removing unwanted materials from the shelves for either discard or relegation to remote storage. This is an important element of collection management that ensures that library resources are useful and easily accessible to information seekers. This exercise is vital considering the fact that community needs and goals change, institution's curriculum or the faculty changes and large parts of the collection may fall into the seldom used category (Adomi, 2008). The analysis and evaluation of the collection as a whole emphasizes the necessity of weeding the collection systematically to keep it responsive to patron's need (Buckinghan, 1994). Librarians should weed their collection frequently, if the library will not soon become the burial ground for old textbooks, and other items patrons' no longer find useful. Chikezie (2003) identifies problems of collection development in libraries to be poor funding, the tyranny of distances, high prices of library materials, poor accommodation facilities, negative actions of readers, and high illiteracy rate.

Similarly, intellectual Freedom and Access is another factor for strategic collection development/management for effective information delivery. Hannabuss and Allard (2001) asserted that the wider issue is that of intellectual freedom and access, and the role of information work and of libraries. The American Library Association (ALA) (2005) states that freedom of expression is an inalienable human right and the function for self government, freedom of expression encompasses the freedom of speech and corollary right to receive information, that libraries and librarians protect and promote these rights by selecting, producing, providing access to, identifying, receiving, organizing, providing instruction in the use of, and preserving recorded expression irrespective of the format or technology (IFLA, 2003). The major challenge for the libraries and information profession is commitment to intellectual freedom and adherence to the principles of intellectual freedom, unrestricted access to information and freedom of expression and to recognize the privacy of library user. Any attempt by a member of the community to remove resources from a library's Collection or to restrict access to them is a challenge to intellectual freedom which the library should vehemently discourage.

Preservation and conservation of Library Resources is another factor for strategic collection development/management for effective information delivery. The very core aspect of collection development and management is conservation and preservation of information resources. Library and Information resources are undoubtedly very expensive, thus, there is need to ensure that they are always in good condition (Aina, 2004 Adomi 2008). Otherwise, it will be a great waste of time and fund to select and acquire materials without taking adequate and proper steps to ensure their longevity.

Trinity College Dublin (2007) and Chester Beatty Library (2007), argued that preservation activities are those aimed to minimize deterioration or prevent changes to the collection. This includes buildings maintenance, environmental control, providing safe storage, security, handling skills training, exhibition conditions, and disaster preparedness planning. One of the main goals of the library is to make its collections available for use by eligible users. This must be balanced at all times with the need to ensure the preservation of the resources.

Conclusion

Collection development is not an adhoc activity, rather is a planned, continuous, and cost-effective acquisition of quality, relevant materials to meet the information needs of users and the corporate objectives of libraries and their parent institutions. Collection development is not only growth in volumes and titles but in the quality of acquired materials in enhancing effective information delivery. It is only from this perspective that the word “development” could be meaningful in relation to collection development.

Recommendations

To have live, virile and responsive collection, the following are recommended:

(i) Libraries should insist on having a written and functional acquisition policy in libraries;
(ii) Libraries should also be proactive in ordering library materials continuously without necessarily waiting for things like accreditation exercise to embark on fire brigade approach to acquisitions.
(iii) Efforts should be made by heads of libraries to refuse to be intimidated but overcome any social, political, economic and environmental factors.
(iv) Due process principles should be well defined by library managers in relation to collection development to avoid unnecessary bottlenecks and delays;
(v) Libraries should educate the parent institutions that library automation and Internet connectivity is of high priority for all types of libraries;
(vi) Libraries should emphasise training and re-training is of utmost importance with regard to resource sharing (consortia), therefore strengthen the committee of University Libraries of Nigerian Universities (CULNU) Consortium.
(vii) Nigerian Library Association (NLA) Should formulate a standard policy and ensure compliance by all academic libraries for them to enjoy increased funding;
(viii) Library Development Funds (LDF) in academic libraries should be resuscitated;
(ix) Tertiary Education Trust Fund (TETF) for book intervention should not be divested and should be timely accessed by libraries.
(x) High proficiency in acquisition processes and collection development/ management by libraries can improve the status of an academic library.
(xi) Libraries should key into parent institutions linkages/partnerships/networking for collection development.
(xii) Libraries should reach out to the Alumni Association for fund raising activities for collection building.
(xiii) Libraries should tap into Book Exhibitions to rejuvenate your library collection.

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MAPPING CONCENTRATIONS OF CARBON DIOXIDE OVER CENTRAL KUBWA, ABUJA, USING GEOGRAPHIC INFORMATION SYSTEM

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Abstract

The key concept of this study is the presentation of the CO_2 emission signature at Central Kubwa as an interactive Geographic Information System (GIS) layer. Such an interactive GIS layer would serve as an environmental audit mechanism tool to monitor compliance with regulations designed to limit greenhouse gas emissions; furthermore, such a layer should be interfaced with the existing Abuja Geographic Information System (AGIS). Over 1200 stations of interest (i.e. locations with active sources of CO_2 over any 24-hour period) were appropriately geo-referenced and marked in the conventional way, in terms of street identifiers. The stations were re-visited with the CO_2 level meter whence information about the outdoor levels of CO_2 was logged progressively from one point to the next. Majority of the locations visited for this survey indicated ambient CO_2 levels above the 450 parts per million (ppm) threshold selected for this study. Of the different sources of CO_2 identified for this survey, the petrol-powered internal combustion engines predominate. The GIS emission layer maps for this study show that the western segment of Central Kubwa is characterized by heavy red clusters, indicating a high CO_2 emission zone, whereas the red clusters are dispersed on the eastern sector, indicating a low CO_2 emission zone. This novelty GIS-enabled, Windows-compatible, interactive CO_2 map of Central Kubwa is now a veritable planning tool in the hands of environmental monitoring auditors devoted to the issue of global warming and climate change.

Keywords: Carbon dioxide, GIS, Mapping, Interactive, Layer

Introduction

Large-scale emission of anthropogenic greenhouse gases resulting in the global warming trend is the focus of attention at the moment. The main greenhouse gases are water vapour, carbon dioxide (CO_2), methane, nitrous oxide and ozone, but CO_2 is easily the rogue gas implicated in the global warming episode because it is not easily cleaned from the upper atmosphere once it released. Presently, there is no database of any greenhouse gas for any town or city of Nigeria. Since Nigeria is a signatory to several international protocols on environmental protection best practices, it is just proper that there exist a means by which information on environmental issues can be collated and disseminated. Thus, this project was designed as a follow-up to the pioneering effort specifically targeted towards creating a protocol for greenhouse gases emission studies. Such studies would necessarily be incorporated into the global warming and climate change discussion. The stations of interest selected for this study were locations with active sources of carbon dioxide over any 24-hour period.

The published literature states that mean atmospheric carbon dioxide concentration has increased from a preindustrial value of 280 parts per million (ppm) to 366 ppm in 1998 and was projected to increase at a rate of 1.5 ppm per year (Keeling and Whorf, 1999). Experimental studies growing trees in open-top chambers indicates that a 300 ppm increase in atmospheric carbon dioxide concentration stimulates photosynthesis by 60%, the growth of young trees by 73% and wood growth per unit leaf area by 27% (Norby, 1999). Furthermore, it was pointed out that it seems probable that there will be a similar response in natural forest ecosystems. Because of their intrinsic high productivity, tropical forests are a prime candidate for such a C fertilisation

response, and the crucial question has been to what extent such a response might be limited by low nutrient availability, in particular by low nitrogen or low phosphorus (Lloyd, 1999).

Aim and Objectives of Study: The aim and objectives of this study are the following:

(i) To create a GIS database on carbon dioxide at Greater Kubwa with a view to showing the spatial spread.

(ii) To contribute towards the preparation of a possible futuristic framework for a greenhouse gas emission database for Central Kubwa using the Geographic Information System (GIS).

(iii) As a result of (ii) above, the eventual inauguration of a public enlightenement programme involving environmental monitoring auditors on the prevalence of CO_2 emissions at Central Kubwa, with a view to adopting possible mitigating measures in this regard.

Area of Study: Kubwa town is a province of the Bwari Area Council of Abuja administrative territory. The area of study is about 4.64 km^2 and lies within longitudes $7^0$19.430' and $7^0$21.199' and latitudes $9^0$08.455' and $9^0$09.238' respectively. Kubwa lies in the savanna belt of central Nigeria, characterized by grassland to thick shrub vegetations and undulating topography due to proliferation of rocky outcrops. The area usually experiences an annual two-season spell, with moderate to sufficient rains from April to October and a dry clime from November through March. The soil around Kubwa area has a high coefficient of natural fertility as evidenced by the intense subsistence agriculture in the locality. For this study, satellite imagery maps of Kubwa principality have been used. Fig.1 is the QuickBird satellite map of the whole of Kubwa town showing the extent of Central Kubwa. The grid positioning of Kubwa province is shown as Fig.2.

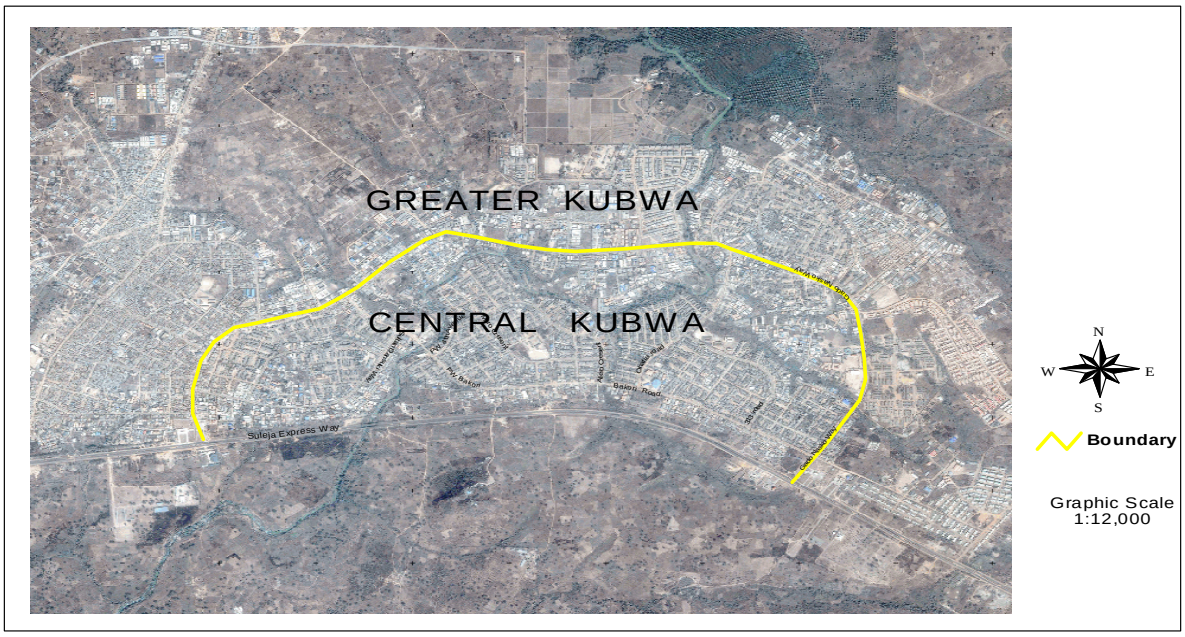

Fig.1: QuickBird satellite imagery of Central Kubwa

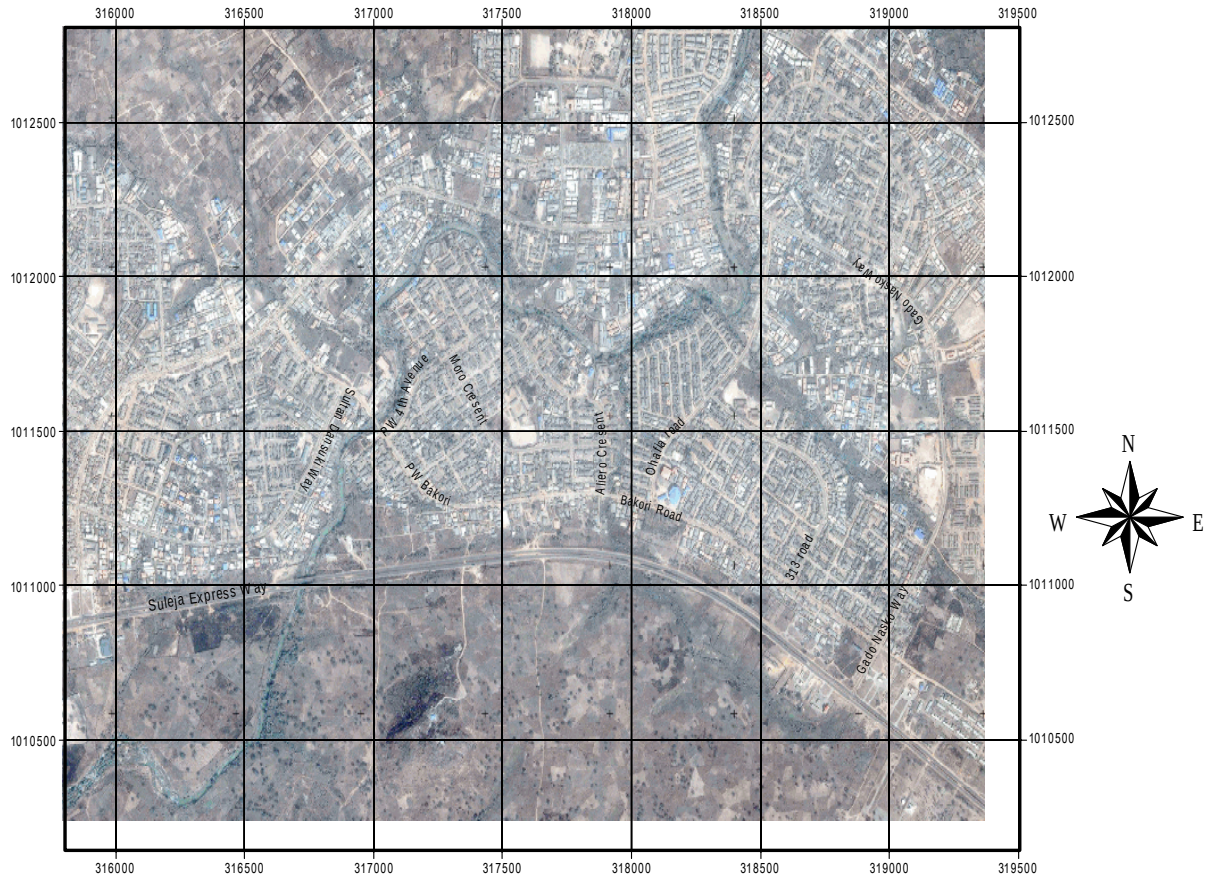

Fig. 2: Grid positioning of Kubwa province

Scope and Limitation of Study: The areal extent of Central Kubwa was covered for this project exercise. Carbon dioxide emission values were taken at 1,264 georeferenced locations and these constituted the stations of interest for this project work (see Appendix). Each of these georeferenced stations was either a household or a business premises that was defined to be an "active" emitter of carbon dioxide. "Active", as specified by the field workers, referred to any location that emitted carbon dioxide above the 450ppm value within any 24-hour period.

As is usual with studies of this nature, time and cost constraints are always impediments to full-scale coverage of any designated study area. For this study, cost implication was the most vexing issue encountered; hence Kubwa town was segmented into Greater Kubwa and Central Kubwa. Central Kubwa was covered for this exercise.

Justification: This study was carried out in order to fill the knowledge gap that is integral to understanding an aspect of the climate change issue.

Literature Review: A carbon dioxide study with a local significance was carried out by Ndoke et al (2006). They pointed out that since the beginning of the industrial revolution, atmospheric concentration of carbon dioxide has increased considerably, as well as those of other greenhouse gases. The authors noted that this increase in concentration was likely to accelerate the rate of climate change i.e. an indirect implication of global warming. The authors pointed out also that global average temperature will rise by about 2^0C (3.6^0F) by the year 2100 if current emission trend continues. CO_2 is being generated in ever increasing amount in part due to increase in the population of the earth, in part due to clearing of forests and in part to increased combustion of fossil fuels. If this increase becomes severe, it could enhance greenhouse effect, leading to

global warming trend. This warming might be enough to melt part of the polar ice caps and raise the level of the oceans.

Elsewhere, Robinson et al (1998) studied the effect of increased amount of carbon dioxide and other greenhouse gases. They postulated that the greenhouse effect amplifies solar warming of the earth. Greenhouse gases such as H_2O, CO_2, CH_4 and others in the earth's atmosphere, through combined convective readjustments and the radiative blanketing effect essentially decrease the net escape of terrestrial thermal infrared radiation. They proposed that increasing CO_2, therefore, effectively increases radiative energy input to the Earth's atmosphere. The path of this radiative input is complex. They also asserted that an increase in the atmospheric carbon dioxide leads to increased plant life.

Jacobson (2009) explained that climate-warming carbon dioxide spewed by coal-fired power plants and fossil-fuelled vehicles has been causing hundreds of premature US deaths each year over the several decades. The deaths were due to lung and heart ailments linked to ozone and polluting particles in the air, which are spurred by carbon dioxide that comes from human activities. As the planet warms due to carbon dioxide emissions, the annual death rate is forecast to climb, with premature deaths in the United States from human-generated carbon dioxide is expected to hit 1000 a year when the global temperature has risen by 1C.

Enger and Smith (2006) posited that urbanised, industrialised civilisation has dense concentration of people that use large qualities of fossil feels for manufacturing, transportation and domestic purpose. These activities release large qualities of polluting by-products (including carbon dioxide) into our environment. The authors pointed out that thousands of deaths have been directly related to poor air quality in cities and many of the megacities of the developing world have extremely poor air quality.

Tanz et al. (1990) reported that observed atmospheric concentrations of carbon dioxide and data on the partial pressures of carbon dioxide in surface ocean waters were combined to identify globally significant sources and sinks of carbon dioxide. The atmospheric data were compared with boundary layer concentrations calculated with the transport fields generated by a general circulation model (GCM) for specified source-sink distributions. The authors pointed out that, in their model, the observed north-south atmospheric concentration gradient can be maintained only if sinks for carbon dioxide were greater in the Northern than in the Southern Hemisphere. They concluded that the observed differences between the partial pressure of carbon dioxide in the surface waters of the Northern Hemisphere and the atmosphere were too small for the oceans to be the major sink of fossil fuel carbon dioxide, thus leading to the absorption of a large amount of carbon dioxide on the continents by terrestrial ecosystems.

Malhi and Grace (2000) mentioned that tropical forests play a major role in determining atmospheric concentrations of carbon dioxide, as both sources of carbon dioxide following deforestation and sinks of carbon dioxide resulting probably resulting from carbon dioxide stimulation of forest photosynthesis. They pointed out that, in trying to quantify the role of tropical forests, the results by researchers in this field suggested that both the carbon sources and sinks in tropical forests were significantly greater than had been assumed.

Data Acquisition Procedures

Site Selection: This phase involved a preliminary reconnaissance of the area of study to identify locations where emissions of carbon dioxide were considered significant. The stations of interest thus identified were geo-referenced and marked in the conventional way in terms of their street identifiers. For this project work, 1264 locations in Central Kubwa were duly identified. Some of the well-known neighbourhoods visited were the following, viz: Federal Housing Authority Estate, INEC Quarters, Kubwa Phase 2, Kubwa Phase 3, RCCG's Environs, Navy Quarters, PW Quarters, and Mr. Bigg's Quarters.

The choice of Central Kubwa for this study was primarily determined because of cost consideration as no grant was secured for this study. The heart of the Federal Capital Territory was the original target for this study, alas, this couldn't be followed through because the key participants in this survey could easily be quartered for days at Kubwa with no extra cost to the survey party because of well-established social and family ties at Central Kubwa. Quartering and transportation logistics would have been really difficult at the Garki-Wuse axis. As it were, a pioneering work of this nature has been carried out at Minna, Niger State.

The locations chosen for this survey were the household and business premises where it was determined that, in any twenty-four hour period, an active static source of carbon dioxide (i.e. petrol-powered generator, coal-powered hearth, etc.) would be "live." This means that, for certainty, carbon dioxide emission will occur. The duration of emission was not necessary for our purpose to create an emission pollution layer. What was important was if emission occurred at all. The identification of any such station of interest was facilitated by oral interviews of the householders or the merchants that the survey party encountered during their visits. Furthermore, the source of carbon dioxide emission must be visually identified and tested with the carbon dioxide meter.

Data Acquisition: The carbon dioxide (CO_2) meter (GC-2028 Model of the Lurton Instruments) was employed for the measurement of outdoor ambient values of carbon dioxide at the designated stations of interest. The carbon dioxide (CO_2) meter was leased from the Kaduna State Environmental Protection Agency (KSEPA) at the prevailing rate of ₦27, 000 per day (including KSEPA's technician per diem).

Dataset of Study Area: The abridged dataset for this study is shown in the Appendix section. The dataset is presented as a table showing designated station numbers (chosen arbitrarily), their latitude and longitude values, conventional locations (corresponding to street locations), sources of carbon dioxide emissions, power ratings of sources (where applicable), and the measured numerical CO_2 values.

Results

The full-bodied dataset (i.e. 1264 stations of interest) of the study area, in Microsoft Excel, was exported to the Arcview 3.2 GIS platform. The multiple field creation enables the GIS application to function with better user interface co-ordination in terms of interactive abilities.

It is important to convert analogue maps, like scanned maps and satellite images, into digital formats accessible in the Geographic Information System (GIS) environment. The step or process involved in the conversion of these attribute data is known as "digitization." The digitized map of the study area on ArcView3.2 is shown as Fig.3 whilst the overlay of the digitized map on the QuickBird satellite map is shown as Fig.4.

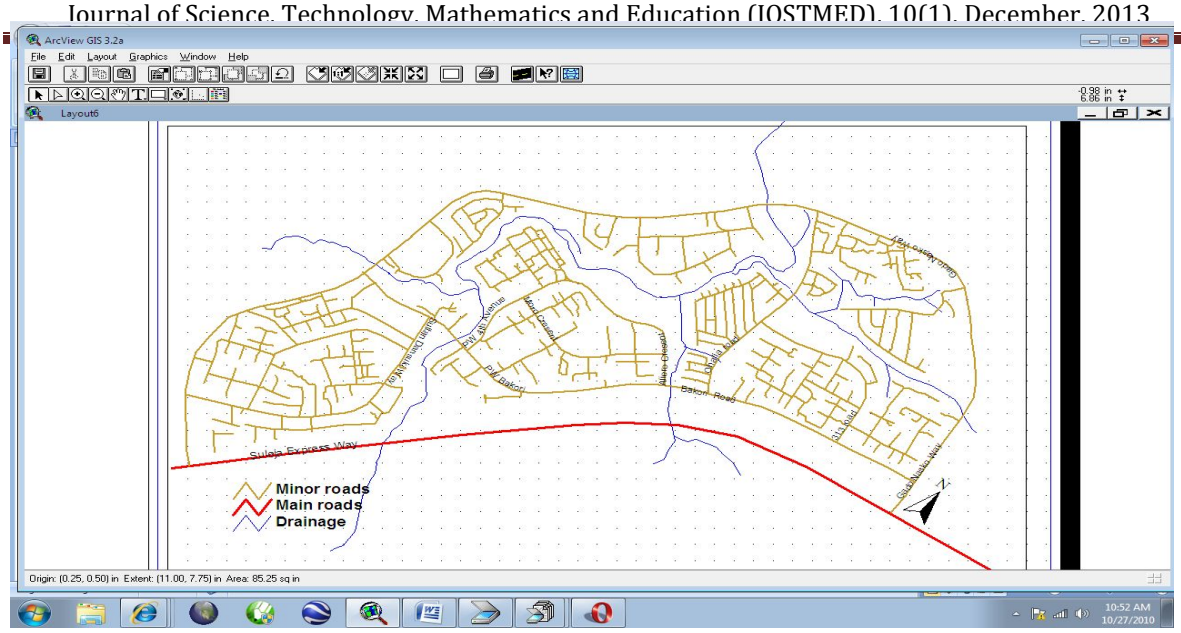

Fig. 3: Digitized map of the study area on ArcView3.2

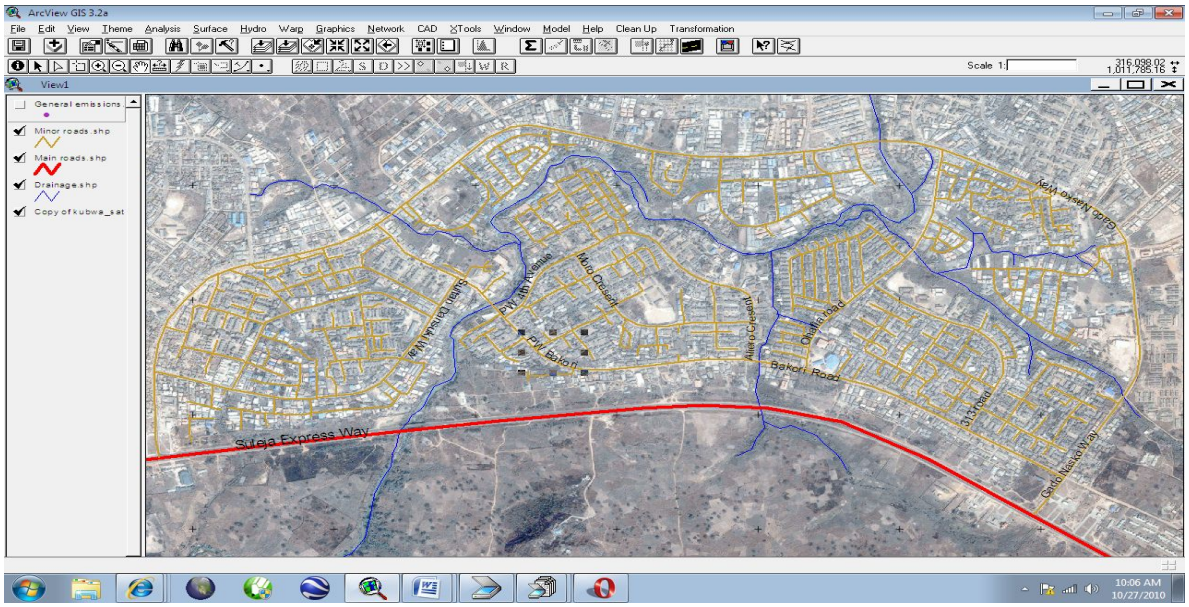

Fig. 4: Overlay of the digitized map on the QuickBird satellite map of study area

After the digitization of the map of the study area, points were identified on the map with respect to their conventional locations. Then the latitude and longitudes values were converted to the Universal Trasverse Mercator (UTM) system and inputted into the GIS platform. By this means, all of the points identified as stations of interest were “shifted” to their true position on the digitized map, as shown in Fig.5. Such a map is called a “vector map.”

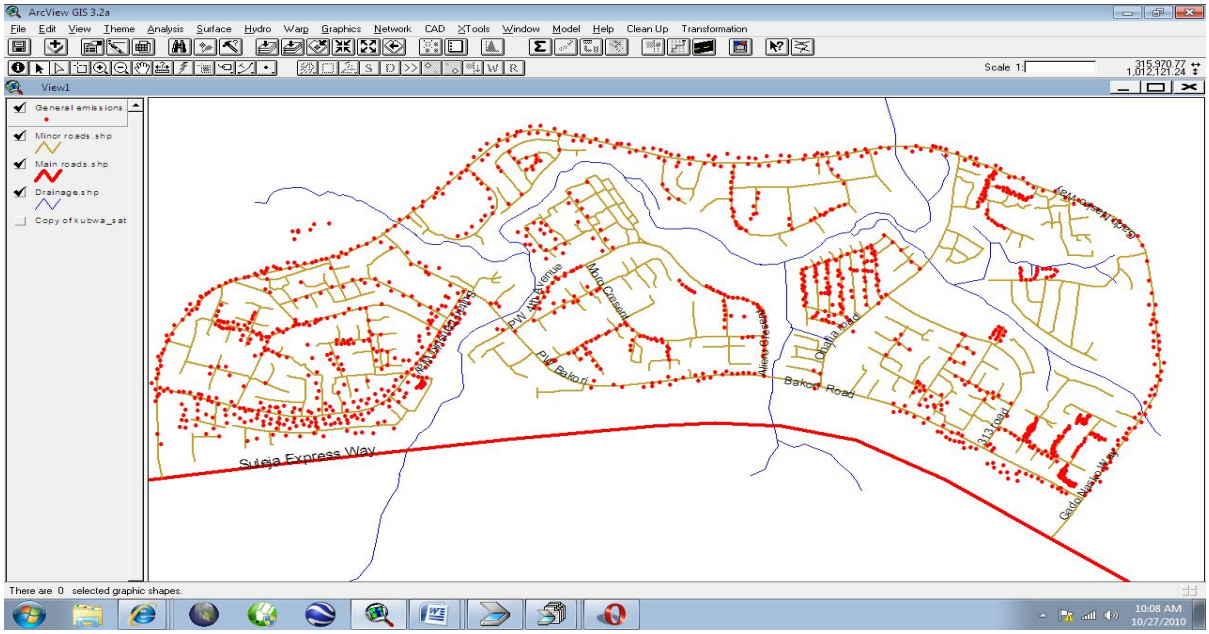

Fig. 5: Vector CO_2 emission map of study area

(Note that each of the red dots on this figure corresponds to an "active" source of carbon dioxide emission, representing the 1264 stations visited).

Several layer maps were also created for the different sources of carbon dioxide emissions for Central Kubwa, and these maps are shown as Fig.6 for coal-powered hearths, Fig.7 for diesel-powered generators, Fig.8 for kerosene-powered stoves, Fig.9 for petrol-powered generators, Fig.10 for stalling traffic points, and Fig.11 for wood-powered hearths. These layer maps show the distribution of the different sources of CO_2 emissions at Central Kubwa.

These sources of CO_2 were visually identified (the sources of atmospheric CO_2 are already known to most every science person). The CO_2 meter was employed to confirm if the sources truly emit CO_2 and by how much (please refer to the Appendix). The CO_2 were not necessarily "isolated" but their concentrations in the ambient environment in parts per million with respect to each source was what was measured.

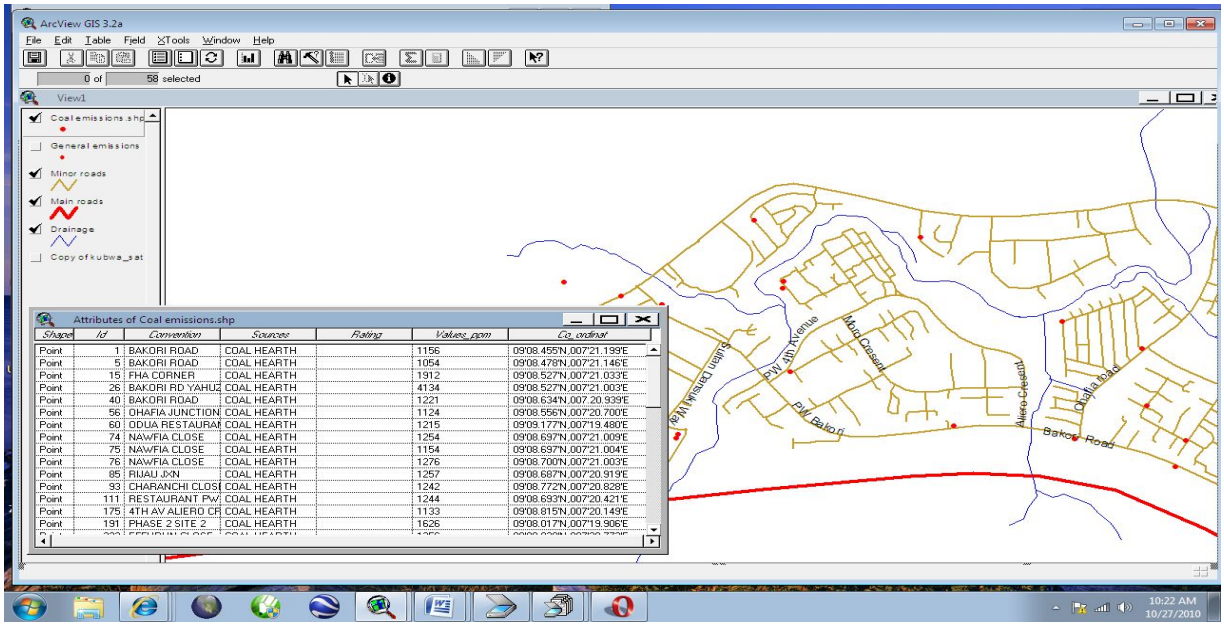

Fig. 6: Layer map and corresponding table for coal-powered hearths

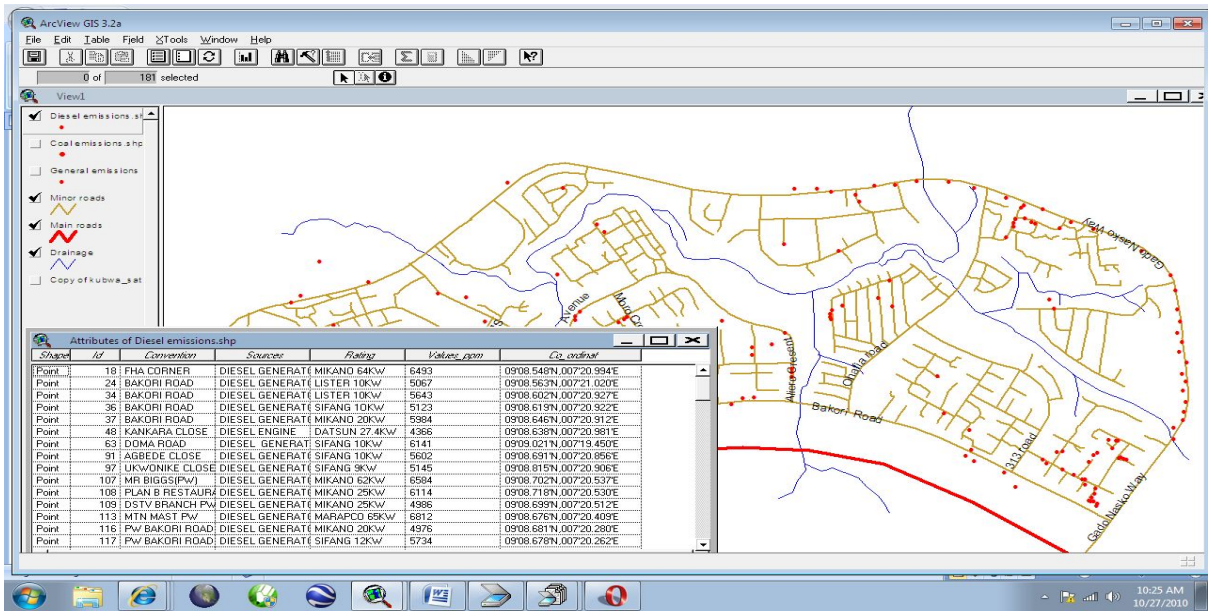

Fig. 7: Layer map and corresponding table for diesel-powered generators

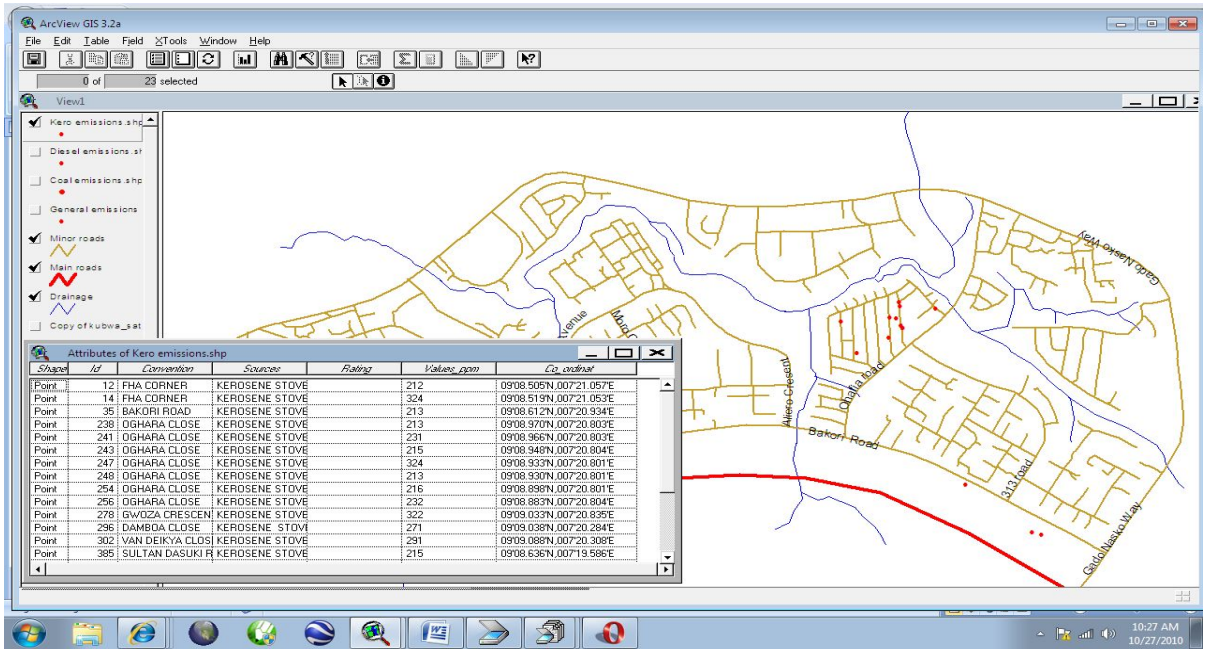

Fig. 8: Layer map and corresponding table for kerosene-powered stoves

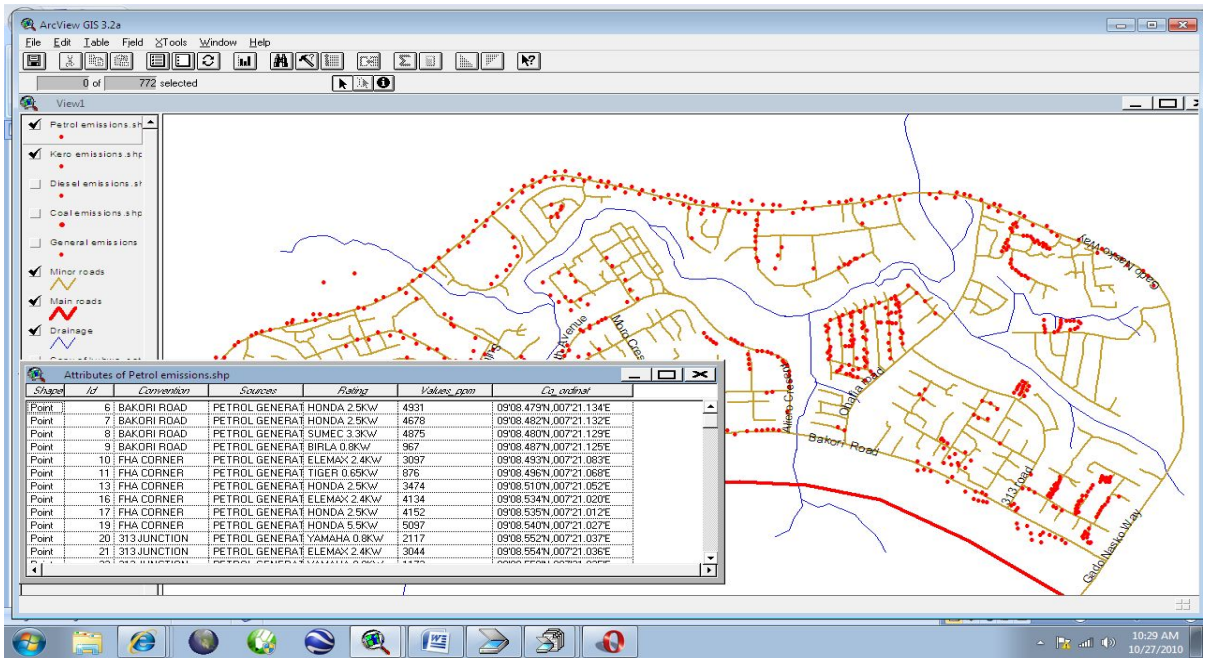

Fig. 9: Layer map and corresponding table for petrol-powered generators

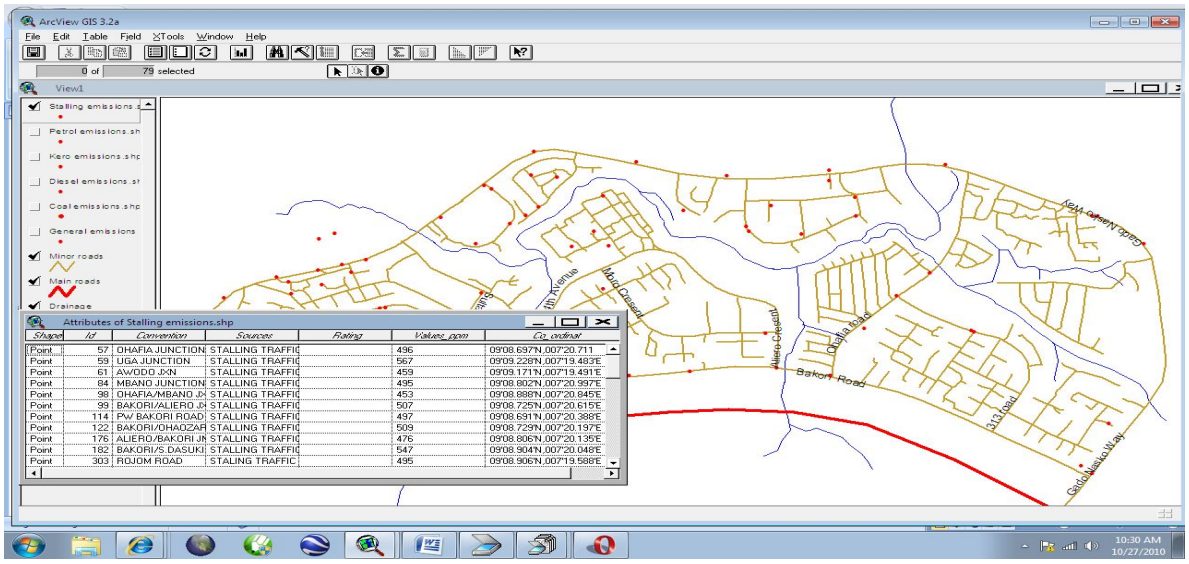

Fig. 10: Layer map and corresponding table for stalling traffic points

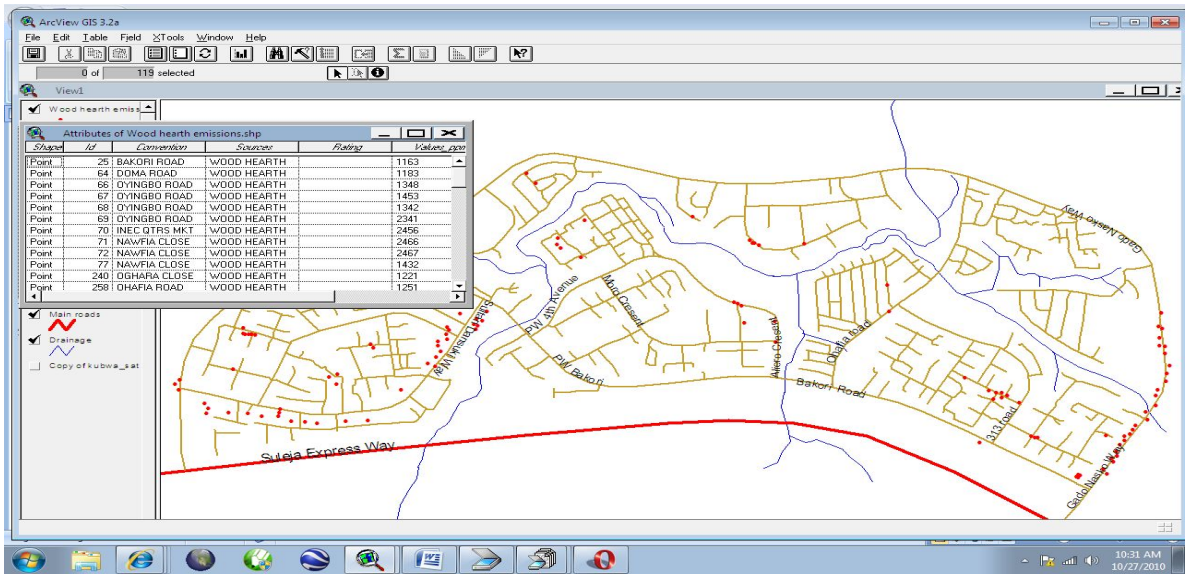

Fig. 11: Layer map and corresponding table for wood-powered hearths

The GIS application is characterised by a built-in user-interface coordination that gives it its interactive ability. The interactive nature of the application makes it possible for the points on the digitized map to be hot-linked to the full-bodied dataset of the study area. Each layer created has its own unique signature database. For instance, Fig.12 shows the result of the query procedure for Station 62 of the full-bodied dataset. All the pertinent infromation on that location can be viewed on the drop-down box.

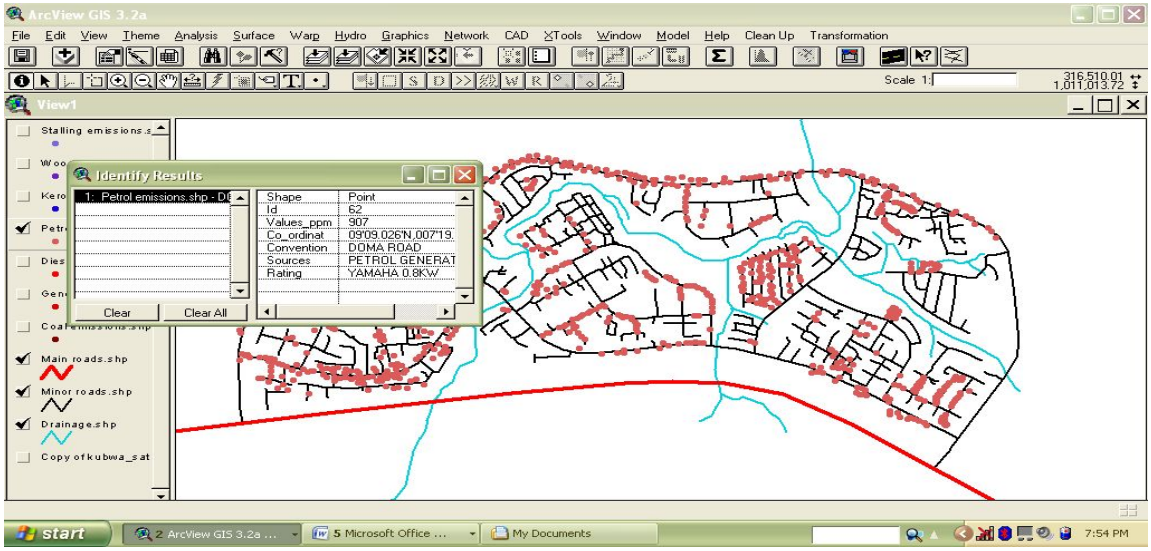

Fig. 12: Query procedure for station 62 of the dataset of study area

The carbon dioxide emission layer map of Central Kubwa is shown as Fig.13.

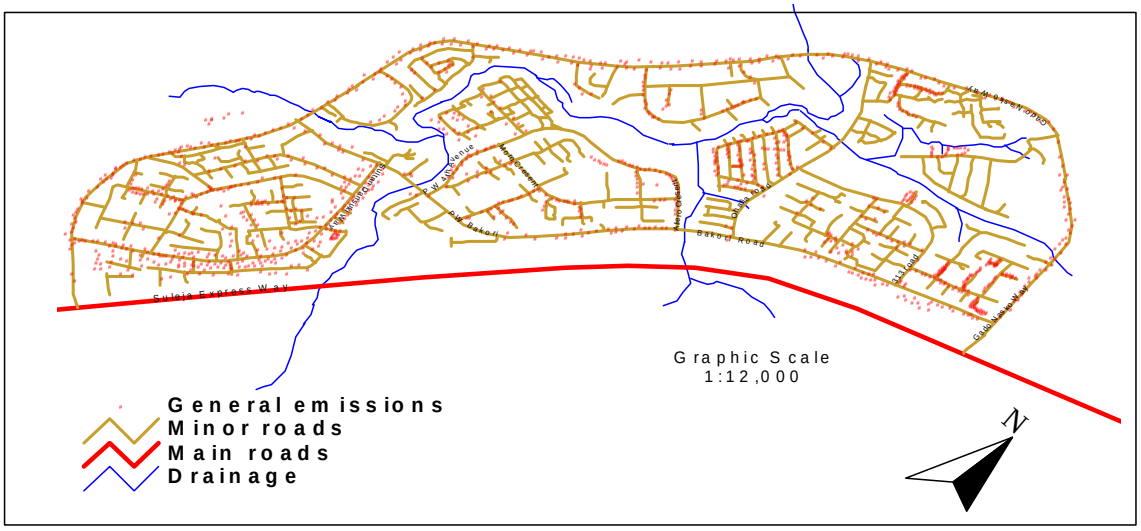

Fig. 13: Carbon dioxide emission layer map of Central Kubwa

The carbon dioxide emission overlay layer map of Central Kubwa is shown in Fig.14.

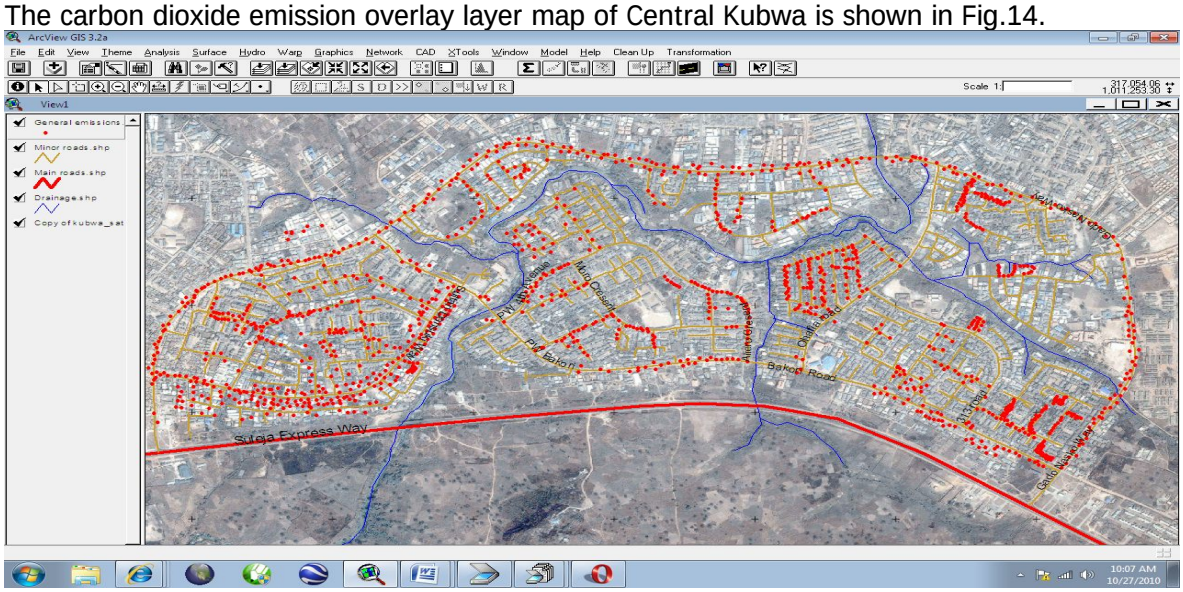

Fig. 14: Carbon dioxide emission overlay layer map of Central Kubwa

Discussion

Majority of the locations visited for this survey indicated ambient CO_2 levels above the 450 parts per million (ppm) threshold selected for this study (usually, "significant" CO_2 emission implies a range of values between 350ppm to 450ppm). Of the different sources of CO_2 identified for this survey, the petrol-powered internal combustion engines predominate. The GIS emission layer maps for this study show that the western segment of Central Kubwa is characterized by heavy red clusters, indicating a high CO_2 emission zone, whereas the red clusters are dispersed on the eastern sector, indicating a low CO_2 emission zone. The red colour scheme was used here because only stations with "significant" CO_2 emissions are presented

This novelty GIS-enabled, Windows-compatible, interactive CO_2 map of Central Kubwa is now a veritable planning tool in the hands of environmental monitoring auditors devoted to the issue of CO_2 emission. Appropriate intervention measures to reduce overall CO_2 emissions can now be inaugurated for the Central Kubwa province of Abuja, Nigeria.

Conclusion

Access to business premises was less restricted than access to private residential quarters, and this state of affairs can be observed in the emission layer maps. The western sector of Central Kubwa is obviously the business district while the eastern sector is mainly devoted to private residences. The CO_2 emission profile along the outer envelope of Central Kubwa (i.e. Gado Nasko Way) is prominent because, by necessity, businesses are clustered along this major road. Locations where diesel-powered generators are installed are the main culprit locations for CO_2 emissions. It can be deduced from this study that electricity supply to Kubwa province is not reliable, thus encouraging householders and businesses to depend on heavy CO_2 belchers for their electricity needs.

Acknowledgements

The authors wish to acknowledge the support of the Vice-Chancellor, Federal University of Technology, Minna, Nigeria, for making transportation available on the first day of the site selection and co-ordinate identification trip from Minna to Kubwa, a round trip of slightly over 300km.

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APPENDIX: Abridged Dataset of Study Area (57 of the 1264 stations of interest)

S/N	NORTH	EAST	CONVENTIONAL LOCATION	SOURCE	RATING AND MAKE (WHERE APPLICABLE)	CO_2 VALUE (ppm)
1	09°08.455'	007°21.199	FHA JUNCTION	COAL HEARTH		1156
2	09°08.461'	007°21.176	BAKORI ROAD	WOOD HEARTH		1096
3	09°08.465'	007°21.170'	BAKORI ROAD	GENERATOR (PETROL)	Yamaha 0.8KW	1198
4	09°08.473'	007°21.157'	BAKORI ROAD	GENERATOR (PETROL)	Yamaha 0.8KW	1198
5	09°08.478'	007°21.146'	BAKORI ROAD	COAL HEARTH		1054
6	09°08.479'	007°21.134'	BAKORI ROAD	GENERATOR (PETROL)	Honda 2.5KW	4931
7	09°08.482'	007°21.132'	BAKORI ROAD	GENERATOR (PETROL)	Honda 2.5KW	4678
8	09°08.480'	007°21.129'	SULTAN DASUKI RD	GENERATOR (PETROL)	Sumec 3.3KW	4975
9	09°08.487'	007°21.125'	SULTAN DASUKI RD	GENERATOR (PETROL)	Birla 0.8KW	967
10	09°08.493'	007°21.083'	FHA CORNER	GENERATOR (PETROL)	Elemax 2.4KW	3097
11	09°08.496'	007°21.068'	FHA CORNER	GENERATOR (PETROL)	Tiger 0.65KW	876
12	09°08.505'	007°21.057'	FHA CORNER	KEROSENE STOVE		212
13	09°08.510'	007°21.052'	FHA CORNER	PETROL	Honda 2.5KW	3474
14	09°08.519'	007°21.'053	FHA CORNER	KEROSENE STOVE		324
15	09°08.527'	007°21.033'	FHA CORNER	COAL HEARTH		1912
16	09°08.534'	007°21.020'	FHA CORNER	GENERATOR (PETROL)	Elemax 2.4KW	4134
17	09°08.535'	007°21.012'	FHA CORNER	GENERATOR (PETROL)	Honda 2.4KW	4152
18	09°08.548'	007°20.994'	FHA CORNER	DIESEL ENGINE	64KW	6493
19	09°08.540'	007°21.027'	FHA CORNER	GENERATOR (PETROL)	Honda 5.5KW	5097
20	09°08.552'	007°21.037'	313 JUNCTION	GENERATOR (PETROL)	Yamaha 0.8KW	2017
21	09°08.554'	007°21.036'	313.JUNCTION	GENERATOR (PETROL)	Elemax 2.4KW	3044
22	09°08.558'	007°21.035'	313.JUNCTION	GENERATOR (PETROL)	Yamaha 0.8KW	1172
23	09°08.561'	007°21.023'	313.JUNCTION	GENERATOR (PETROL)	Tiger 0.65KW	980
24	09°08.563'	007°21.'020	SULTAN DASUKI RD	DIESEL (GENERATOR)	10KW	5067
25	09°08.561'	007°21.020'	SULTAN DASUKI RD	WOOD HEARTH		1163
26	09°08.556'	007°21.005'	SULTAN DASUKI RD YAHUZA SPT	COAL HEARTH		4134
27	09°08.553'	007°21.008'	SULTAN DASUKI RD	GENERATOR (PETROL)	6KW	4563
28	09°08.568'	007°20.991'	SULTAN DASUKI RD	GENERATOR (PETROL)	5KW	3427
29	09°08.571'	007°20.985'	SULTAN DASUKI RD	GENERATOR (PETROL)	3.3KW	3433
30	09°08.579'	007°20.950'	SULTAN DASUKI RD	GENERATOR (PETROL)	Tiger 0.65KW	1023
31	09°08.591'	007°20.945'	SULTAN DASUKI RD	GENERATOR (PETROL)	Elemax 2.4KW	4533
32	09°08.595'	007°20.944'	SULTAN DASUKI RD	GENERATOR (PETROL)	Honda 5KW	5024
33	09°08.618'	007°20.924'	SULTAN DASUKI RD	GENERATOR (PETROL)	TEC 5.5KW	3306
34	09°08.602'	007°20.927'	SULTAN DASUKI RD	DIESEL(GENERATOR)	10KW	5643
35	09°08.612'	007°20.934'	SULTAN DASUKI RD	KEROSENE STOVE		213
36	09°08.619'	007°20.922'	SULTAN DASUKI RD	DIESEL(GENERATOR)	10KW	5123
37	09°08.646'	007°20.912'	SULTAN DASUKI RD	MIKANO DIESEL	20KW	5984
38	09°08.637'	007°20.914'	SULTAN DASUKI RD	GENERATOR (PETROL)	Sumec 3.3KW	3421
39	09°08.'621	007°20.927'	SULTAN DASUKI RD	GENERATOR (PETROL)	Elemax 2.4KW	3218
40	09°08.'634	007°20.939'	SULTAN DASUKI RD	COAL HEARTH		1221
41	09°08.659'	007°20.954'	KANKARA CLOSE	GENERATOR (PETROL)	Tiger 0.65KW	1032
42	09°08.663'	007°20.943'	KANKARA CLOSE	GENERATOR (PETROL)	Elemax 2.4KW	5087

43	09°08.664'	007°20.939'	KANKARA CLOSE	GENERATOR (PETROL)	5KW	3097
44	09°08.667'	007°20.936'	KANKARA CLOSE	GENERATOR (PETROL)	Elemax 2.4KW	3129
45	09°08.669'	007°20.931'	KANKARA CLOSE	GENERATOR (PETROL)	2.7KW	2494
46	09°08.675'	007°20.945'	KANKARA CLOSE	GENERATOR (PETROL)	Honda 2.5KW	2245
47	09°08.669'	007°20.956'	KANKARA CLOSE	GENERATOR (PETROL)	Tiger 0.65KW	1051
48	09°08.638'	007°20.981'	KANKARA CLOSE	DIESEL(GENERATOR)	Datsun 27.4KW	4366
49	09°08.645'	007°20.999'	KANKARA CLOSE	GENERATOR (PETROL)	TEC 6KW	3122
50	09°08.677'	007°20.998'	KANKARA CLOSE	GENERATOR (PETROL)	TEC 6.5KW	4543
51	09°08.650'	007°20.861'	WELDER BUS STOP	GENERATOR (PETROL)	Elemax 2.0KW	2196
52	09°08.651'	007°20.860'	WELDER BUS STOP	GENERATOR (PETROL)	Honda 2.5KW	2119
53	09°08.654'	007°20.859'	WELDER BUS STOP	GENERATOR (PETROL)	Sumec 6.5KW	3218
54	09°08.642'	007°20.847'	WELDER BUS STOP	GENERATOR (PETROL)	Elemax 5KW	4507
55	09°08.652'	007°20.812'	WELDER BUS STOP	GENERATOR (PETROL)	yamaha 0.4KW	786
56	09°08.687'	007°20.700'	OHAFIA JUNCTION	COAL HEARTH		1124
57	09°08.697'	007°20.711'	OHAFIA JUNCTION	STALLING TRAFFIC		496

EFFECTS OF FUNGICIDES ON THE FUNGI ASSOCIATED WITH CASSAVA TUBERS (*Manihot esculenta* Crantz) FROM ILORIN METROPOLIS, NIGERIA

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Abstract
This study investigated in vitro effects of different concentrations of Team fungicide and Z-Force fungicides on the mycelial growth of fungi associated with cassava tuber rot. Team fungicide contained 12% Carbendazim and 63% Mancozeb and only 80% mancozeb was present as Active Ingredient (A.I) of Z-Force fungicide. Aspergillus flavus, Aspergillus niger and Rhizopus stolonifer were isolated from infected tubers after incubation at 27±2^{0}C for one week. Different concentrations of each fungicide (100 mgL^{-1}, 200mgL^{-1}, 400 mgL^{-1} and 500mgL^{-1}) were prepared and their effects on mycelia growths were observed. R. stolonifer was the most pathogenic causing rot symptoms with mean diameter value of 29.10mm while A. niger and A. flavus induced rot with mean diameter of 22.70mm and 17.30mm, respectively. The Team fungicide, at 100mg/L retarded the mycelial growth of A. niger and the inhibitory zone covered 57.57mm which was significantly different from the value recorded for A. flavus (34.00mm) but it had no effect on the mycelial growth of R. stolonifer. The same concentration of Z-Force fungicide was less inhibitory to the growth of the two Aspergillus spp. than Team fungicide. A. niger was observed to have higher inhibitory zone at 200mgL^{-1} out of the two fungicides tested in this study but concentration had no effect on the growth of R. stolonifer. At the highest concentration, the mycelial growth of A. niger and A. flavus was completely arrested. No inhibition was observed in the control experiment. The synergy between carbendazim and mancozeb in Team fungicide was noted. This study aim at comparing the inhibitory effects of Team fungicide and Z-Force fungicide against fungi associated with cassava tubers.

Keywords: Cassava, Mancozeb, Carbendazim, Fungicides, Mycelial growth

Introduction
Cassava (*Manihot esculenta* Crantz) is a woody shrub with an edible root. It grows in tropical and subtropical areas of the world. Cassava is otherwise called “ege” (Yoruba), “akpu” (Igbo), and “rogo” (Hausa). It is a woody shrub of the Euphorbiaceae (spurge) family, native to South America. It is extensively cultivated as an annual crop in tropical and subtropical regions for its edible starchy, tuberous root. Cassava is the third-largest source of carbohydrates in the Tropics and is a major staple food in the developing world, providing a basic diet for 502 million people worldwide (Claude and Denis, 1990). Nigeria is the world's largest producer of cassava; a third more than production from Brazil and almost double that of Indonesia and Thailand (FAO, 2013).

A number of different species of bacteria and fungi isolated from cassava tubers showed that post-harvest decay of the crop is a complex matter involving more than a single organism. Soft rot of cassava tubers is caused by a complex fungi; *Lasiodiplodia theobromae*, *Aspergillus niger*, *Aspergillus flavus, Cylindrocarpon candidum*, and *Trichoderma harizianum* (Ekundayo and Daniel, 1973). Other microbial pathogens that can instigate deterioration of the crop include members of the following genera: *Pythium, Mucor, Rhizopus, Penicillium, Fusarium, Cladosporium, Glomerella, Gloeosporium, Rhizoctonia, Bacillus, Xanthomonas, Erwinia, Agrobacterium* and many saprophytic bacteria (Booth, 1976). Diseases caused by these pathogens may cause photosynthetic inefficiency or pre-harvest and post-harvest losses.

Fungicides are biocidal chemical compounds that kill or inhibit the growth of disease-causing fungi. These biocidal agents operate different mode of actions. Contact fungicides act on the surface of the plant and this include mancozeb, a derivative of dithiocarbamic acid but systemic

ones are absorbed through the foliage or root and are translocated upward internally by the plant through the xylem (Agrios, 2005). It has been noted that since fungi differ significantly in morphology and physiology from other forms of life, they may be successfully combated by compounds of low toxicity to other organisms, notably mammals (Edwards *et al.,* 1991).

Team is a systemic and contact fungicide containing 12% Carbendazim and 63% Mancozeb as the active ingredients. Z-force contained 80% Mancozeb as active ingredient and work as contact and broad spectrum fungicide. Mancozeb is a derivative of dithiocarbamic acid. Carbendazim is a carbamate ester-amine. Carbamates are chemically similar to, but more reactive than amides. This research work aimed at detecting the synergy between mancozeb and carbendazim as fungicidal agents.

Materials and Methods

Collection of Samples: Healthy cassava tubers samples were purchased from one of the cassava processing centers in Ilorin metropolis; these were collected in clean polythene-bag and taken to the laboratory. The cassava samples were stored in the laboratory for seven days at room temperature.

Isolation and Identification of Associated Fungi

The cassava tubers were surface sterilized using 70% ethanol and were rinsed with sterile distilled water for three consecutive times. Small portions of the infected areas of the tubers were removed using flamed scalpel and placed into recently cooled agar media in a Petri-dishes. This process was carried out under strict aseptic conditions. The plates were incubated at 28 ± 2^0C for four days after which colonies obtained were further sub-cultured until pure culture of the individual isolates were obtained. The isolates were subjected to microscopic examination. Identification was made with reference to Barnett and Hunter (2010) and Campell and Stewart (1980).

Pathogenicity Test

Healthy cassava tubers were selected for this purpose. The surfaces of the samples were swabbed with 70% ethanol for 1munite and then rinsed with sterile distilled water. The tubers were wounded by dip-cutting each sample with a sterile dissecting loop and inoculated with 5mm disc of pure culture of each isolate. The control tubers were treated with sterile distilled water. All tubers were inoculated at 25 ± 2^oC for seven days. All groups were observed for symptoms (Oladiran and Iwu, 1993). The test was carried out in three replicates for each fungal isolate.

Preparation of Fungicidal Solution of Different Concentrations

The different concentrations of fungicidal solutions were prepared in distilled water. Each solution was prepared by weighing 100, 200, 400 and 500mg of the fungicides into 1litre of distilled water.

Effects of Fungicidal Solution on Tested Fungi

The effect of fungicidal solutions on isolates was studied using a method adopted by Ahmed *et. al*. (2012). The Potato Dextrose Agar was poured into sterilized petridishes (9cm diameter) and allowed to solidified. One milliliter of the various concentrations of fungicides was introduced into PDA and allowed to solidify. For each test fungus, 5mm (diameter) of mycelial was cut from advancing margin of each fungal colony. The plug was placed at the centre of each agar medium containing different concentrations of fungicides. Control experiments contained the mycelial plug with sterile distilled water. All the plates were incubated at $25\pm$ ^{o}C. the zone of inhibition was measured and frequency of occurrence was calculated using the method of Pathak and Zaidi (2013).

The frequency of occurrence of fungus was calculated by the following formula:

$$\frac{\text{No. of seeds containing a particular fungus}}{\text{Total seeds used}} \times 100$$

Statistical Analysis

Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS). The means were separated using Duncan's Multiple Range Test (DMRT) at 5 % significant level.

Results and Discussion

After seven days of incubation, three fungi species were isolated from cassava tubers, viz: *Rhizopus stolonifer, Aspergillus flavus* and *A. niger*. From the results of pathogenicity test, the cassava tuber treated with *R. stolonifer* recorded the highest diameter of rot symptoms with mean value of 29.10mm while *A. niger* and *A. flavus* induced rot development with mean diameter of 22.70mm and 17.30mm, respectively (Table 1). For the frequency of occurrence, *R. stolonifer* was responsible for 74% of rot observed, followed by *A. niger* (68%) and *A. flavus* (51%) as shown in Table 2.

The Team fungicide (12% Carbendazim and 63% Mancozeb), at 100mg/L, inhibited the growth of *A. flavus* and the inhibitory zone covered 34.00mm which was significantly different from the value recorded for *A.niger* (57.57mm) but it had no effect on the mycelia growth of *R. stolonifer* (Table 3). The same concentration of Z-Force fungicide inhibited the growth of the two *Aspergiillus spp* lesser than Team fungicide (Table 4). The mycelia growth of *R. stolonifer* resisted against the effects of both fungicides at 100mg/L and 200mg/L but the two fungicides overcame the resistance when the concentrations increased to 400mg/L and 500mg/L respectively. At the highest concentration, the mycelia growth of *A. niger* and *A. flavus* was completely arrested except *A. flavus* treated with Z-Force that recorded 54.00mm (Table 4).

This study revealed that *R. stolonifer* is the most destructive agent associated with cassava tubers. Woolfe (1992) reported that the fungus was responsible for sweet potato rot in Tropics supported this finding. Yusuf and Okusanya (2008) reported that *R. stolonifer* was responsible for 44% rot observed in *Discorea rotundata* against 74% rot reported in this work. Both Team and Z-Fungicide inhibited the mycelia growth of the three fungi. The inhibitory potential of each fungicide increased as the concentraton increased.

Mancozeb is a broad spectrum fungicide used to control a number of fungi diseases such as anthracnose, leaf spot, and rust (USAID, 2012). The toxicity of mancozeb is not restricted to fungi alone but also affects man by causing skin irritation and other chronic skin diseases (Kegley *et al.*, 2010). Pozo *et al.*(1994) reported that the Agricultural doze of mancozeb significantly decreased the population of fungi, denitrifying bacteria and aerobic diazotrophs. These results are in conformity with Pathak and Zahid (2013) who had comparatively studied seed dressing fungicides and *Calotropis procera* latex for the control of seed-borne mycoflora of wheat and concluded that mancozeb increased the germination percentage and reduced seed mycoflora. Nghiep and Gaur (2005) confirmed the efficacy of mancozeb against *Aspergillus* and *Rhizopus* species. Carbendazim is systemic in action and its effectiveness had being confirmed by Saleem *et al*, (2012) against *Aspergillus* spp. The application of Team fungicide at rates higher than recommended concentration while not contributing any extra impact on inhibiting the target groups affects the environment negatively by its action on non-target organisms (Fawole *et al.,* 2008).

The results of the work showed the effectiveness of the synergy of mancozeb and carbendazim in Team fungicides.

Table 1: Pathogenicity of fungi isolated from cassava tubers after seven days of inoculation

Fungi Species	Mean Diameter of Rot (mm)
Aspergillus flavus	17.30
A. niger	22. 70
Rhizopus stolonifer	29.10
Control	0.00

Table 2: Percentage incidence of isolated fungi from cassava tubers

Fungi	Frequency of Occurrence
Aspergillus flavus	51
A. niger	68
Rhizopus stolonifer	74

Table 3: Effects of Team fungicide on the Mycelial growth of isolated fungi.

Fungal Isolates	Zone of Inhibition (mm)				
	Control	100mgL^{-1}	200mgL^{-1}	400mgL^{-1}	500mgL^{-1}
Aspergillus flavus	0.00±0.00^{a}	34.00±0.58^{b}	57.50±0.61^{b}	63.50±0.06^{b}	85.00±0.00^{a}
A. niger	0.00±0.00^{a}	57.57±0.58^{a}	66.50±0.52^{a}	83.53±0.38^{a}	85.00±0.00^{a}
Rhizopus stolonifer	0.00±0.00^{a}	0.00 ±0.00^{c}	0.00±0.00^{c}	5.03±0.35^{c}	27.50±0.61^{b}

Means with the same superscript letters down the column are not significantly different 0.05 α level

Table 4: Effects of Z-Force fungicide on the mycelial growth of isolated fungi

Fungal Isolates	Zone of Inhibition (mm)				
	Control	100mgL^{-1}	200mgL^{-1}	400mgL^{-1}	500mgL^{-1}
Aspergillus flavus	0.00±0.00^{a}	4.00±0.06^{b}	23.50±0.03^{b}	72.50±0.29^{a}	85.00±0.00^{a}
A. niger	0.00±0.00^{a}	37.57±0.38^{a}	37.67±0.88^{a}	44.50±0.58^{b}	54.00±0.58^{b}
Rhizopus stolonifer	0.00±0.00^{a}	0.00 ±0.00^{c}	0.00 ±0.00^{c}	3.00±0.29^{c}	6.00±0.25^{c}

Means with the same superscript letters down the column are not significantly different 0.05 α level

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BACTERIOLOGICAL AND PHYSICOCHEMICAL QUALITY OF WATER SUPPLY TO SOME RESTAURANTS IN UNIVERSITY OF ILORIN, NIGERIA

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Abstract

The water supply to some public restaurants within University of Ilorin, Permanent Site were assessed for their physicochemical and bacteriological qualities. Water samples were collected directly from the taps and the reservoirs. The bacteriological parameters assessed were the aerobic bacterial, total coliform and faecal coliform counts while the physiochemical parameters included pH, free residual chlorine, total solids, and hardness of water. The results of the physiochemical parameters were as follows: pH 6.34 to 7.03; free residual chlorine 1.04 to 1.16 mg/l; total solids 450 to 1020 mg/l; and total hardness 108 to 148 mg/l. The aerobic bacterial counts ranged from 1.0 x 10^1 to 1.8 x 10^3cfu/ml. The total coliforms per 100ml of the water ranged from 15 to 1100 most probable number (MPN) while the faecal coliforms ranged from 2 to 100 cfu/ml. The bacterial species isolated from the water samples were Bacillus subtilis, Staphylococcus aureus, Micrococcus luteus, Corynebacterium sp., Enterobacter aerogenes and Escherichia coli. Some of these bacterial isolates are of public health concern. The sanitary conditions of the vicinity of the water sources at each restaurant were evaluated in order to identify the possible sources of contamination and the necessary control measures to be adopted.

Keywords: Bacteriological, Physiochemical, Water supply, Restaurants

Introduction

Water is essential for the survival of all known forms of life on Earth (Hughes & Koplan, 2005). Access to drinking water has improved steadily and substantially over the last decades in all parts of the world (Bjorn, 2001). Water can be divided into different types according to occurrence: surface water, ground water, mineral water, and fresh water. Approximately 70% of fresh water is used for agriculture (Baroni *et al.*, 2007).

Water is a tasteless, colourless, odourless liquid at normal temperature and pressure. Water is considered to be neutral with a pH of 7. The hardness of water affects its pH (De Zuane, 1997). Water fit for human consumption is called potable water. It is estimated that 15% of worldwide water is used for drinking, bathing, cooking, washing and agricultural purposes. Basic household water requirements have been estimated around 50 litres per person per day (Island Press, 2009).

Humans require water that does not contain impurities. Common impurities include metal salts and /or harmful bacteria such as *Escherichia coli*, *Enterobacter* sp., *Salmonella* sp., *Streptococcus* sp., *Klebsiella* sp., *Shigella* sp., and *Vibrio* sp., this occur through construction operation and maintenance of water distribution channels which provide ample opportunities for microbial contamination (Anguiar *et al.*, 2000). Pipe joints, valves, elbows, tees and other fittings may provide stagnant areas where bacteria can attach and colonize (Le Chevallier *et al.*, 1996). According to UNESCO (2006) more than 2.2 million people died in the year 2000 due to water borne diseases.

Coliforms are found in large numbers in human faeces and their presence in a water sample is an indication of faecal pollution. High load of coliforms usually signify that further measures such as chlorination or boiling are required before consumption to ensure safety. In compliance to

the international water supply and sanitation laws, developing countries have made special efforts to increase the availability of potable water to the populace (Musa *et al.*, 1999).

This research was carried out to check the water quality at the restaurants. The use of unwholesome or contaminated water at the restaurants for activities such as cooking, drinking and washing of cutlery could pose health problems to the consumers.

The objectives of this study were to determine the pH, residual chlorine, hardness and total solids as well as the aerobic bacterial count, total and faecal coliform counts of water supplies to restaurants at the University of Ilorin. The possible sources of contamination were also noted.

Materials and Methods

Collection of samples: Water sample (500ml) was collected from each public restaurant within University of Ilorin permanent site using sterile conical flask. The water samples were collected from these restaurants since they were close to the students' hostels. The samples were collected from the tap according to Standard Methods (American Public Health Association, 1998).

Physicochemical analyses: The pH of the water sample was determined using Pyecam pH meter (model 29 mk) as described by American Society for Test and Measurements (1985). The free residual chlorine was determined by argentiometric titration as reported by British Pharmacopeia (1993). In addition, the total hardness and total solid contents of the samples were determined as described by De Zuane (1997); Hammer and Hammer, (2003).

Bacteriological analyses: The aerobic bacterial count was determined using standard Methods as described by American Public Health Association (1998). Pour plate technique was used with nutrient agar as the medium of choice for the enumeration of viable bacterial count.

The total coliforms count was determined using most probable number (MPN) method with MacConkey broth as the medium for cultivation (Fawole & Oso, 1988). Simlarly, faecal coliform count was done using eosin methylene blue agar medium and spread plate technique as described by Salle (1973).

Sanitary survey: A Survey of all surroundings and conditions that may affect the quality of the water supply at each restaurant was undertaken using some of the parameters given by WHO (2008) and Palomi *et al*. (2001). The sanitary score of each restaurant in percent was obtained by dividing the number of ''yes'' scores by total number of parameters assessed and multiplying the result by 100 (Sule *et al.*, 2011).

Identification of bacterial isolates: This was determined based on the colonial, cellular and biochemical characteristics of the pure culture of each bacterial isolate (Fawole & Oso, 1988). The biochemical tests carried out included catalase, oxidase, coagulase, indole, methyl red, citrate, voges proskauer, starch hydrolysis, lactose fermentation, and oxidative-fermentation.

Statistical analysis: The data obtained were analysed using SPSS 15.0 for their mean, range, percentage, standard deviation, and one way analysis of variance was determined using Duncan's multiple range test (SPSS, 2010).

Results

The pH values of water samples from the restaurants ranged from 6.34 to 7.03 while the free residual chlorine ranged between 1.04 to 1.16 mg/l. The total hardness had minimum and maximum values of 108 and 148mg/l respectively. Similarly, the total solid contents had a range of 450 to 1020 mg/l (Table1).

The aerobic bacterial count of the water samples ranged between1.0 x 10^1 to 1.8 x 10^3 cful/ml. The total coliform count ranged between 15 to 1100 coliform /100ml of water while the faecal coliform count ranged between 0.0 x 10^1 to 1.0 x 10^2 cfu/ml (Table 2).

Based on the colonial morphology, cellular and biochemical characteristics the following bacterial species were identified: *Bacillus subtilis*, *Staphylococcus aureus*, *Micrococcus luteus*, *Corynebacterium* sp., *Enterobacter aerogenes* and *Escherichia coli* (Table 3). The occurrence of diverse bacterial species in the water samples were as presented in (Table 4) while the sanitary survey and sanitary scores of the restaurants were as presented in (Table 5). The sanitary score ranged from 60 to 90% for the different restaurants.

Table 1: Physicochemical qualities of the water samples from different restaurants

Water samples	pH *	Free residual chlorine (mg/l)*	Total solids (mg/l)*	Total hardness (mg/l)*
A	6.70^{c} ± 0.03	1.14^{de} ±0.10	590^{b} ±20	132^{bc} ±11
B	7.03^{f}± 0.03	1.11^{cd} ±0.10	980^{f} ±20	148^{c} ±8
C	6.84^{e}±0.04	1.14^{de} ±0.02	450^{a} ±25	124^{ab} ±10
D	6.77^{d} ±0.02	1.04^{a} ±0.02	630^{bc} ±30	108^{a} ±8
E	6.78^{d} ±0.03	1.11^{cd}±0.03	800^{e} ±50	116^{ab} ±6
F	6.75^{d} ±0.02	1.11^{cd}±0.02	670^{cd} ±20	128^{b} ±8
G	6.34^{a} ±0.03	1.16^{e} ±0.01	720^{d} ±30	132^{bc} ±12
H	6.36^{ab} ±0.02	1.05^{ab} ±0.02	830^{e} ±25	120^{ab} ±10
I	6.4^{b} ±0.01	1.08^{bc} ±0.02	1020^{f} ±50	116^{ab} ±10

*values are means of three replicates ± standard deviation

Values in the same column with different superscripts are significantly different at $p<0.05$
A – I indicates water from different restaurants

Table 2: Bacteriological counts of the water samples from different restaurants

Water samples	Bacterial count (cfu/ml)*	Total coliforms (MPN / 100ml of water)	Faecal coliform (cfu/ml)*
A	12^{a}±2.0	43^{a}	0^{a}±0.0
B	700^{c}±20	1100^{c}	2^{a}±1.0
C	10^{a}±2.0	43^{a}	0^{a} ±0.0
D	24^{a}±4.0	75^{ab}	0^{a} ±0.0
E	35^{a}±3.0	210^{b}	0^{a} ±0.0
F	22^{a}±3.0	15^{a}	0^{a} ±0.0
G	680^{c}±15.0	93^{ab}	0^{a} ±0.0
H	460^{b}±20.0	1100^{c}	100^{a} ±10.0
I	1800^{d}±50.0	210^{b}	0^{a} ±0.0

*values are means of three replicates ± standard deviation

Values in the same column with different superscripts are significantly different at $p<0.05$
A – I indicates water from different restaurants.

Table 3: Characterization and identification of bacterial isolates

Bacterial isolates	Colonial colour	Colonial shape	Optical characteristics	Colonial elevation	Gram's reaction	Cell's shape	Cells' arrangement	Spore staining	Lactose fermentation	Oxidase	Starch hydrolysis	Citrate	Coagulase	Catalase	Methyl- red	Voges –Proskauer	Indole	Oxidation-Ferrmentation	Probable identity	
I	Cr	Ci	Tl	F	-	R	Ch	-	+	-	-	+	-	+	-	+	-	Fe	*Enterobacter aerogenes*	*Bacillus sphaericus*
II	Y	Ci	Tl	Co	+	C	Cl	-	+	-	+	-	+	+	+	+	-	Fe	*Staphylococcus aureus*	*Staphylococcus aureus*
III	Cr	Ci	Tl	r	+	R	S	+	-	-	+	+	-	+	+	+	-	Ox	*Bacillus subtilis*	*Bacillus azotoformans*
IV	Y	Ci	Tl	F	+	C	S	-	+	+	+	-	-	+	-	-	-	Ox	*Micrococcus luteus*	*Micrococcus* sp.
V	W	Ci	Tl	F	+	R	S	-	-	-	+	+	-	+	-	-	-	Fe	*Corynebacterium* sp.	*Streptococcus* sp.
VI	Cr	Ci	Tl	r	-	R	S	-	+	-	+	-	-	+	+	-	+	Fe	*Escherichia coli*	*Bacillus* sp.

Key: Cr = cream; Y= yellow; W = white; Ci = circular; R = rod; Tl = translucent; ; F, = flat; Co = convex; r = raised; S = Single; Ch = chain; Cl = cluster; Fe = Fermentative; Ox = Oxidative; - = negative reaction; + = positive reaction

Table 4: Occurrence of bacterial isolates in water samples from different restaurants

S/N	Bacterial isolates	Sampling points								
		A	B	C	D	E	F	G	H	I
I	*Bacillus subtilis*	-	+	-	+	+	-	+	+	+
II	*Staphylococcus aureus*	-	+	-	-	+	+	-	-	+
III	*Micrococcus luteus*	-	+	-	-	+	+	+	+	+
IV	*Corynebacterium* sp.	-	-	-	-	-	-	+	-	-
V	*Enterobacter aerogenes*	-	-	-	-	-	+	-	-	-
VI	*Escherichia coli*	-	+	-	-	-	-	-	+	-

Key: +, isolated; - , not isolated; A – I, water from different restaurants

Table 5: Sanitary appraisal of water from different restaurants

Water samples	Sanitary parameters										Sanitary score (%)
	I	II	III	IV	V	VI	VII	VIII	IX	X	
A	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	90
B	Y	Y	Y	Y	Y	Y	Y	N	N	Y	80
C	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	90
D	N	Y	N	Y	Y	Y	Y	Y	N	Y	70
E	N	N	N	Y	Y	Y	Y	Y	N	Y	60
F	Y	Y	Y	Y	Y	N	Y	Y	N	Y	80
G	N	N	Y	Y	N	Y	N	Y	Y	Y	60
H	Y	Y	N	Y	N	Y	Y	Y	Y	Y	80
I	Y	Y	Y	Y	N	Y	Y	N	Y	Y	80

Key: I, Water does not accumulate near the tap stand; II, Tap did not show any evidence of leakage; III, No observable point of leakage of the water pipe; IV, Is the sampling point not in a close vicinity to septic tank? ; V, Is the sampling point not in a close vicinity to open dirty gutter? ; VI, Is the sampling point not in a close vicinity to refuse dump? ; VII, Does the tap nozzle as lock? ; VIII, No storage of water in reservoir tank prior to use; IX, The surrounding

does not have vegetation or tall trees; X, The plinth of the tap not cracked or eroded; Y, Yes; N, No

Discussion

The maintenance of residual chlorine level up to 1mg/l is intended to provide a safeguard against possible microbial contaminations along the distribution network. The residual chlorine levels of all the water samples collected from the restaurants ranged from 1.05 – 1.16 mg/l which indicated adequate chlorination. Alanc *et al*. (2000) reported that chlorine disinfection level of 0.5 – 2.0 mg/l are commonly in use because of high rate of contamination. The pH values 6.34 – 7.03 values were in conformity with the WHO guideline for drinking water quality which recommends pH values of less than 8.0 for effective disinfection with chlorine (Twort *et al*., 2000; WHO, 2008).

The total hardness level of the water samples with a range of 108 – 148 mg/l can be said to be moderately hard. The purpose of total solid contents evaluation is to determine all the suspended and dissolved matters in water. This should not be more than 500mg/l (De Zuane, 1997). However, a range of 450 – 1020 mg/l was obtained in this investigation. The high level of total solids from some of these sampling points are indications of leakages or broken pipes. Values up to 1000 mg/l of total solids have been encountered in drinking water (Le Chevallier *et al*., 1996).

The total bacterial count of 10 – 1800 cfu/ml was obtained from the water samples. Fifty six percent of the water samples conformed in terms of total bacterial count of less than or equal to 100 cfu/ml. Twenty two percent of the water samples had faecal coliform. WHO (2008) reported that there must be absent of faecal coliform in water in the distribution system. All the water samples had varying ranges of total coliforms (15 – 1100 coliform per 100ml of the water sample). This means that there was contamination along the pipes conveying the water to the different restaurants. The two restaurants (B and H) with faecal coliforms also had the highest total coliform counts. Igunnugbemi *et al.* (2004) reported that over 95% of water samples from University of Ilorin hostel were positive for coliforms while just less than 5% of these were positive for faecal coliforms. Sanitary surveillance revealed the possible sources of contaminations as leaking pipes, proximity of sampling points to gutter and temporary storage of water in reservoir. Lloyd and Bartram (1991); Palomi *et al*. (2001); WHO (2008) suggested that sanitary surveys should be conducted with sufficient frequency for their use in interpreting changes in the quality of drinking water as determined in physical, microbial and chemical monitoring.

A total of six bacterial species were isolated. These were *Bacillus subtilis, Staphylococcus aureus, Micrococcus luteus, Corynebacterium* sp.*, Enterobacter aerogenes* and *E. coli*. The bacterial species isolated from the restaurants ranged from the normal commensals such as *Bacillus* spp. to faecal and non feacal coliforms some of which may be pathogenic. This suggests that efforts need to be made to prevent contamination along the pipes and at the restaurants. Le Chevallier *et al*. (1996) reported the occurrence of coliforms in drinking water with free residual chlorine. In a similar study, Sule *et al*. (2011) reported that only 10% of water stored exteriorly in storage tanks at some homes at Tanke in Ilorin, Kwara, Nigeria were devoid of coliform.

Conclusion

It can be concluded from this study that some of the water samples from the restaurants were not potable in terms of the bacteriological qualities. The isolation of *E. coli* in some of the water samples indicated faecal contamination. The sanitary survey conducted at each restaurant revealed other possible sources of contamination.

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ARTICLES AND RESEARCH REPORTS ON TECHNOLOGY

TREND ANALYSIS OF WIND SPEED VARIABILITY IN MINNA, NIGERIA

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Abstract

Many countries have included renewable energy systems in their future energy plans so that they can produce reliable and environmentally friendly energy. Weather and climate have a profound influence on life on earth. They are part of the daily experiences of human beings and are essential for health, food production and well-being. Wind power consumes no fuel, and emits no air pollution. However, it's advisable to realize that wind energy is based on natural force which means it's highly spatial correlated, and is also variable over time. Moreover, wind regimes are not static; they are dynamic in nature. The daily wind speed data was obtained from the Minna Airport Meteorological Centre for the period of 2000 to 2010. The wind speed data was subjected to trend and regression analysis. The analysis was carried out using Microsoft Excel 2010 and Statistics 7.It was concluded that the actual mean yearly wind speed was 2.93 m/s and the regression model performance parameters are all measures that incorporate both systematic and random errors which are within the actual range. This further implies that the average wind speed is enough to transport pollen grains from one location to another provided there are no obstacles.

Keywords: Climate, speed, variation, weather, wind

Introduction

Weather and climate have a profound influence on life and earth. They are part of the daily experiences of human beings and are essential for health, food production and well-being (Baede*et al.*, 2002). The weather, as we experience it, is the fluctuating state of the atmosphere around us, characterized by the temperature, wind, precipitation, clouds and other weather elements. Climate, on the other hand, refers to the average weather in terms of the mean and its variability over a certain time-span and a certain area. The classical period often referred to in climate change studies is 30 years (Hannah *et al.*, 2005). Climate varies from place to place, depending on latitude, distance to the sea, vegetation, presence or absence of mountains or other geographical factors (Baede*et al.*, 2002). Climate varies also in time; from season to season, year to year, decade to decade or on much longer time scales, such as the Ice Ages.

Climate change is a physical process but because of the dependency of humans on the availability and quality of natural resources (e.g., air, land, water, biota and materials) any changes in the physical characteristics of the environment will be reflected by cumulative, interacting social and economic impacts. Their intensity and frequency will not be the same due to variations in site-specific characteristics (Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) 2009). Around the world, the effects of climate change are already upon us. Many countries have included renewable energy systems in their future energy plans so that they can produce reliable and environmentally friendly energy. Compare to the environmental effects of traditional energy sources, the environmental effects of wind power are relatively minor (Dvorak *et al.*, 2010; Migoya*et al.*, 2007). Wind power consumes no fuel, and emits no air pollution. However, it's desirable to realize that wind energy is based on natural force which means it's highly spatially correlated, and is also variable over time. Moreover, wind regimes are not static; they are dynamic in nature. James (2008) stated that wind regimes are sensitive to natural climate variability as well as anthropogenic-driven climate change. He further stated that natural factors such as solar variations, wind variations and volcanic activities occur

beyond human activities. Anthropogenic factors are human based activities causing changes in earth's atmosphere. The fundamental concern with all renewable energy based on meteorological parameters is determining the variability of that resource on spatial and temporal scales (Krauze, 2009). As the climate warms, global weather patterns will change, affecting local climates everywhere. Changes will occur to local wind speeds and precipitation, as well as to temperature. Both the average wind speed and the variability of the wind are likely to be affected.

If global patterns change, local wind patterns might change as well. A Geophysical Research Letters Study notes that any change in near-surface wind velocities caused by global climate change could have large societal impacts (Pryor *etal*., 2006). Therefore, understanding the influences of climate change on wind speed is important for forecasting potential changes in wind velocity on a seasonal basis because wind climate are sensitive to changes in seasons. Climate variations and change, caused by external forcing, may be partly predictable, particularly on the larger, continental and global, spatial scales (Baede*et al*., 2002). Because human activities, such as the emission of greenhouse gases or land-use change, do result in external forcing, it is believed that the large-scale aspects of human-induced climate change are also partly predictable (Baede*et al*., 2002). However, the ability to actually do so is limited because we cannot accurately predict population change, economic change, technological development, and other relevant characteristics of future human activity. In practice, therefore, one has to rely on carefully constructed scenarios of human behavior and determine climate projections on the basis of such scenarios.

The aim and objective of this study is to analyze wind variation in Minna using statistical approach/method and to study wind speed changes on a seasonal basis.

Materials and Methods

Study Area: Minna metropolis was selected for the study. Minna, the Capital city of Niger state, is a city in North Central Nigeria. The estimated population of Minna was 304,113 (NPC, 2006) with an average temperature of 31^0C and wind speed at 10km/h (MMS, 2013). Minna lies on the geographical coordinates of latitude $9^0 36' 50''$ north of the equator and longitude $6^0 33' 24''$ east of the Greenwich Meridian, on geological base of undifferentiated basement complex rock of mainly quartz and magnetite situated at the base of prominent hills in an undulating plain. The average elevation of Minna is 272m and altitude 1007 feet.

Fig. 1: Map of Minna, Nigeria

Wind Speed Data: The daily wind speed data used in this study was obtained from the Minna Airport Meteorological Centre for the period of 2000 to 2010 (11 years) were there are no tall buildings or trees. The wind speed data was measured continuously with a cup-generator anemometer at a hub height of 10m. The daily mean speeds were computed as the average of the speeds for each day.The wind speed data was subjected to trend and regression analysis. The analysis was carried out using Microsoft Excel 2010 and Statistics 7.

A trend line represents the long-term movement in time series data after other components have been accounted for. It tells whether the data set have increased or decreased over the period of time. Trend line thus shows observed changes in the wind speed data at a point in time.Regression analysis, on the other hand, is employed to determine how a straight line can be drawn through a series of wind speed data points in order to provide the best fit. The calculations involved are used to determine the slope and intercept of the line. The measure of how good a fit is obtained is done using the R-square value.

A line of best fitis drawn through the wind speed data points. This line is also called the regression line. Excel refers to it as a Trend line. The line of best fit is a straight line in which the data fits a linear equation. This equation is generally written in the form

$$y = mx + b \quad \text{..... 1}$$

where b is the intercept and m is the slope. Having drawn the line of best fit, the values of the slope, intercept and R-square (R^2) are calculated. Knowing the slope and the intercept of the line of best fit, the expected y values are calculated. Excel provides the forecast function that gives another way to get the expected y values. The formula computes the slope and intercept and finds the expected y value.

Prediction/Forecast Performance Evaluation: The prediction accuracy of the model in the estimation of the wind speeds with respect to the actual values were evaluated based on the correlation coefficient (R^2), Root Mean Square Error (RMSE), MeanAbsolute Error (MAE), and Mean Absolute Percentage Error (MAPE). These parameters were calculated based on the following equations:

$$R^2 = \frac{\sum_{i=1}^{N}(yi-z)^2 - \sum_{i=1}^{N}(xi-z)^2}{\sum_{i=1}^{N}(yi-z)^2} \quad \ldots\ldots 2$$

$$RMSE = [\frac{1}{N}\sum_{i=1}^{N}(yi-xi)^2]^{1/2} \quad \ldots\ldots 3$$

$$MAE = \frac{1}{N}\sum_{i=1}^{N}|yi-xi| \quad \ldots\ldots 4$$

$$MAPE = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{(|yi-xi|)}{yi}\right) \quad \ldots\ldots 5$$

Where y_i is the i^{th} actual data, x_i is the i^{th} predicted data, z is the mean of actual data, N is the number of observations, RMSE is the root mean square error, MAE is the mean average error and MAPE ismean absolute percentage error.

Results and Discussion

The monthly wind speed values over the period of 11 years from 2000 – 2010 are presented in Table 1, while the monthly mean wind speed values are presented in Table 2. It can be observed from Table 2 that the highest monthly wind speeds occur in the months of January (4.65 m/s), February (4.98 m/s), March (3.72 m/s) and April (3.74 m/s) for the whole year, while the minimum monthly wind speeds occur in the months of August (1.82 m/s), September (1.83 m/s) and October (1.37 m/s). The highest wind speed of 3.33 m/s occurs in the year 2002, while the minimum wind speed of 2.44 m/s occurs in the year 2009. The overall yearly wind speed in Minna is found to be 2.93 m/s.

Table 1: Monthly and Yearly Actual Wind Speeds in Minna from 2000 to 2010 (Unit: m/s).

Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
January	133.8	157	224.7	104.1	116.6	198.5	68.1	214.5	181	75.5	108	143.8
February	227.3	188	142.8	100	172.6	114.1	86.3	127.9	196	76.8	99.7	139.2
March	144.3	136	98.6	117.3	142.9	83.7	89.8	113.2	89.5	99.4	150	115
April	120.3	111	113.6	124.3	122.4	113.8	96.3	107.8	105	110.8	109	112.2
May	105.1	96	107.3	112	106.5	94.6	83.5	72.3	97.5	81.7	87.5	94.9
June	82.6	72.5	94.6	75.2	79.9	79.9	69.9	68.9	89.2	82.8	48.2	76.7
July	68.2	68.1	68	72	75.6	61.9	64.3	58	64.5	73.8	44	65.3
August	58.5	57.9	66.7	61.9	65.5	65.9	52.5	45.3	63.5	47.5	31.7	56.1
September	63.8	65.3	61.8	66.7	66.4	63.9	54.8	39.7	47.4	45.9	30	55.1
October	44.1	59.2	41	52.6	42.4	45.5	43.4	25.4	41.9	35.4	38.3	42.7
November	46.3	69.4	53.3	65.3	66.1	63.6	94.4	26	60.3	75	41.6	60.1
December	97.3	106	134.3	110.2	80.5	81.3	131	98.9	97.8	90.8	113	103.8
Yearly Average	99.3	98.8	100.6	88.5	94.8	88.9	77.9	83.2	94.4	74.6	75.1	88.7

The monthly model performance parameters for the 12th year is presented in Table 3. The model prediction performance parameters for the monthly wind speed distributions showed that the forecasted values ranged between 41 and 153 (m/s), R^2 values rangedbetween 0.853 and 1, the root mean square error (RMSE) ranged between 6.8 and 53.8, the mean average error (MAE) ranged between 5 and 48 while the mean absolute percentage error(MAPE) ranged between 5 and 43 respectively. When the forecasted values are compared with the average values of the previous eleven years, it was observed that the actual wind speed values ranged between 42.7 and 143.8 m/s while the forecasted value ranged between 41 and 153 m/s. this shows that there

is a close correlation between the actual and the forecasted values.Fadare (2008) reported similar observation for the wind speed analysis for Ibadan, Nigeria.

Table 3: Monthly Performance Parameters in Minna for the 12th year

		Model Performance Parameters			
Month	Forecast (m/s)	R^2	RMSE	MAE	MAPE
January	153	0.98	53.8	48	43
February	123	1	45.9	38	26
March	107	1	26.6	19	16
April	111	1	7	6	5
May	91	1	12	10	11
June	75	1	10.7	9	12
July	65	1	7.3	5	9
August	57	1	8.6	7	15
September	56	1	6.8	5	11
October	41	1	7.6	7	18
November	61	0.85	17	13	28
December	104	0.98	16.9	14	13
Yearly	87	1	6.6	5	5

The correlation coefficient, R^2, is an index of the degree of linear association between two variables. The magnitude of R^2 indicates whether or not the regression will provide accurate predictions of the criterion variable. It can be seen in Table 4.3 that the R^2 values and other model performance parameters were found to be good as the measured and predicted values agreed. Therefore, all these parameters could be used as a measure of the accuracy of future prediction.

Minna is located in the Guinea Savannah having a climate with well-marked dry and rainy seasons. In order to determine the seasonal mean wind speed, the months are divided into two seasons identified as follows:

(a) Rain season: May to October.
(b) Dry season: November to April.

Table 4 shows the forecasted wind speed and its mean for the year 2012 while the forecast mean, mean actual wind speed and performance parameters for the two seasons for the whole year are given in Table 5. The mean wind speed for rain and dry seasons are 2.12 and 3.74 m/s, while the forecast mean predicted by the regression model are 2.32 and 3.63 m/srespectively. The forecast mean and mean wind speed was higher during the dry season than the rainy season because the equator-to-pole temperature and pressure gradients are most intense during this period.

Table 4: Forecast Mean Wind Speed in Minna.

Month	Forecast (m/s)	Forecast Mean (m/s)
January	153	4.94
February	123	4.39
March	107	3.45
April	111	3.7
May	91	2.94
June	75	2.5
July	65	2.1
August	57	1.84
September	56	1.87
October	41	1.32
November	61	2.03
December	104	3.36
Yearly	87	2.87

Table 5: Seasonal mean actual, forecast and forecast mean wind speeds with performance parameters in Minna

Season	Actual Mean (m/s)	Forecast (m/s)	Forecast Mean (m/s)	Model Performance Parameters			
				R^2	RMSE	MAE	MAPE
Rain	2.12	64.17	2.32	0.997	8.8	7.2	12.7
Dry	3.74	109.83	3.63	0.969	27.9	22.7	21.8

The average wind speed data alongside forecast performance parameters for Minna between 2012 and 2015 are given in Table 6 and presented graphically in figure 1. The line of best fit as observed in figure 1 gives an intercept of 106.79, a slope of -3.28333 and the R^2-value of 0.999.

Table 6: Yearly (Average) and Forecast Wind Speeds in Minna from 2000 to 2015.

Year	Average	Forecast	Error	Absolute Error	% Error	Square Error	U-Stat
2000	99	104	-4.7	4.7	4.73	22.09	
2001	99	100	-1.17	1.17	1.18	1.36	0.22
2002	101	97	3.56	3.56	3.54	12.66	2.98
2003	88	94	-5.53	5.53	6.25	30.62	146.21
2004	95	90	4.78	4.78	5.05	22.88	39.9
2005	89	87	1.89	1.89	2.13	3.58	34.71
2006	78	84	-6.11	6.11	7.84	37.31	121
2007	83	81	2.16	2.16	2.6	4.66	27.74
2008	94	71	17.43	17.43	18.45	303.63	126.94
2009	75	74	0.62	0.62	0.83	0.38	392.37
2010	75	71	4.09	4.09	5.45	16.74	0.23
2011		67					
2012		64					
2013		61					
2014		58					
2015		54					

It is observed from the figure 1 below that the wind speed in Minna was cyclic in nature and decreases' as the years increased from 2010. This implies that less wind activities will be observed in the area which have its toll on agricultural activities. Though, most of the land mass has being turned residential in the last decade, the impact of wind speed may not be felt.

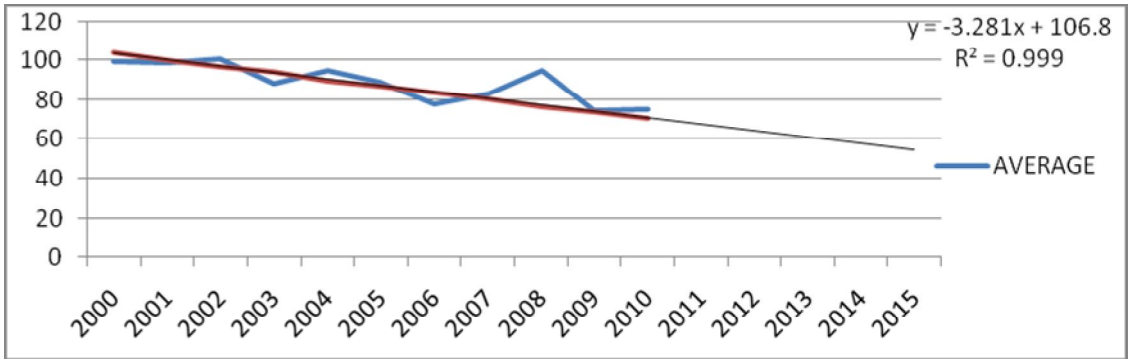

Fig. 1: Average Trend of Wind Speeds in Minna from 2000 to 2015.

Conclusion

The daily measured time series wind speed data for Minna, Nigeria have been analyzed statistically based on trend and regression analysis. The daily, monthly, seasonal and yearly mean wind speeds for the location have been determined. Based on the analysis, the following conclusions can be made:

(a) The actual mean yearly wind speed of 2.93 m/s for Minna shows that Minna is in a low wind speed region.

(b) The regression model performance parameters are all measures that incorporate both systematic and random errors that are within the acceptable range.

(c) The coefficient of determination (R^2) between the measured and forecast wind speed data ranges between 0.853 - 1. The trend and regression analysis can be used with acceptable accuracy for prediction of wind speed.
(d) This further implies that the average wind speed is enough to transport pollen grains from one location to another provided there are no obstacles.

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EXISTENCE AND UNIQUENESS OF SOLUTION FOR CONTRACTION PRINCIPLE IN METRIC SPACES

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Abstract
This article uses contraction mapping principle in metric space to illustrate the existence and uniqueness of solution to second order differential equations. Some examples are considered to justify our claim.

Keywords: Picard theorem, Fixed point, Lipschitz map, Nonlinear operator.

Introduction
The study of nonlinear operator was introduced in the early twenties. The Picard's existence and uniqueness of solution to first-order equations [Picard (1893)] with given initial conditions have received rigorous attention of researchers. The proof is basically on transforming the differential equation and applying fixed point. It can be established by using the Banach fixed point theorem [A'lvarez (2011) and Banach (1932)] such that the Picard iteration is convergent with a unique limit. In this paper, we consider second order differential equations which is transformed to first-order vector differential equation and employ the Banach's theorem to discuss the existence and uniqueness of their solutions. See [Ambrosetti & A'lvarez (2011), Kreyszig, Maddox, Rhoades(1977)].

Preliminary Results
Let us consider the general first order equation:

$$y' = f(t,y) \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (1)$$

Where f is defined for (t,y) on some continuous sets. Suppose $f_1,\ f_2,\ \ldots,\ f_n$ are continuous-valued functions defined for $(t, y_1,\ y_2,\ \cdots,\ y_n)$ space. A wide class of (1) is the system:

$$\begin{aligned} y_1' &= f_1(t, y_1,\ y_2,\ \cdots,\ y_n) \\ y_2' &= f_2(t, y_1,\ y_2,\ \cdots,\ y_n) \\ &\vdots \quad\quad\quad\quad \vdots \\ y_n' &= f_n(t, y_1,\ y_2,\ \cdots,\ y_n) \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (2) \end{aligned}$$

This is a system of n ordinary differential equations of the first order, the derivatives $y_1', y_2', y_3' \cdots\cdots\cdots, y_n'$ appear explicitly and they are analogue of (1).

Second Order Equation. An equation of second order

$$y'' = f(t, y, y') \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (3)$$

may be treated as a system of the form (2).

Let y = y_1, y' = y_2

Then (3) can be written as:

$$y_1' = y_2 \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (4a)$$
$$y_2' = f(t, y_1, y_2) \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (4b)$$

which may be viewed as the type (2). The clear difference between (1) and (2) is that a complex number y is now to deal with two such complex numbers y_1, y_2.

Let y be a vector of the two complex numbers and we may write

y = (y_1, y_2). The set of all such vectors is called the complex

2-dimensional space C^2. Systems as Vector Equations. Consider the first order system of equations

$$y_1' = f_1(t, y_1, y_2) \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (5a)$$
$$y_2' = f_2(t, y_1, y_2) \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (5b)$$

It is assumed that f_1, f_2 are complex-valued functions defined for

(t, y_1, y_2) on some set, where t is real and y_1, y_2 are complex.

Clearly, f_1, f_2 are functions of t and the vector y, where y = (y_1, y_2) in C^2. Therefore, we may write

$$f_1(t, y) = f_1(t, y_1, y_2)$$
$$f_2(t, y) = f_2(t, y_1, y_2)$$

In (5a) and (5b), we have two functions f_1, f_2 which may be regarded as a vector-valued function f = (f_1, f_2), which may also be given by

f (t, y) = (f_1(t, y), f_2(t, y)) .

Suppose

$$y' = (y_1', y_2''),$$

then the system (5a) and (5b) may now be written as

$$y' = f(t, y) \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (6)$$

Remark. The vector differential equation (6) now has the form (1).

Definition 2.1. A vector-valued function f is said to satisfy a Lipschitz condition on Ω if there is a number K > 0 such that

$$|f(t, y) - f(t, z)| \leq K\,|y - z| \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (7)$$

for all y, z $\in$ C^2 and (t, y), (t, z) $\in$ Ω . The least value of constant K is called the Lipschitz constant.

Proposition 2.1. Let *f* be a vector-valued function defined for (t, y) on a set Ω given by

$$\Omega := \{(t, y): |t - t_o| \leq a, |y - y_o| \leq b,\ a, b > 0\}$$

If $\frac{\partial f}{\partial yk}$ (k = 1, 2) is continuous on Ω and there is a constant $K > 0$ such that $\left|\frac{\partial f}{\partial yk}\right| \leq K$ for (t, y) $\in \Omega$, then f satisfies a Lipschitz condition on Ω.

Proof: See [Coddington(1989)]

Proposition 2.2. Consider the vector differential equation

$$y' = f(t, y)$$

where the components f_1, f_2 of f are of the form

$$f_1(t, y) = a_{11}(t)y_1 + a_{12}(t)y_2 \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (8a)$$

$$f_2(t, y) = a_{21}(t)y_1 + a_{22}(t)y_2 \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (8b)$$

where $a_{11}(t), \cdots, a_{22}(t)$, $b_1(t)$, $b_2(t)$ are complex-valued functions defined for real t in some interval I. If all the aij are continuous on an interval I : $|t - t_o| \leq a$, where a > 0, then the corresponding vector-valued function f satisfies a Lipschitz condition on the strip

$$\Omega : |t - t_o| \leq a, |y - y_o| \leq b \text{ or } |y| < \infty, \text{ a, b} > 0$$

Proof: See [Coddington(1989)]

Proposition 2.3. The vector differential equation (6) defined on Ω is equivalent to the integral equation

$$y = y_o + \int_{t_o}^{t} f(\tau, y(\tau))d\tau \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (9)$$

where $y_o = (\alpha_1, \alpha_2), f(\tau, y(\tau)) = (f_1, f_2)$ and

$$f_k(\tau, y(\tau)) = \sum_1^2 a_{jk}(\tau)\, y_k(\tau) + b_k(\tau), K = 1, 2$$

We complete this section with a proposition which is sequel to our work.

Proposition 2.4. Let X be a metric space. Then X is said to be complete if every cauchy sequence in X has a limit x which is in X.
A subset Y of a metric space X is complete if it is closed See [Chidume (1989)].

Problem Formulation

In this section, we discuss the Banach fixed point theorem which states sufficient conditions for the existence and uniqueness of a fixed point and also gives a constructive procedure for obtaining sharp results to the fixed point. We start with the following definitions:

Definition 3.1. Let X be a non-empty set and T be a mapping of X into itself. A point $x \in X$ is said to be a fixed point of the mapping T if

$$Tx = x \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

i.e. the image Tx coincides with x

Definition 3.2. Let $X = (X, d)$ be a metric space. A mapping $T: X \to X$ is called a Lipschitz map if there is a real number $c > 0$ such that for all $x, y \in X$

$$d(Tx, Ty) \leq cd(x, y) \quad \text{.....(11)}$$

for all $x, y \in X$ and T is called a contraction on X if there is a positive real number $c < 1$ such that for all $x, y \in X$.

Remark. If $c = 1$, then (11) becomes $d(Tx, Ty) < d(x, y)$ which may not be replaced for (11). In this case, T is called nonexpansive (9).

Proposition 3.3. Let T be a contraction mapping, then for any positive integer n, T^n is also a contraction mapping.

Proof

Let T be a contraction mapping $T: X \to X$, (by Definition 3.2) there exists $c < 1$ for $x, y \in X$ such that

$$d(Tx, Ty) \leq cd(x, y)$$

Now,

$$\begin{aligned} d(T^n x, T^n y) &= d\big(T(T^{n-1}x), T(T^{n-1}y)\big) \\ &\leq cd(T^{n-1}x, T^{n-1}y) \\ &\leq c^2 d(T^{n-2}x, T^{n-2}y) \\ &\vdots \\ &= c^n d(T^{n-n}x, T^{n-n}y) \\ &\leq c^n d(x, y) \\ \Rightarrow d(T^n x, T^n y) &\leq c^n d(x, y) \end{aligned}$$

Since $c < 1$, then $c^n < 1$ for all n. Therefore, T^n is a contraction.

Remark. If c is a constant of contraction T then c^n is a constant of contraction T^n.

Proposition 3.4. Every contraction mapping of a metric space (X, d) is a continuous mapping.

Proof

Let $T: X \to X$ be a contraction mapping of a metric space X, then there is a positive constant $c < 1$ such that

$$d(Tx, Ty) \leq cd(x, y) \text{ for all } x, y \in X$$

Let $\varepsilon > 0$ be given, we want to find $\delta > 0$ such that whenever

$$d(x, y) < \delta \Longrightarrow d(Tx, Ty) < \varepsilon$$

Choose $0 < \delta < \frac{\varepsilon}{c}$. Then, for $x, y \in X \;\; d(x, y) < \delta$

$$\Longrightarrow d(Tx, Ty) \leq cd(x, y) < c\frac{\varepsilon}{c} = \varepsilon$$

Hence the proof. See [1] for similar proof.

Theorem 3.5 (Banach Fixed Point Theorem). Let X be a non empty metric space. Suppose that X is complete and $T: X \to X$, is a contraction on X. Then, T has precisely one fixed point $x \in X$.

Proof

Let $x_0 \in X$ be arbitrarily fixed and define the iterative sequence $\{x_n\}$ by

$$x_0, x_1 = Tx_0, \; x_2 = T^2x_0, \ldots, x_n = T^nx_0. \quad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

We have constructed the sequence of various images of x_0 under repeated application of T. Next, we show that $\{x_n\}$ is Cauchy.

By (10) and (11), we have

$$\begin{aligned} d(x_n, x_{n+1}) = d(Tx_{n-1}, Tx_n) & \\ \leq cd(x_{n-1}, x_n) & \\ \leq c^2 d(x_{n-2}, x_{n-1}) & \\ \vdots & \\ = c^n d(x_{n-n}, x_{n-n+1}) & \\ \leq c^n d(x_0, x_1) \quad \ldots\ldots\ldots\ldots\ldots\ldots & (13) \end{aligned}$$

Let $m > n$ for $n, m \in N$, then by geometric progression and proposition (3.3),we have

$$d(x_n, x_m) \leq d(x_n, x_{n+1}) + d(x_{n+1}, x_{n+2}) + \cdots + d(x_{m-1}, x_m)$$

$$\leq c^n d(x_0, x_1) + c^{n+1} d(x_0, x_1) + \cdots + c^{m-1} d(x_0, x_1)$$
$$= c^n d(x_0, x_1)(1 + c + c^2 + \cdots + c^{m-n-1})$$
$$= c^n \left(\frac{1-c^{m-n}}{1-c}\right) d(x_0, x_1)$$

Since $c < 1$, then $1 - c^{m-n} < 1$ for $m - n > 0$

So that,

$$d(x_n, x_m) \leq \left(\frac{c^n}{1-c}\right) d(x_0, x_1) \quad \text{..... (14)}$$

On the right, $c < 1$ and $d(x_0, x_1)$ is fixed. So, as $n \to \infty, c^n \to 0$ which make the right hand side inequality as small as we please.

This proves that $\{x_n\}$ is Cauchy.

Since X is a complete metric space, then $\{x_n\}$ converges to a point,

say, x in X, that is

$$x_n \to x, as\ n \to \infty \quad \text{..... (15)}$$

Also, since T is a contraction, (by proposition (3.4)) T is continuous.

Therefore, $Tx_n \to Tx$ whenever (15) holds.

Next is to show that the limit x is the fixed point of the mapping T.

By (10),

$$d(Tx, x) \leq d(x, x_n) + d(x_n, Tx)$$
$$\leq d(x, x_n) + cd(x_{n-1}, x)$$

By (15), $x_n \to x$ and $x_{n-1} \to x$, as $n \to \infty$

Thus,

$$d(Tx, x) = 0 \Leftrightarrow Tx = x$$

And finally, we show that the limit x is the only fixed point of T.

Suppose x and $\tilde{x}$ are two fixed points, then

$$d(x, \tilde{x}) = d(Tx, T\tilde{x})$$
$$\leq cd(x, \tilde{x})$$

Thus,

$$d(x, \tilde{x}) = 0, \text{ if and only if } x = \tilde{x}$$

Hence, x is the only fixed point of T.

This completes the proof.

Corollary 3.6. Let X be a complete metric space and T is such that $T: X \to X$. Suppose T^n is a contraction on X, then T^n has only one fixed point.

Remark. Generally in application, the mapping T is a contraction not on the entire space X.

Since a closed subset of a complete space X is complete, T has a fixed point on the closed

subset provided there is a restriction on the choice of x_0 so that the x_n lie in the closed subset.

This is justified by the following theorems.

Theorem 3.7 (Baire Category). Let X be a non empty complete metric space. Let $\{F_n\}_{n=1}^{\infty}$ be sequence of closed sets such that

$$X = \bigcup_{n=1}^{\infty} F_n$$

Then, there exists an integer n_0 such that $Int(F_{n_0}) \neq \emptyset$

Proof

Suppose no F_n contains an open ball. Let S_0 be an open ball in X , then for any $x_0 \in S_0$, there exists $r_0 < 1$ such that

$$B(x_0, r_0) \subset S_0$$

Then, the complement F_n^c intersects every open ball $S_0 \in X$.

Observe that $F_n^c \cap S_0$ is a non empty open set.

Let $x_1 \in F_1^c \cap S_0$, there exists $r_1 < \frac{1}{2}$ such that $\overline{B(x_1, r_1)} \subset F_1^c \cap S_0$

Since no F_n contains an open ball, then $B(x_1, r_1) \not\subset F_1$

Hence, F_2^c intersects B_1. Let $x_2 \in F_2^c \cap B_1$, since $F_2^c \cap B_1$ is an open set, then

$\exists\ r_2 < \frac{1}{4}$ such that

$$B_2 \equiv \overline{B(x_2, r_2)} \subset F_2^c \cap B_1 \subset B_1$$

Since no F_n contains an open ball, then $B(x_2, r_2) \not\subset F_3$

$$F_3^c \cap B_2 \neq \emptyset$$

Let $x_3 \in F_3^c \cap B_2$, since $F_3^c \cap B_2$ is an open set, then $\exists\ r_3 < \frac{1}{8}$ such that

$$B_3 \equiv \overline{B(x_3, r_3)} \subset F_3^c \cap B_2 \subset B_2$$

Since no F_n contains an open ball, then $B(x_2, r_2) \not\subset F_3$, if we continue in this manner , we obtain , by induction a sequence $B_n \equiv B(x_n, r_n)$

$$B_{n+1} \equiv \overline{B(x_{n+1}, r_{n+1})} \subset F_{n+1}^c \cap B_n \subset B_n, \quad r_n < \frac{1}{2^n}$$

Furthermore, $\overline{B_{n+1}} \subset B_n$, for each n

Moreover, $\{x_n\}_{n=1}^{\infty}$ is a cauchy sequencein X. By completeness of X.

$x_n \to x^* \in \bigcap_{n=1}^{\infty} B_n$ (i.e $x^* \in B_n\ for\ each\ n$) Since F_n^c intersects B_n for each n.

Hence,

$x^* \in F_n^c \Longrightarrow x^* \notin F_n$ for each n

This implies

$$x^* \notin \bigcup_{n=1}^{\infty} F_n$$

This is a contradiction and therefore

$$Int(F_{n_0}) \neq \emptyset$$

Remark. Observe that the diameter of $B_1 \supset B_2 \supset B_3 \supset \ldots \supset B_n \supset B_{n+1}$, where each B_n is a non empty closed subset of X, shrinks to a point , i.e diameter $(B_n) \to 0 \ \ as \ n \to \infty$ and we have

$\bigcap_{n=1}^{\infty} B_n \neq \emptyset$ .....(16)

In fact, (16) is a singleton set. This is generally reffered to as Principle of Nested sequences. We shall show how this theorem can be adapted to show existence and uniqueness of solutions of vector differential equation (6)

Main Result

We begin with the following theorem

Theorem 4.1. Let f be a continuous vector-valued function defined on

$$\Omega := \{(t,y): |t - t_0| \leq a, |y - y_0| \leq b, (a,b > 0)\}$$

And bounded on Ω, say

$$|f(t,y)| \leq M$$

Suppose *f* satisfies a Lipschitz condition on Ω with respect to its second argument. Then, the iterative function sequence $\{\Phi_m\}_{m=1}^{\infty}$ obtained in (19) converge on the interval $[t_0 - \beta, t_0 + \beta]$ where

$\beta < min\left\{a, \frac{b}{M}, \frac{1}{K}\right\}$.....(17)

To a solution Φ of the system (6)

Proof

Let $C(I)$ be the metric space of all complex-valued continuous function on the interval $I = [t_0 - a, t_0 + a]$. For $t \in [t_0 - a, t_0 + a]$ and $\Phi(t), \Psi(t) \in C(I)$, the metric on $C(I)$ is defined by

$$d(\Phi(t), \Psi(t)) = \sup_{t \in [t_0 - a, t_0 + a]} |\Phi(t) - \Psi(t)|$$

$C(I)$ is complete (7).

Let $J = [t_0 - \beta, t_0 + \beta] \subset I$, then $C(J)$ is a closed subspace of $C(I)$ which is also complete by proposition 2.5

Define the mapping $T: C(J) \to C(J)$ and $T\Phi(t) = \Phi(t)$ for $\Phi \in C(J)$

Consider a ball B in $C(J)$ with radius b centred at y_0 given by

$$B = \{\Phi \in C(J): |\Phi(t) - y_0| \leq b\}$$

We show that $B \supset T(B)$, suppose

$$T\Phi(t) = y_0 + \int_{t_0}^{t} f_k(\tau, \Phi(\tau))d\tau$$

Where

$$f_k(\tau, y(\tau)) = \sum_{j=1}^{2} a_{jk}(\tau)yk(\tau) + bk(\tau), \quad k = 1,2$$

$$\Longrightarrow d(T\Phi(t), y_0) = \sup |T\Phi(t) - y_0|$$

$$= sup \left| \int_{t_0}^{t} f_k(\tau, \Phi(\tau))d\tau \right|$$

$$\leq sup \left| \int_{t_0}^{t} |f_k(\tau, \Phi(\tau))|d\tau \right|$$

$$\leq M \; sup|t - t_0|$$

$$\leq M\beta < b.$$

Which implies for $\Phi \in T(B) \Longrightarrow \Phi \in B$, and thus, T maps $C(J)$ into itself. Next is to show that T is a contradiction on $C(J)$.

By the Lipschitzian assumptions (7) and for $\Phi(t), \Psi(t) \in C(J)$.

We have

$$d(T\Phi, T\Psi) = sup|T\Phi(t) - T\Psi(t)|$$

$$= sup \left| \int_{t_0}^{t} f_k(\tau, \Phi(\tau))d\tau - \left(\int_{t_0}^{t} f_k(\tau, \Psi(\tau))d\tau \right) \right|$$

$$\leq sup \left| \int_{t_0}^{t} \left| \sum_{j=1}^{2} a_{jk}(\tau)\phi_k(\tau) - \sum_{j=1}^{2} a_{jk}(\tau)\psi_k(\tau) \right| d\tau \right|$$

$$\leq sup \left| \int_{t_0}^{t} \sum_{j=1}^{2} |a_{jk}(\tau)||C\phi_k(\tau) - \psi_k(\tau)|d\tau \right|$$

$$\leq K \; sup|\Phi(\tau) - \Psi(\tau)| \; \sup|t - t_0|$$

$$\leq K\beta d(\phi, \psi)$$

From (17), choose $c = k\beta < 1$, so that T is a contraction on $c(J)$

The conclusion of the theorem follows from Theorem 3.5.

Remark 4.1

Observe that the existence result proved above is local. Moreso, interval I depends on M, K and on the initial condition.

Remark 4.2

Let f be a continuous vector –valued function and global on the strip.

$$\Omega' := \{(t, y): |t - t_0| \leq a, |y| < \infty\}$$

Then the iterative sequence $\{\Phi_m(t)\}_{m=1}^{\infty}$ exist on $|t - t_0| \leq a$ and converge to a solution of the system (6).

We now discuss the existence and uniqueness of solution of a second order differential equation. We now consider the following examples:

Example 1:

Let us consider the problem

$$\frac{d^2u}{dt^2} + \mu^2 u = 0, \mu \epsilon \Re, u(0) = 0, u'(0) = 1$$

Solution

Let u =u_1 , so that

$$u_1' = u_2 ,$$
$$u_2' = -\mu^2 u_1$$

This can be represented as the vector differential equation

$$u' = f(t, u_1, u_2)$$

Where $\boldsymbol{f}(t, u_1, u_2)$ =$(u_2, -\mu^2 u_1)$.

Now,

$$\frac{\partial f_1}{\partial u_1} = 0, \frac{\partial f_1}{\partial u_2} = 1$$
$$\frac{\partial f_2}{\partial u_1} = -\mu^2, \frac{\partial f_2}{\partial u_2} = 0$$

So,

$$\left|\frac{\partial \boldsymbol{f}}{\partial u_1}\right| = \mu^2, \left|\frac{\partial \boldsymbol{f}}{\partial u_1}\right| = 1$$

Thus, $\boldsymbol{f}$ satisfies a lipschitz conditions with constant $L = \mu^2$

Also, Let T be a mapping defined by

$$T\mathbf{u} = \mathbf{u_0} + \int_{t_0}^{t} \mathbf{f}(\tau, \mathbf{u}(\tau))d\tau$$
$$d(T\mathbf{u}, T\mathbf{v}) = |T\mathbf{u}(t) - T\mathbf{v}(t)|$$

$$= \left| \int_{t_0}^{t} \mathbf{f}(\tau, \mathbf{u}(\tau)) d\tau - \int_{t_0}^{t} \mathbf{f}(\tau, \mathbf{v}(\tau))\, d\tau \right|$$

$$= \left| \int_{t_0}^{t} [\mathbf{f}(\tau, \mathbf{u}(\tau)) - \mathbf{f}(\tau, \mathbf{v}(\tau))] d\tau \right|$$

$$\leq \left| \int_{t_0}^{t} |(u_2, \mu^2 u_1) - (v_2, \mu^2 v_1)|\, d\tau \right|$$

$$\leq \left| \int_{t_0}^{t} |u_2 - v_2, \mu^2 (v_1 - u_1)|\, d\tau \right|$$

$$= |t|(|u_2 - v_2| + |\mu^2||v_1 - u_1|)$$

$$\leq |t|(1 + \mu^2)|\mathbf{u} - \mathbf{v}|$$

$$= |t|K|\mathbf{u} - \mathbf{v}|$$

Where $K = 1 + \mu^2 \equiv 1 + L$ and $c = |t|K < 1$

Hence, T is a contraction

Now, we show that $\mathbf{u}_m \rightarrow \mathbf{u}, \quad m = 1,2,3, \ldots$

Let $\mathbf{u}_m \equiv \mathbf{u}^m and\ \mathbf{u}^0 = (0,1)$ be fixed.

$$\mathbf{u}^1 = (0,1) + \int_0^t \mathbf{f}(s, u_1^0 u_2^0) ds$$

$$= (0,1) + \int_0^t (u_2^0, -\mu u_1^0)\, ds$$

$$= (0,1) + \int_0^t (0,1) ds$$

$$= (0,1) + (t,0) = (t,1)$$

$$\mathbf{u}^2 = (0,1) + \int_0^t (u_2^1, -\mu u_1^1) ds$$

$$= (0,1) + \int_0^t (1, -\mu^2 s) ds$$

$$= (0,1) + \left(t, -\mu^2 \frac{t^2}{2}\right) = \left(t, 1 - \mu^2 \frac{t^2}{2}\right)$$

$$\mathbf{u}^3 = (0,1) + \int_0^t (u_2^2, -\mu u_1^2) ds$$

$$= (0,1) + \int_0^t \left(1 - \mu^2 \frac{s^2}{2}, -\mu^2 s\right) ds$$

$$= (0,1) + \left(t - \mu^2 \frac{t^3}{6}, -\mu^2 \frac{t^2}{2}\right) = \left(t - \mu^2 \frac{t^3}{6}, 1 - \mu^2 \frac{t^2}{2}\right)$$

$$\boldsymbol{u}^4 = (0,1) + \int_0^t (u_2^3 - \mu u_1^3) ds$$

$$= (0,1) + \int_0^t \left(1 - \mu^2 \frac{s^2}{2}, -\mu^2 s + \mu^4 \frac{s^3}{6}\right) ds$$

$$= (0,1) + \left(t - \mu^2 \frac{t^3}{6}, -\mu^2 \frac{t^2}{2} + \mu^4 \frac{t^4}{24}\right)$$

$$= \left(t - \mu^2 \frac{t^3}{6}, 1 - \mu^2 \frac{t^2}{2} + \mu^4 \frac{t^4}{24}\right)$$

$$\boldsymbol{u}^5 = (0,1) + \int_0^t (u_2^4, -\mu u_1^4) ds$$

$$= (0,1) + \int_0^t \left(1 - \mu^2 \frac{s^2}{2} + \mu^4 \frac{t^4}{24}, -\mu^2 s - \mu^4 \frac{s^3}{6}\right) ds$$

$$= (0,1) + \left(t - \mu^2 \frac{t^3}{6} + \mu^4 \frac{t^5}{120}, -\mu^2 \frac{t^2}{2} + \mu^4 \frac{t^4}{24}\right)$$

$$= \left(t - \mu^2 \frac{t^3}{6} \mu^4 \frac{t^5}{120}, 1 - \mu^2 \frac{t^2}{2} + \mu^4 \frac{t^4}{24}\right)$$

It is easily seen that $\mathbf{u}_m$ exists for all real t and that

$$\mathbf{u}_m \to \mathbf{u} = (\sin \mu t, \cos \mu t)$$

Example 2

Let us consider the problem

$$\frac{du}{dt} + u^{\frac{3}{4}} = 0, \qquad u(0) = 0$$

Solution

$$\Rightarrow \frac{du}{dt} = -u^{\frac{3}{4}} \equiv f(t,u)$$

Now,

$$\frac{\partial f}{\partial u} = -\frac{3}{4}u^{-\frac{1}{4}}$$

And

$$\left|\frac{\partial f}{\partial u}\right| = \frac{3}{4}u^{-\frac{1}{4}}$$

Observe that $f(t,u) = -u^{\frac{3}{4}}$ is not Lipchitian at the origin and hence, the uniqueness of the solution is not guaranteed.

Conclusion

In conclusion, if we suppose f is a continuous vector-valued function defined on

$$\widehat{\Omega} := \{(t,y): |t| < \infty, |y| < \infty\}$$

and satisfies Lipschitz conditions on each strip

$$(t,y): |t| \leq a, |y| < \infty$$

where a a is any positive number. Then, the iterative sequence

$$\{\Phi_m(t)\}_{m=1}^{\infty}$$

converges to a solution which exist for all real t.

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ON THE NUMERICAL SIMULATIONS OF A MATHEMATICAL MODEL OF TUBERCULOSIS WITH EFFECT OF IMMUNIZATION AND INFECTIOUS TUBERCULOSIS TREATMENT

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Absract
In this study we used Euler's numerical method to derive an algorithm for the solution of an existing mathematical model for preventing mother to child transmission of tuberculosis using Bacillus Calmette-Guerin. The algorithm was used to produce a software for simulation using visual basic programming language. We observed that total eradication of Tuberculosis within two decades is only achievable when there is at least 90 % immunization coverage along side with very low contraction rate.

Keywords: Mathematical Model, Tuberculosis, Immunization and Total Eradication

Introduction

In 1993, concerned with the rising cases of deaths and infection rates, the World Health Organization (WHO) declared tuberculosis as a global emergency. Approximately a third of the worlds' population wass affected by tuberculosis, particularly affecting people in developing countries where 99% of tuberculosis deaths occur. Of the 1.7 billion people estimated to be infected with tuberculosis, 1.3 billion live in developing countries.

Despite many decades of study, the widespread availability of vaccines, an arsenal of anti-microbial drugs and, more recently, a highly visible World Health Organization effort to promote a unified global control strategy, tuberculosis (TB) remains a leading cause of infectious mortality. It is responsible for approximately two million deaths each year. Although TB is currently well-controlled in most countries, recent data indicate that the overall global incidence of TB is rising as a result of resurgence of disease in Africa and parts of Eastern Europe and Asia (Dye, 2006). In these regions, the emergence of drug-resistant TB and the convergence of the HIV (human immunodeficiency virus) and TB epidemics have created substantial new challenges for disease control.

Bacillus Calmette-Guérin (or Bacille Calmette-Guérin, BCG) is a vaccine against tuberculosis that is prepared from a strain of the attenuated (weakened) live bovine tuberculosis bacillus, *Mycobacterium bovis*, that has lost its virulence in humans by being specially cultured in an artificial medium for years. The bacilli have retained enough strong antigenicity to become a somewhat effective vaccine for the prevention of human tuberculosis. At best, the BCG vaccine is 80% effective in preventing tuberculosis for a duration of 15 years; however, its protective effect appears to vary according to geography Colditz et al (1994).

Mathematical models can be defined as the process of creating a mathematical representation of some phenomena in order to gain a better understanding of then. It is therefore, an abstraction of reality in to the world of mathematics. Any phenomena which have the ability to grow or decay over time can be represented by a mathematical model and then solved analytically where feasible or in several cases tools of advanced calculus and Functional analysis are employed to study and interpret the dynamics. Sowumi (1993) described this as experimenting on paper which is safer than using human or animal lives. Also, numerical or computer simulations of such models can be carried out. The analysis of such models will then give an insight into the dynamics of the real life situation. Mathematical knowledge such as the existence of equilibrium

states and their stability analysis are of great interest in the mathematical models of population dynamics.

Mathematical models have played great role in discussing the dynamics of Tuberculosis, this includes Okyere (2007) who proposed a deterministic compartmental models of HIV and TB, but this model did not take into account that latently infected individual can recover without progressing to infectious class, He also stated that Successfully treated Infectious individuals move back to slow rate Latent class this is not also realistic, this happens when re infection occurs else they move into recovered class.

Yusuf (2008) also proposed a deterministic compartmental model but ignored the different rates of progression from latent to infectious class, this however precludes the speedy progression of TB caused by HIV infections. By weakening the immune system of a TB patient, HIV acts as catalyst in the progression of TB from latent class to infectious class. A patient with AIDS who become infected with mycobacterium tuberculosis has a 50% chance of developing active tuberculosis within 2 months and a 5 to 10% chance of developing active disease there after, infants and young children are also more likely to develop active TB than older people since their immune system are not yet well developed (WHO report 2003)

Hughes et al (2006) established that progression to active TB is said to be rapid if it occurs within 5 years after infection. The same paper also stated that 14% of HIV negative people or early HIV positive people develop active TB within these five years after which the progression is slow which is 0.001/year. Also 67% of people who are in their late stage of HIV develop TB within 5 years, after that the progression is slow, 0.1/year Hughes et al (2006).

Enagi, (2011), Enagi and Ibrahim (2011a), Enagi and Ibrahim (2011b) and Enagi, (2013) presented four new deterministic compartmental mathematical models for the dynamics of tuberculosis taking into consideration the effect of HIV/AIDS on immune system and administration of BCG vaccines as immunity against infection.

In this work we extended the work of Enagi and Ibrahim (2011b) by developing a software for numerical simulation of the model in order to have a clear insight into the dynamics of the model.

Materials and Method

The Model as presented in Enagi and Ibrahim (2011b) was described by a system of four differential equations as shown below.

$$\frac{dM}{dt} = \theta\rho - (\alpha + \mu)M \qquad (1)$$

$$\frac{dS}{dt} = (1-\theta)\rho + \alpha M - \beta SI - \mu S \qquad (2)$$

$$\frac{dI}{dt} = \beta SI - (\gamma + \mu + \delta)I \qquad (3)$$

$$\frac{dR}{dt} = \gamma I - \mu R \qquad (4)$$

The model parameters and variables are given below with their respective descriptions
M(t) :- Immuned compartment at time t.
S(t) :- Susceptible compartment at time t.
R(t):- Recovered compartment at time
I (t): - Infectious compartment at time t.

ρ :- Recruitment rate.
μ :- Natural death rate.
α :- Removal rate from Immuned compartment into Susceptible compartment at time t.
β :- Tuberculosis instantaneous incidence rate per Susceptible.
θ :- Proportion of the Susceptible class Immunized at birth against Infection .
δ :- Tuberculosis induced death rate
γ - Recovery rate of I(t).

Numerical Solution

The system of equations in the model was converted into difference equations using Euler's numerical method (Stroud and Dexter, 2003).

$$f(a+h) = f(a) + hf'(a)$$

Where *h* is the step size and $f'(a)$ is the derivative of $f(a)$.

From (1)

$$M'(t) = \theta\rho - (\alpha + \mu)M(t)$$

Thus, by the Euler's method:

$$M(t+h) = M(t) + hM'(t)$$

We have that

$$M(t+h) = M(t) + h[\theta\rho - (\alpha + \mu)M(t)]$$

With *h=1,* we have

$$M(t+1) = M(t) + \theta\rho - (\alpha + \mu)M(t)$$

Similarly from (2)

$$S'(t) = (1-\theta)\rho + \alpha M(t) - \beta S(t)I(t) - \mu S(t)$$

And hence the Euler's method with *h=1* leads to

$$S(t+1) = S(t) + (1-\theta)\rho + \alpha M(t) - \beta S(t)I(t) - \mu S(t)$$

From (3)

$$I'(t) = \beta S(t)I(t) - (\gamma + \mu + \delta)I(t)$$

So that Euler's method with *h=1* gives

$$I(t+1) = I(t) + \beta S(t)I(t) - (\gamma + \mu + \delta)I(t)$$

From (4)

$$R'(t) = \gamma I(t) - \mu R(t)$$

Consequently , Euler's method also gives

$$R(t+1) = R(t) + \gamma I(t) - \mu R(t)$$

The resulting difference equations was coded using visual basic programming language to produce the software for the simulations (Appendix A).

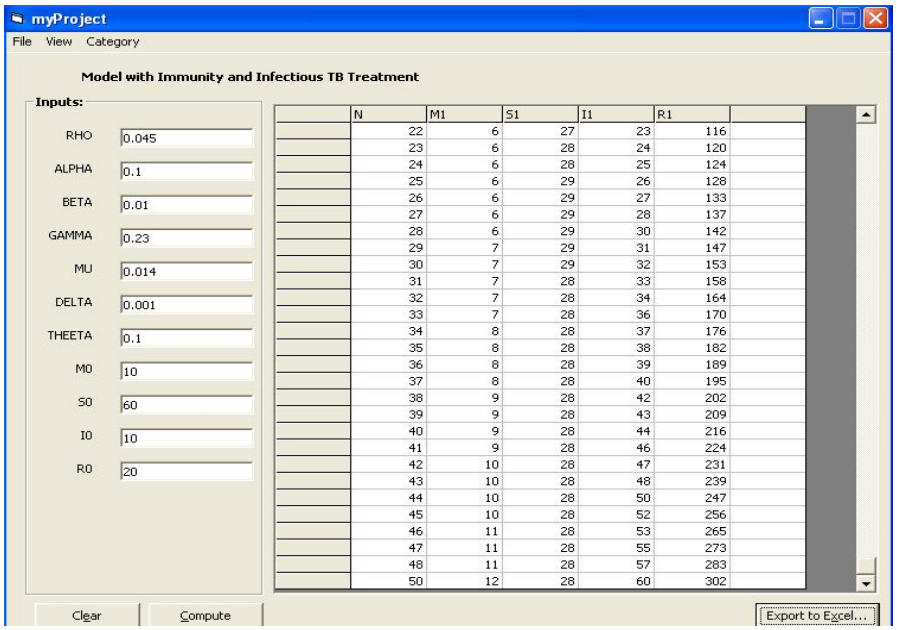
Results and Discussion

Numerical Simulations of the Model

This section presents graphs generated using the model-based software developed with visual basic programming language. The aim of this is to study the profile of the population in respect of the distinct compartments in the model and to consider the effect of varying some parameter values on the population.

From the available literature, we adopted the following values for the parameters in the model

Recruitment rate ρ = 0.045 (National Population Commission, Abuja, 2008).
Natural death rate μ= 0.014 (National Population Commission, Abuja, 2008).
Movement rate from Latent class to infectious class τ = 0.03 (Sanchez and Blower 1997, WHO 2006a, WHO 2006b).
Recovery rate of I(t) γ =0.23 (National Tuberculosis And Leprosy Control Programme Abuja, 2008).
Tuberculosis induced death rate δ = 0.001 (Estimated from National (Tuberculosis And Leprosy Control Programme Abuja, 2008))
Expiration of vaccine efficacy α (varied hypothetically).
Tuberculosis contraction rate β (varied hypothetically).



	N	M1	S1	I1	R1
	22	6	27	23	116
	23	6	28	24	120
	24	6	28	25	124
	25	6	29	26	128
	26	6	29	27	133
	27	6	29	28	137
	28	6	29	30	142
	29	7	29	31	147
	30	7	29	32	153
	31	7	28	33	158
	32	7	28	34	164
	33	7	28	36	170
	34	8	28	37	176
	35	8	28	38	182
	36	8	28	39	189
	37	8	28	40	195
	38	9	28	42	202
	39	9	28	43	209
	40	9	28	44	216
	41	9	28	46	224
	42	10	28	47	231
	43	10	28	48	239
	44	10	28	50	247
	45	10	28	52	256
	46	11	28	53	265
	47	11	28	55	273
	48	11	28	57	283
	50	12	28	60	302

Figure 1: Software interface

The following graphs were obtained for the model with the initial conditions of M(0) = 10, S(0) = 60, I(0) = 10 and R(0) = 20.

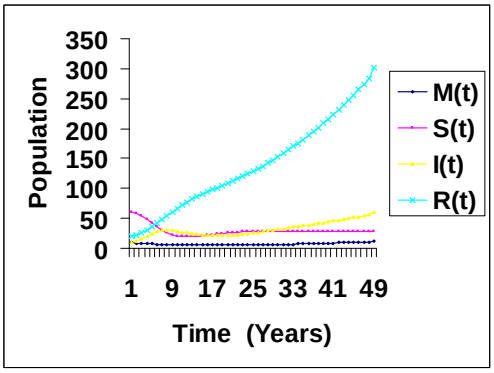


Fig 2: Graphical profile of the compartments for $\alpha = 0.1, \beta = 0.01 \& \theta = 0.1$

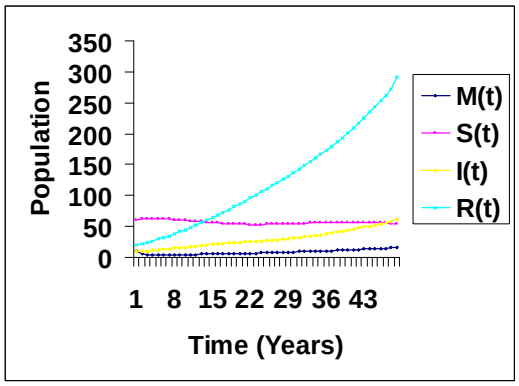


Fig 3 Graphical profile of the compartments for $\alpha = 0.5, \beta = 0.005 \& \theta = 0.5$

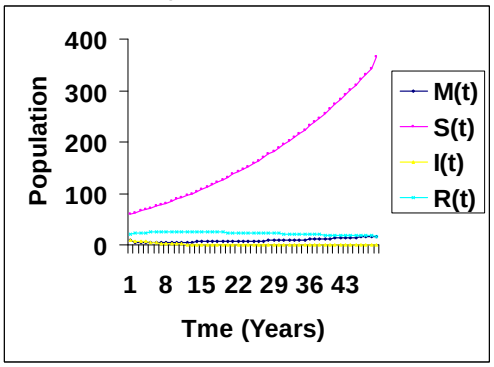


Fig 4: Graphical profile of the compartments for $\alpha = 0.9, \beta = 0.001 \& \theta = 0.9$

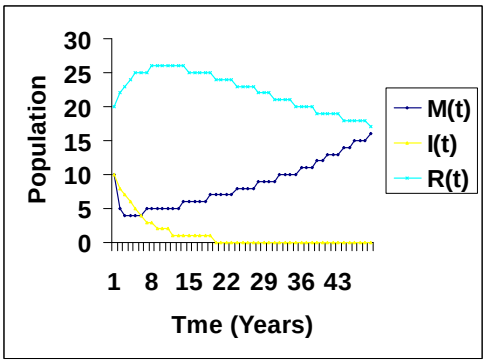


Fig 5: Closer view of M(t), I(t) and R(t) for $\alpha = 0.9, \beta = 0.001 \& \theta = 0.9$

Fig 2 shows the graphical profile of each compartment in the model for $\alpha = 0.1, \beta = 0.01 \& \theta = 0.1$ implying High contraction rate and low immunisation coverage. It was observed that R(t) was increasing rapidly. The susceptible compartment was gradually decreasing from the beginning until the 11th year. From the 11th to the 28th year, the Susceptible and Infectious classes were fluctuating until the 30th year when the two compartments continue to increase gradually leading to a TB endemic state.

With 50% immunization coverage and subsequent reduction in contraction rate 0.005 as shown in fig 3, it took the susceptible class 24 years to decrease gradually from 60 to 53 and then continue to increase gradually until the 48th year when it began to decrease again compared to fig 2 where the susceptible class decreased to as low as 20 within 14 years. The Infectious class increased steadily and intercepts with the susceptible class after 47 years when the susceptible class began to decrease while the infectious class continued increasing. This happened as early as 27th year in fig 2.

Increasing both α and θ to 0.9 and reducing β to 0.001 (i.e. low contraction rate and High immunisation coverage) as shown in figure 4, brought down the number of infectious individuals to 1 at t=12 and complete eradication at t=20. The immuned class was increasing steadily from t=20 at the same rate of decrement of R(t); this is because there was no more infectious individuals to be treated.

Conclusion

In order to achieve complete eradication of Tuberculosis within two decades there must be at least 90% immunization coverage along side with very low contraction rate. Introduction of

Latent TB treatment into this model will guarantee total eradication of Tuberculosis earlier than this time. The result of this study agrees with Enagi and Ibrahim, (2011b)

Recommendations

Efforts should be intensified to move the nation out of the current endemic situation to a stable disease free nation. This can be achieved by committing more effort and resources into

(i) detecting and treating Latently infected individuals;
(ii) reducing the break down of immune system of HIV patients by procurement of Antiretroviral drugs;
(iii) immediate isolation and commencement of treatment of Infectious TB cases;
(iv) administering Tuberculin Skin Test to all contacts to an infectious TB case;
(v) isoniazid preventive therapy should be administered to those positive to Tuberculin Skin Test.

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Appendix A

Source code for the software

```
'/**************************************************************************
'//  File Name: frmMain.frm
'//  File Size: 33.9 KB
'//  File Date: 7/9/13  10:14:32 AM
'// Printed On: Fri. July 9, 2013  10:15:31 AM
'/**************************************************************************

'Option Explicit
Dim i, x       As Integer
Attribute x.VB_VarUserMemId = 1073938432

Private Sub Form_Load()
   N = GetSetting(App.Title, "Settings", "N", N)
   A = GetSetting(App.Title, "Settings", "A", A)
   ClearTextBoxes

   Me.MSFlxGrd_TT.Clear
   Me.MSFlxGrd_TT.Rows = 50
   Me.MSFlxGrd_TT.Cols = 7

End Sub

Private Sub cmdExport_Click()
'Define the required variable
   Dim Data_Row As Integer, Data_Col As Integer

   Dim Excel  As Excel.Application        ' This is the excel program
   Dim ExcelWBk As Excel.Workbook         ' This is the work book
   Dim ExcelWS As Excel.Worksheet         ' This is the sheet

   If Not Excel Is Nothing Then Set Excel = Nothing
   Set Excel = CreateObject("Excel.Application")        'Create Excel Object.
```

```
   Set ExcelWBk = Excel.Workbooks.Add        'Add this Workbook to Excel.
   Set ExcelWS = ExcelWBk.Worksheets(1)        ' Add this sheet to this Workbook
   'Fill the Excel Sheet
   For Data_Row = 0 To Me.MSFlxGrd_TT.Rows - 1
      For Data_Col = 0 To Me.MSFlxGrd_TT.Cols - 1        '***MODIFIED***
         'For Data_Col = 1 To Me.MSFlxGrd_TT.Cols - 1    '**PREVIOUOSLY**
         Me.MSFlxGrd_TT.Row = Data_Row
         Me.MSFlxGrd_TT.Col = Data_Col
         ExcelWS.Cells(Data_Row + 1, Data_Col + 1) = Me.MSFlxGrd_TT.Text
      Next
   Next
   Me.CommonDialog1.ShowSave
   If       Len(Me.CommonDialog1.FileName)       >       0       Then       ExcelWBk.SaveAs
Me.CommonDialog1.FileName
   ' Close the WorkBook
   ExcelWBk.Close
   ' Quit Excel app
   Excel.Quit
   Set Excel = Nothing
End Sub

Private Sub cmdNew_Click()
'clear textboxes
   ClearTextBoxes
   ClearListView
End Sub

Private Sub mnuData_Click()
   InitialiseVariables
End Sub

Private Sub cmdCompute_Click()
   On Error Resume Next

      RHO = Val(Text(0).Text)
      AP = Val(Text(1).Text)
      BT = Val(Text(2).Text)
      GM = Val(Text(3).Text)
      MU = Val(Text(4).Text)
      DT = Val(Text(5).Text)
      TT = Val(Text(6).Text)
      M = Val(Text(7).Text)
      S = Val(Text(8).Text)
      i = Val(Text(9).Text)
      R = Val(Text(10).Text)

      For K = 1 To N

         Me.MSFlxGrd_TT.Row = K
         Me.MSFlxGrd_TT.Col = 1
         Me.MSFlxGrd_TT.Text = K

         Me.MSFlxGrd_TT.Row = K
         Me.MSFlxGrd_TT.Col = 2
```

```
        Me.MSFlxGrd_TT.Text = Format(M, "0")

        Me.MSFlxGrd_TT.Row = K
        Me.MSFlxGrd_TT.Col = 3
        Me.MSFlxGrd_TT.Text = Format(S, "0")

        Me.MSFlxGrd_TT.Row = K
        Me.MSFlxGrd_TT.Col = 4
        Me.MSFlxGrd_TT.Text = Format(i, "0")

        Me.MSFlxGrd_TT.Row = K
        Me.MSFlxGrd_TT.Col = 5
        Me.MSFlxGrd_TT.Text = Format(R, "0")

        T = S + L + i + R
        RH = RHO * T
        M = M + TT * RH - (AP + MU) * M
        S = S + (1 - TT) * RH + AP * M - BT * S * i - MU * S
        i = i + BT * S * i - (GM + MU + DT) * i
        R = R + GM * i - MU * R

    Next K

End Sub

Sub
   ClearLabels
   lblModelType.Caption = "Model With Immunity and Infectious TB Treatment"
   Me.Label(0).Caption = "RHO"
   Me.Label(1).Caption = "ALPHA"
   Me.Label(2).Caption = "BETA"
   Me.Label(3).Caption = "GAMMA"
   Me.Label(4).Caption = "MU"
   Me.Label(5).Caption = "DELTA"
   Me.Label(6).Caption = "THEETA"
   Me.Label(7).Caption = "M0"
   Me.Label(8).Caption = "S0"
   Me.Label(9).Caption = "I0"
   Me.Label(10).Caption = "R0"

   For i = 0 To 10
      Text(i).Visible = True
   Next

   Text(11).Visible = False
   Text(12).Visible = False
   Text(13).Visible = False


   Me.MSFlxGrd_TT.Row = 0
   Me.MSFlxGrd_TT.Col = 1
   Me.MSFlxGrd_TT.Text = "N"

   Me.MSFlxGrd_TT.Row = 0
   Me.MSFlxGrd_TT.Col = 2
```

```
    Me.MSFlxGrd_TT.Text = "M1"

    Me.MSFlxGrd_TT.Row = 0
    Me.MSFlxGrd_TT.Col = 3
    Me.MSFlxGrd_TT.Text = "S1"

    Me.MSFlxGrd_TT.Row = 0
    Me.MSFlxGrd_TT.Col = 4
    Me.MSFlxGrd_TT.Text = "I1"

    Me.MSFlxGrd_TT.Row = 0
    Me.MSFlxGrd_TT.Col = 5
    Me.MSFlxGrd_TT.Text = "R1"
End Sub

Private Sub mnuFileNew_Click()
    cmdNew_Click
End Sub

Private Sub mnuHelpAbout_Click()
    frmAbout.Show vbModal, Me
End Sub

Private Sub mnuN_Click()
    On Error Resume Next
    frmOptions.Show
End Sub

Private Sub mnuViewStatusBar_Click()
    mnuViewStatusBar.Checked = Not mnuViewStatusBar.Checked
    sbStatusBar.Visible = mnuViewStatusBar.Checked
End Sub

Sub ClearTextBoxes()
'clears all textboxes
    Dim i
    For i = 0 To 13
        Text(i).Text = ""
    Next
End Sub

Sub ClearLabels()
'clears all labels
    Dim i
    For i = 0 To 13
        Label(i).Caption = ""
    Next
End Sub

Sub ClearListView()
    On Error Resume Next
    Me.MSFlxGrd_TT.Clear
End Sub

Private Sub mnuFileExit_Click()
```

```
'unload the form
   Unload Me
End Sub

Private Sub Form_Unload(Cancel As Integer)
   Dim i      As Integer

   'close all Sub forms
   For i = Forms.Count - 1 To 1 Step -1
      Unload Forms(i)
   Next
   If Me.WindowState <> vbMinimized Then
      SaveSetting App.Title, "Settings", "MainLeft", Me.Left
      SaveSetting App.Title, "Settings", "MainTop", Me.Top
      SaveSetting App.Title, "Settings", "MainWidth", Me.Width
      SaveSetting App.Title, "Settings", "MainHeight", Me.Height
      SaveSetting App.Title, "Settings", "N", N
      SaveSetting App.Title, "Settings", "A", A

   End If
End Sub
```

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ARTICLES AND RESEARCH REPORTS ON EDUCATION

EFFECTS OF SHIFTING INTERACTION QUESTIONING TECHNIQUE ON STUDENTS' ACHIEVEMENT IN BASIC ELECTRICITY IN TECHNICAL COLLEGES

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Abstract

This study was to investigate effects of shifting interaction questioning technique on students' achievement in basic electricity in all the technical colleges in Federal Capital Territory and Niger State using quasi experimental Pretest posttest non-equivalent research design. The population for the study consisted of 165 year I basic electricity students. The entire population was used for the study. Two research questions were developed and answered while 3 null hypotheses were formulated and tested at 0.05 level of signifcance. The instrument used for data collection was Basic Electricity Achievement Test (BEEAT). The instrument was developed by the researcher, and validated by three experts in electrical/electronic technology education and measurement and evaluation. The reliability coefficient of BEAT was found to be 0.83 using Pearson Product Moment Correlation coefficient. Mean was used to answer the research questions; while ANCOVA was employed to test the hypotheses. The results of the data analysis showed among other things that shifting interaction Questioning Technique was more effective in enhancing female students' achievement in Basic electricity than the conventional questioning technique. The study found out that there was no interaction effect of treatment and gender on achievement in basic electricity. Based on the findings of the study, it is recommended among others that Basic electricity teachers should practice the use of shifting interaction questioning technique as part of their teaching techniques to encourage female participation in science and technology education.

Keywords: Shifting Interaction, Questioning technique, Achievement Basic Electricity and Gender

Introduction

Most technology educators are disenchanted with the conventional pedagogy of transmission of knowledge without inculcating in the students the ability to think for themselves and use problem-solving skills to handle novel situations. According to Oranu (2001), most vocational and technical teachers still adhere to the traditional lecture method in the classroom. This adherence to lecture method led to the evolution of what looks like "Critical thinking movement" in America (Schrag, 1992). Sequel to this also, the widely spreading programme, "Questioning and Understanding for Improving Learning and Thinking" (QUILT) sprang up in the United States of America (Orletsky, 1997).

Nigeria was not left out of the development, in technical colleges, the use of constructivist method of teaching is emphasized in order to inculcate in students the ability to think for themselve and move away from the highly criticized lecture method (Owoso, 2009). Owoso (2009) further asserted that the constructivist approach has recorded many successes in many vocational and technical education domains and many vocational and technical educators now advocate for its use in the vocational and technical classroom. Any behaviour, practice or technique that will enable students develop thinking skills is likely to help them to acquire technology concepts, which will lead to better achievement. The vocational and technical teacher is therefore expected not only to know what to teach but also how to teach it.

Basic Electricity is one of the courses offered in technical colleges. It involves the basic rudiment of electricity. It provides students with basic conceptual understanding of basic electrical concepts including basic electrical measurements, basic electrical theory and understanding of how common electrical components work. UNESCO and ILO (2002) pointed out that the methodology for teaching vocational and technical subjects must enable students to think and ask questions during classroom lesson. One way of developing students' thinking skill is to ask questions in the classroom to facilitate discussion and to get the students to think. There is therefore a good link between teaching methods and questioning. Questioning therefore fits closely into the matrix of the pedagogy of science and technology subjects of which basic electricity is one.

A question is a statement that seeks to provoke thinking so as to elicit an answer. Classroom questioning has been the focus of many education researchers for over a century. Research has shown that verbal questions used in the classrooms are more effective in fostering learning than written questions (Cotton, 2001). Though, it is popularly believed that oral questioning which is the conventional ways of asking students questions in the classroom enhances students' thinking and learning, research shows that the current classroom practice falls far short of this notion (Orletsky, 1997). In other words, the type of questioning in the classrooms today does not really enhance students' thinking and learning.

There are many techniques of questioning, but how effectively they are applied to achieve the desired goal is not clear. Common questioning techniques include; wait-time in questioning, cognitive level of teacher's questions, frequency of questioning and shifting interaction. Shifting Interaction is the redirection of classroom questions from one student to another and probing each student's answer, rather than the teacher answering any question he/she asked immediately one student or two fail to provide the right answer. In shifting interaction, the teacher is very reluctant in providing the answer to his question until all available opportunities of eliciting the right answer from students have been utilized and they failed to get it. Redirection and probing are positively related to achievement (Cotton, 2001) In shifting interaction the teacher does not give long period of uninterrupted silence rather he/she uses the time to redirect a question from one student to the other ensuring adequate participation of the students in arriving at the right answer. From the foregoing analysis it was therefore, necessary to investigate the effect of this questioning technique on students' achievement in basic electricity.

Academic achievement connotes performance in school subject as symbolized by a score in an achievement test. Epunnah (1999) defined performance as the learning outcome of students which include the knowledge, skills and ideas acquired and retained through course of studies within and outside the classroom situation. Academic achievement in basic electricity is the quality and level of skills acquired and retained by students. Mbah (2002) remarked that achievement is dependent upon several factors among which are instructional techniques, the learning environment, motivation for stimulating students' interest in learning and the learners.

Besides, gender has been identified as one of the factors influencing student's achievement in vocational and technical education (Howden, 1998). The issue of gender has assumed prominence in technical and vocational education discourse. Gender is a sense of awareness of being male or female. It is a behavioural pattern and attitude perceived as masculine or femine within a culture (Coleman, 2000). There is also the long held view that gender differences in achievement in vocational and technical education in favour of the males is caused primarily by biological inheritance (Howden 1998), but Okeke (1999) asserted that so far there is no .biological evidence that boys have innate superior intellectual abilities over girls. Therefore, if differences in achievement exist, they must be caused by other factors. Recent studies show that women and men respond differently to specific teaching methods, questions and to discussion (West Virginia University for Women Studies (W V U), 1997). This is in line with Okeke's (2001)

assertion that instructional strategies are known to produce different effects on learners. Schwartz and Hanson (1992) expressed that boys volunteer more than girls in response to teacher's questions. This is supported by Okeke (2001), who stated that women are unlikely to volunteer to answer questions. Therefore, any instructional strategy that employs the voluntary answer to questions would put women learners at a disadvantage. Men tend to answer questions more confidently and quickly regardless of the quality of their responses, formulating their answer as they speak. On the contrary women choose their words carefully, wait longer to respond to a question in class (Women Science Students (WSS), 1996). This may be why it is alleged that in coeducational schools, boys dominate class discussions. Learners are likely to learn better if the teacher-student questioning interaction patterns are suitable to them. It appears from the discourse on gender that different questioning techniques may affect boys and girls differently. There was therefore, the need to investigate gender interaction, with shifting interaction techniques in classroom questioning.

Statement of the Problem

Many vocational and technical educators have over the years been concerned about the problem of students' low achievement in technology subjects. One of such factors that affect student's achievement in technology subjects is the non-stimulating ways of teaching the subject in technical colleges due to lack of relevant teaching skills by the teachers. If instruction is not presented in a stimulating way to students, the degree of learning may not be high. The criticism of our conventional pedagogy that emphasizes mere transmission of knowledge places the onus on teachers to find better ways of teaching that would de-emphasize mere transmission of knowledge. It is widely believed that in order to teach well, one should be able to question well. Questioning has been reported to have greater potential than any other teaching skills for stimulating thinking in students. For over one century, classroom questioning has been the focus of many education researches. But consistently researches find a large gap between typical questioning which is normally obtained in our classrooms and effective questioning, which is stimulating. Questioning is made effective by employing the right kind of questioning techniques. Effective questioning is an instrument of motivation to raise the interest of students in what is being learnt. Raising students' interest helps them to learn better and most likely retain what is learnt for a longer period and subsequently, achievement would be enhanced. The relative effectiveness of some of these questioning techniques in enhancing achievement in basic electricity was not clear, it has also been shown that boys and girls respond differently to different questioning techniques (WVU, 1997). The effect of gender on questioning techniques in enhancing achievement in basic electricity was also not conclusive. The main concern of this study was to investigate effects of shifting interaction questioning technique on students' achievement in basic electricity.

Purpose of the Study

The study sought to determine:

(i) The effect of shifting interaction technique in classroom questioning on students' achievement in basic electricity.

(ii) The effect of gender on students' achievement in basic electricity using shifting interaction classroom questioning.

Research Questions

The following research questions were answered:

(i) What is the effect of shifting interaction in classroom questioning on students' achievement in basic electricity concepts?

(ii) What is the effect of gender on students' achievement mean scores using basic electricity in shifting interaction classroom questioning?

Hypotheses

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

Ho_1: There is no significant difference in the achievement of basic electricity students exposed to shifting interaction and conventional Questioning Techniques

Ho_2: There is no significant difference between the effects of gender on students' achievement in basic electricity when exposed to shifting interaction questioning technique.

Ho_3: There is no significant interaction effect of treatments on gender with respect to their mean scores in basic electricity achievement test

Methodology

The research design is a quasi- experimental design using intact classes. Specifically, pre-test, post-test, non-randomized comparison groups design. This design was used because the researcher wants to use intact classes. The design is symbolically represented as follows:

EG = O_1 × O_2

CG = O_1 – O_2

Where EG stands for experimental (shifting interaction) group:

C_G = stands for control (conventional) group

O_1 = stands for pre-test observation

O_2 = post -test

X = shifting interaction questioning technique

\- = Conventional questioning technique

The population of this study comprises 165 (121 boys and 44 girls) year I students of basic electricity in all the technical colleges that offer basic electricity in Niger State. The entire population was used for the study.

Instruments for Data Collection

The instrument used was Basic Electricity Achievement Test (BEAT) developed by the researcher. The instrument was designed to measure the cognitive achievement of the students before and after treatment in Basic electricity before and after treatment. BEAT was used for pre-testing and post-testing the subjects.

The determination of the face validity of BEAT was done by a team of experts comprising two technical educators, two basic electricity teachers and one specialist in Measurement and Evaluation. The corrections they made were adequately done before the final copy of the instrument was produced. The reliability coefficient of BEAT was determined as 0.79 using split-half estimate and Spearman-Brown's correlation factor.

Experimental Procedure

The researcher developed four lesson notes for each of the two questioning technique. The notes have built-in mode questions that were used for classroom interactions. The lesson notes were used by the Basic electricity teachers of the sampled colleges (Sulaiman B Technical College Suleja and Government Science Technical College, Garki). Before the experiment commenced, the researcher held a pre-experimental training for the Basic electricity teachers who served as research assistants. The training centred on the focus of the study and how to use the lesson plans appropriately.

Before the experiment, both groups were pre-tested. The pre-testing involved administration of BEAT to the subjects. After pre-testing, the treatment began and it lasted for five weeks. This experiment was done during the normal 'school periods. The wait time in questioning was measured using a wristwatch with liquid crystal display (LCD), which displays time in seconds. '

The experimental group was exposed to shifting interaction in questioning by redirection of questions from one student to the other while probing each student's response. The emphasis here was on using the students to get the right answer and ensuring the participation of as many students as possible within a certain frame. Whether a student was willing to answer a

question asked or not was not important here. The teacher made sure that almost all- the students had an opportunity to answer the question in class by asking both willing and non-willing students. He did not give the students long time of silence to think but he was patient enough to probe any answer supplied by a student whether right or wrong. The teacher developed more questions from one student's answer, which he distributed to other students thereby giving almost every student a fair opportunity to attempt one question or the other in a lesson. The teacher guided the students in such a manner as to lead the students to arrive at an answer to a question by themselves without the teacher supplying the answer. The control group was exposed to conventional method of questioning which involve asking students questions in a normal way without probing.

At the end of the five weeks of experiment, the students of the two groups were post-tested which also involved administering BEAT to the students. Data collected from pre and post were used to answer the research questions and test the hypotheses. The research questions were answered using mean scores and standard deviation while the hypotheses were tested using ANCOVA.

Results

The results of the analyzed data are presented and interpreted in line with the research questions and hypotheses.

Research Question 1: What is the effect of shifting interaction questioning in classroom on students achievement mean scores in basic electricity concepts?

Table 1: Achievement mean scores and standard deviation of scores of students exposed to shifting interaction and conventional questioning technique in basic electricity

Group	N	Pretest		Posttest		Mean Gain
		$\overline{X}$	SD	$\overline{X}$	SD	
Experimental	84	4.39	2.18	25.34	4.32.	20.95
Control	81	4.24	1.94	17.70	1.94	13.46

Key:
N = Number of subjects
$\overline{X}$ = Mean\
SD = Standard Deviation

The data presented in Table 1 show that the experimental group had a mean score of 4.39 and a standard deviation of 2.18 in the pretest and a mean score of 25.34 and a standard deviation of 4.32 in the posttest making a pretest, posttest mean gain in experimental group to be 20.95. The control group had a mean score of 4.24 and a standard deviation of 1.94 in the pretest and a posttest mean score of 17.70 and a standard deviation of 3.24 with a pretest, posttest mean gain of 13.46. With this result, the students in the experimental group performed better in the achievement test than the students in the control group. Hence, shifting interaction questioning technique is effective than the conventional questioning technique on students achievement in basic electricity.

Research Question 2: What is the effect of gender on students' achievement mean scores in basic electricity in shifting interaction classroom questioning?

Table 2: Achievement mean scores and standard deviation of scores of students exposed to shifting interaction and conventional questioning techniques by gender in basic electricity

	Shifting Interaction questioning technique					Conventional questioning technique			
Gender	N	Pretest	SD	Posttest SD	*Mean Gain* $\overline{X}$	N	Pretest SD	Posttest SD	*Mean Gain* $\overline{X}$
Male	84	4.37	1.93	24.13 3.32	19.76	60	4.10 1.85	19.02 3.65	14.92
Female	23	4.44	2.04	26.45 3.68	22.01	21	4.12 1.95	19.13 3.75	15.01

Key
N = Number of subjects
$\overline{X}$ = Mean
SD = Standard Deviation

The data presented in Table 2 show that female students had a mean score of 4.44 and a standard deviation of 2.04 in the pretest and a mean score of 26.45 and a standard deviation of 3.68 in the posttest making a pretest, posttest mean gain of the female students in basic electricity during shifting interaction classroom questioning technique to be 22.01. Meanwhile, male students had a mean score of 4.37 and a standard deviation of 1.93 in the pretest and a posttest mean of 24.13 with a pretest, posttest mean gain of 19.76 in basic electricity during shifting interaction classroom questioning technique. Also, male students had a mean score of 4.10 and a standard deviation of 1.85 in the pretest and a mean score of 19.02 and a standard deviation of 3.65 in the posttest making a pretest, posttest mean gain in the male students in basic electricity using conventional questioning technique to be 14.92. Meanwhile, female students taught had a mean score of 4.12 and a standard deviation of 1.95 in the pretest and a posttest mean of 19.13 and a standard deviation of 3.75 with a pretest, posttest mean gain of 15.01. With these results female students had higher mean scores than male students in the Achievement Test. Thus, there is an effect attributable to gender on the achievement of students in basic electricity during shifting interaction classroom questioning technique.

Hypotheses

Ho_1: There is no significant difference in the achievement of basic electricity students exposed to shifting interaction and conventional Questioning Technique.

Ho_2: There is no significant mean difference between the effects of gender on students' achievement in basic electricity when exposed shifting interaction questioning technique.

$HO_{3:}$ There is no significant interaction effect of treatments on gender with respect to their mean scores in basic electricity Achievement Test

Table 3, shows the Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean Scores of Experimental and Control groups in the Achievement Test, Effects of Gender and Interaction Effect of Treatments given to Students and their gender with respect to their mean scores in the basic electricity Achievement Test.

Table 3: Summary of Analysis of Covariance (ANCOVA)

Source	Sum of Squares	df	Mean Square	f	Sig.
Corrected Model	992.311[a]	4	239.046	46.379	.000
Intercept	1699.012	1	1699.012	331.007	.000
Pretest	3.456	1	3.456	.666	.415
Group	772.970	1	772.970	152.128*	.000
Gender	24.990	1	24.990	4.794*	.029
Group * Gender	4.997	1	4.997	1.006	.327
Error	502.335	100	5.008		
Total	48878.000	165			
Corrected Total	1502.642	104			

*Significant F< .05

The data presented in Table 3 shows F-calculated values for mean scores of experimental and control groups in the achievement test, gender and interaction effect of treatments and gender on students' achievement in basic electricity. The F-calculated value for Group is 152.128 with a significance of F at .000 which is less than .05. The null-hypothesis is therefore rejected at .05 level of significance. With this result, there is a significant difference between the mean achievement scores of students exposed to shifting interaction questioning technique and conventional Questioning Technique. The F-calculated value for gender is 4.794 with a significance of F at .029 which is less than .05. This means that there is significant difference between the effects of Gender on students' achievement. Therefore, the null hypothesis of no significant difference between the effect of gender (male and female) on students' achievement in basic electricity is rejected at .05 level of significance. The interaction of treatments and gender has F-calculated value of 1.006 with significance of F of .329. Since .329 is higher than .05, the null hypothesis for interaction effect of treatment and gender is accepted. Hence, there is no significant interaction effect of treatments given to students and their gender with respect to their mean scores on the basic electricity Achievement Test.

Discussion of findings

Table 1 showed that the experimental group had higher achievement mean gain score than the control group. This is further supported by the ANCOVA result in Table 3, which showed that there is significant differences in the achievement mean scores of the treatment groups at P< 0.05. Shifting interaction had a more positive effect on students' achievement in basic electricity than the conventional questioning technique.

The significant difference in achievement mean scores obtained in favour of shifting faction may be as a result of the fair distribution of questions in class. This is in agreement with the submission of Brualdi (1998), who asserted that fair distribution of questions in the classroom enhanced students' participation and stimulate student interest in the lesson. In shifting interaction both the higher achieving students and the lower achieving students had equal chances of attempting questions asked in class. The result of this study is in line with the findings of Cotton (2001), who stated that redirection of questions and probing are positively related to achievement. The fair distribution of questions keeps the students alert as the question can get to any of them anytime. Before it gets to anybody's turn, the person would have been thinking about the answer to the question and because the teacher digs deeper, the students are faced with more challenges which help to sharpen their thinking skills. However, literature did not contain information on a comparative study such as this. The result of this study suggests that students understanding and learning were enhanced more by the use of shifting interaction questioning technique in teaching than the use of conventional questioning technique.

Table 2 showed that in shifting interaction group, the female students had higher mean gain score than their male counterpart. This suggests that possibly Shifting Interaction had more positive effect on the achievement mean score of female students. This higher mean gain score recorded by female students of Shifting Interaction group seems to support the view of Okeke (2001), that any instructional strategy that sticks to calling just the volunteers to answer questions put women learners at disadvantage. The fair distribution of questions may have given the females edge over the males since females do not rush to raise their hands up and be thinking while already answering the question. While males are struggling to dominate the class discussion, they take the opportunity to think through the answer to the question. Shifting interaction frees females from male dominance in class discussion and enhances their interest in what is being studied since questions are distributed irrespective of whether one raised the hand or not. However, the ANCOVA result on Table 3 showed that the interaction effect ($P< 0.05$) between gender and the questioning techniques on students' achievement in basic electricity is not significant.

Conclusion and Recommendations

Basic electricity teachers have a role to play in using classroom interaction patterns that would make teaching and learning process more effective. Shifting interaction questioning technique has been shown to be one of such effective interaction means and the onus lies on the basic electricity teacher to use it in class. This is because the result of this study has shown that students exposed to shifting interaction achieved better than those exposed to conventional questioning technique. Since this study has shown that there was no interaction effect between gender and treatment on students' achievement, both male and female students should be exposed to Shifting Interaction questioning technique. On this note, the use of Shifting Interaction has been shown to enhance students' achievement in basic electricity more than conventional. This perceived strength in Shifting Interaction should be led by basic electricity teachers while teaching seemingly difficult basic electricity topics that may discourage students in learning basic electricity. Basic electricity teachers in schools should try to exclusively use shifting interaction technique because of its effect on female learners.

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

(i) Teachers, especially basic electricity teachers should practice the use of shifting interaction questioning technique as part of their teaching techniques since this study has shown that shifting interaction questioning technique is a better questioning technique to use than convention questioning technique for effective classroom teaching.

(ii) Basic electricity teachers in girls' schools should try to exclusively use shifting interaction questioning technique in classroom interaction since it has been shown to favour female learners.

(iii) The State and Federal Governments should from time to time organize workshops and seminars to sensitize teachers on effective teaching techniques. This would enable teachers to increase their knowledge base on such teaching techniques.

(iv) Basic electricity textbook authors and publishers while preparing teachers' guide-textbooks should emphasize the use of shifting interaction as an effective technique of conducting classroom questioning. This is to always draw the attention of teachers to the importance of such effective questioning technique.

(v) Professional associations like National Association of Teachers of Technology (NATT), Science Teachers Association of Nigeria (STAN), Association for Promoting Quality Education in Nigeria (APQEN), should also undertake to organize periodic training sessions in the form of workshops or seminars for basic electricity teachers on the use of effective questioning techniques like shifting interaction to improve classroom teaching and learning.

(vi) Faculties of Education in Universities, Colleges of Education and other teacher education institutions should emphasize the use of effective questioning techniques like shifting interaction while training the would-be classroom teachers. This would

enable the student-teachers to be armed with the necessary competencies needed to make a good teacher.

(vii) Federal and State governments should also provide other incentives that can improve the interest of female students in basic electricity.

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CCESS OF NON-LITERATE ADULTS IN KABBA/BUNU LOCAL GOVERNMENT AREA OF KOGI STATE TO EDUCATION FOR ALL IN NIGERIA

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Abstract

This study attempts to examine the extent to which non literate adults in Kabba/Bunu LGA have access to basic education and the literacy skills acquired by them as a result of their exposure. The study was carried out using the survey design. A sample of 9 adult learning centers spreading across the Kabba/Bunu Local Government Area and 10 adult learners were randomly selected from each. An interview schedule was developed and validated for use in data collection. A pro-forma was also designed to obtain data on enrolment into literacy programmes in the local government. The collected data were analyzed with the use of percentages which were compared with population projections. Findings revealed that with an average of 1.9% of non-literate adults compared to the population in Kabba/Bunu LGA between 2008 and 2011 enrolled in literacy programmes, their access LGA to literacy programmes is limited. It was also found that an average of 4.8% females and 0.4% males compared to the population enrolled in the literacy programmes. Although adult learners attend the basic literacy programme, it was found that they were not exposed to any form of vocational skills acquisition or other relevant life skills to help them cope with expected societal requirements. It is therefore recommended that the adult literacy programme be made more intensive and skills based so that the participants will acquire basic education skills alongside training in particular vocations. More training is required for those involved in managing and implementing the curriculum used for the adult literacy programme to integrate skills acquisition into the adult literacy programmes.

Keywords: Adult Literacy, Literacy Skills, Adult Learning Centres, Literacy in Kabba/Bunu

Introduction

Education has remained a tool for human capital development in every society. There is no society that can survive and do well without giving its members a good quality of education. It is a weapon for transmitting skills, knowledge and attitudes for the survival and sustenance and progress of people in the changing world (Adepoju & Fabiyi, 2005). Obayan (2003) acknowledged that the purpose of education is to transmit the skills of understanding life situations, adapting to and influencing them by contributing to their development. This is also in concert with the fourth National Education Goal of helping learners to acquire appropriate skills and develop mental, physical and social abilities and competencies for equipping the individual to live in and contribute to the development his society (Federal Republic of Nigeria, 2004).

Conventional notions that literacy is just the act of reading, writing and being able to do simple arithmetic have been discarded because such restricted skills are of limited utility. The emphasis of literacy campaigns has thus shifted from these conventional expectations to functional literacy as an evidence of acquiring basic education. To be functionally literate, those who complete basic education are expected to demonstrate a level of reading, writing and numeracy adequate for effective participation in the life of their community (UNESCO, 1978). Children are expected to acquire functional literacy from exposure to basic education. Same is made available to the older ones in Nigerian through the Adult Basic Education Programme (Ayodele & Adedokun, 2008).

Nigeria has adopted the global agreements and objectives of the Millennium Development Goals and is making effort to eradicate illiteracy by integrating literacy and non-formal education for out of school children, youths and adults into the UBE programme (UBE, 2004). Basic education for those outside school age is managed by the National Commission for Adult Education (NCAE) at the federal level in conjunction with the Agency for Adult and Non-Formal Education (AANFE) at the state level. The non-formal system administered by these agencies provides education for youths and adults allowing for exit and re-entry at desired points or times in life with provision for movement from non-formal to the formal system.

Despite the provisions for basic education in Nigeria, the level of access as shown by the number exposed to opportunities for literacy is not yet satisfactory. UNESCO (2012) reported that about 11 million school-aged children are not enrolled in any formal institution in Nigeria; 55% of whom are girls. This confirms earlier reports of the Local Government Areas Baseline Survey (1992) that only 29% of the women in the sample were found to be literate. Earlier survey by UNESCO revealed a drop-out rate of 86% at women's education centres. The literacy rate for the age group 15-24 years was estimated at 71.2% with 90.6% for men and 62.5% for women. The rural-urban distribution also showed 62.1% in rural areas and 84.9% in urban areas (UNESCO-IBE, 2006).

In order to address this issue, a wide variety of non-formal education programmes designed for illiterate adults and out-of-school children and youths have been put in place. The National Commission for Adult Literacy and Adult and Non-formal Education is responsible for developing strategies, coordinating programmes, monitoring and promoting literacy and post-literacy programmes nationwide. This agency provides functional literacy through twelve major programmes including basic literacy, post-literacy, women education, nomadic education, continuing education, Arabic integrated education, literacy for the blind, workers education, functional literacy, vocational education, literacy for the disabled and prison education. To be able to deliver, the agency reported that a total of 15,505 instructors were trained, of whom 8,140 were males and 7,365 were females. In addition, a total of 1,495 supervisors and organizers were trained nationwide, of whom 815 were females and 680 were males. The National Centre for Adult Education established in Kano in 1985, serves as the non-formal education library, documentation and resources development and production centre for the country. It provides in-service training to staff of state agencies for Adult literacy and NGO literacy programmes and carries out research on adult education. Institutional and follow-up materials are also developed for distribution (UNESCO-IBE, 2006).

The National Commission for Adult Education, in conjunction with state agencies, have organized a network of literacy committees linking literacy classes and programmes, through both governmental and non-governmental bodies. Courses are also organized for the training of Adult literacy personnel in three institutes established in Uyo (1952), Maiduguri (1976) and Bauchi (1978). Toboho (2000) noted that participatory committees have been set up at class/centre, village/ward, local and state government levels to co-ordinate activities and aid material distribution; disseminate information; and provide feedback to the agencies.

UNESCO-IBE (2006) reported a study of street children in Lagos, Nigeria and observed the danger posed by lack of basic education within the populace. As a result it recommended an increase in the funds allocated to education by government and an expansion of non-formal remedial vocational continuing education programmes which should be flexible and varied to meet the street children's needs. It suggested the setting up of drop-in educational and vocational centres by education authorities and concerned NGOs. It should also permit a wide choice of options for those with aptitude; and the training of education and welfare workers in the right methods of approach to street children.

The Quranic school has been a strong feature of informal education in Nigeria. As a result of the fact the many children, especially in the northern part of the country, attend these religious

institutions only. It has been suggested that the integration of elements of basic education into the Quranic School curricula has the tendency of making room for products to have access to functional literacy. At least three states: Kano, Katsina and Niger, have provided basic education access to over two million pupils through this means (UNESCO-IBE, 2006).

Voluntary agencies have been part and parcel of basic education provision in Nigeria. Akawo (2012) reported that community-based education programmes were provided by women's co-operative societies and some mosques and churches in Nigeria. He stated further that a home- and community-based informal low-cost participation initiative is also being employed in the provision of non-formal education at the pre-primary and primary schools levels.

The Agency for Adult and Non-Formal Education in Kogi State has been providing literacy programmes through literacy, continuing education, and women education. The literacy programme is designed for the training of non-literate adults at the basic and post basic literacy levels, continuing education programme is designed to cater for the out of school youths through extra moral programmes where subjects that are relevant to make them acquire knowledge for further studies are undertaken in these classes while women education programme is designed to cater for the non-literate women population and also oversees vocational training. All successful candidates in any the programmes are awarded certificates accordingly (Kogi State AANFE, 2012). In either of these categories, basic literacy spans a period of 9 months while the post basic literacy spans 2 years. The literacy by radio programme was also put in place in the state whereby instruction is received over the radio. This is however not functioning in Kabba/Bunu LGA. Rather, adult learners are enrolled through campaigns to the religious bodies and socio cultural groups within the community.

The international community has determined that every citizen of all countries of the present world needs basic education to live effectively (EFA, 2000). Nigerian federal government adopted this position and translated it into objectives for ensuring that all illiterate citizens have access to basic education. Agencies at both the federal, state and local government levels have been charged with the responsibility of extending access to basic education to children and illiterate youths and adult in Nigeria. Since 1999 when the UBE scheme was launched by the federal government and 2004 when the enabling law was enacted, global data and summaries on access are provided especially by international agencies like UNESCO and UNICEF or national agencies like the Federal Ministry of Education, Universal Basic Education Commission and Federal Office of Statistics. The performance of the entire country thus provided has not reflected the picture of access at the local level. Research on access at the local level has been limited. There is thus the need to focus on access to education at the local government level in order to discover areas in which success is recorded and to what extent. In view of all the arrangements to extend literacy to all in Nigeria, Kogi State inclusive, this research has the purpose of finding out the access that non-literate adults have to basic education in Kabba/Bunu LGA.

Purpose of the Study

The main purpose of this study is to examine:

(i) the extent to which non-literate adults have access to Adult Literacy Programme in Kabba/Bunu Local Government area of Kogi state.
(ii) whether gender disparities exist in the access of non-literate adults to Adult Literacy Programme in Kabba/Bunu Local Government area of Kogi state.
(iii) whether location disparities exist in the access to basic education among non-literate adult Literacy in Kabba/Bunu LGA of Kogi state.
(iv) whether non-literate adults have access to the acquisition of vocational skills from Adult Literacy Programme in Kabba/Bunu Local Government area of Kogi state.

Research Questions

The following research questions are generated for this study:

(i) What is the level of access of non literate adults to basic non formal education in Kabba/Bunu LGA?
(ii) Are there gender disparities in the access to basic education and Adult Literacy in Kabba/Bunu LGA?
(iii) Are there location disparities in the access to basic education among non-literate adult Literacy in Kabba/Bunu LGA?
(iv) Are learners exposed to the acquisition of vocational skills from the Adult literacy programme in Kabba/Bunu LGA?

Methodology

This study adopted the survey design. A survey research depends on data gathered from a representative sample of a given population for making judgments about the population. This method will make it possible to obtain valid and reliable data on access that non literate adults in Kabba/Bunu local government area of Kogi state have to basic education. This is an accountability issue at the local government level on the extent to which basic education is being universalized. Kabba/Bunu local government was created in 1991 as one of the areas in the Western Senitorial District of Kogi State. The local government area is bounded by Ijumu LGA and Mopa-Amuro LGA to the West, Lokoja LGA in the North and Okehi LGA in the East. The local government is made up of Kabba and Bunu districts which consist of 12 villages and 38 villages respectively.

The entire Local Government Area has 3 Adult Education Centers controlled by the Agency for Adult and Non-Formal Education (AANFE) running basic literacy and post-literacy programmes respectively. There are 9 Adult Learning Centers controlled by the LGA running the basic literacy programme. All the 3 adult learning centers controlled by AANFE were purposively selected for the study. In addition, the stratified random sampling technique was used to select 6 out of the 9 adult learning centers controlled by the Local Government for the study. The total population of adult learners in the local government was 180. From each of the 9 adult learning centers 10 adult learners were selected for the study. This gave a total of 90 participants.

An interview schedule was developed to find out about vocational skills acaured by adult learners registered in the literacy and post-literacy programmes. The expert opinion of university lecturers with specialization in educational measurement was used to validate the contents of the interview schedule. Three experts were used and there was a consensus among them that the items on the instrument were good for achieving the objectives of the study. The Adult Literacy Pro-forma was designed to be filled by the managers of the programme in Kabba/Bunu Local Government and the Agency for Adult and Non Formal Education to obtain information on enrolment figures on the programmes running in the centers. Data collected using the validated instruments were analyzed with the use of percentage. Comparisons were also made with projected population statistics on literate and non literate adults' population figures from 2007 to 2012.

Results

Research Question 1: What is the level of access non literate adults to non formal education in Kabba/Bunu LGA?

The census figures and projections for Kabba/Bunu LGA were obtained from Kogi State Office of the National Population Commission. Facts from National Census indicated that Kabba/Bunu LGA has a population that is 4% of Kogi State population. With this percentage, data on non literate adults in Kabba/Bunu LGA was derived as displayed in Table 1. The table also shows the enrolment of non literate adults in Kabba/Bunu LGA adult the various literacy programmes in Kabba/Bunu LGA. Data collected by use of proforma are summarized in Table 1.

Table 1: Data on Kabba/Bunu LGA non literate adults (2008-2012)

Year	Population of Non-Literate Adults	Enrolment into Adult Literacy Programmes											Percentage Enrolment of Non Literate Adults in Literacy Programmes to the Population
		Basic		Post Basic		C.E. Centers		Vocational Centers		Radio Literacy			
		F	M	F	M	F	M	F	M	F	M	Total Enrolment	
2008	11152	170	26	54	8	0	0	0	0	0	0	258	2.3%
2009	9333	190	12	0	0	0	0	0	0	0	0	202	1.1%
2010	7834	101	21	0	0	0	0	0	0	0	0	122	1.6%
2011	6778	167	13	0	0	0	0	0	0	0	0	180	2.7%

Source: National Population Commission 2009.

Projected Non Literate Population Figures were sourced from 2006 National Population and Housing Census of the Federal republic of Nigeria: Kogi State Priority Tables Vol. 1. (Page 217) Abuja: National Population Commission 2009.

Table 1 shows that the highest enrolment figure of non literate adults into adult literacy programmes was recorded in 2008. Total enrolment figures went down from 258 in 2008 to 202 in 2009 and again went down to 122 in 2010. The year 2010 had the lowest enrolment figure. In 2011, the enrolment figure went up 180. As a proportion of the population of non-literate adults, the year 2011 recorded the highest with 2.7% registered in adult literacy programmes. Averagely 2% of non-literate adults in Kabba/Bunu LGA registered in basic and post basic adult literacy programmes.

Research Question 2: Are there gender disparities in the access to Adult Literacy in Kabba/Bunu LGA?

Enrolment figures were obtained from the Agency for Adult and Non Formal Education Kabba Area Office and Kabba/Bunu LGA Adult Education Department. Gender disparity in access of non-literate adults to basic education was measured by the percentage enrolment of female to male on in literacy centres in Kabba/Bunu Local Government Area of Kogi State. Also, gender ratio and gaps were calculated and displayed on Table 2.

Table 2: Adult literacy gross enrolment by gender in Kabba/Bunu LGA

Year	Female Enrolment	Male Enrolment	Projected Adult Non Literate Population Female	Male	Female Enrolment as percentage of population	Male Enrolment as percentage of population	Ratio of Female to Male Enrolment	Gender Gaps
2008/09	224	34	4611	6541	4.9%	0.5%	7:5	4.4%
2009/10	190	12	3859	5474	4.9%	0.2%	16:1	4.7%
2010/11	110	21	3239	4595	3.4%	0.5%	5:1	2.9%
2011/12	167	13	2802	3976	5.9%	0.3%	13:1	5.6%

Source: National Population commission

National Population Commission Projected Population figures sourced from 2006 National Population and Housing Census of the Federal republic of Nigeria: Kogi State Priority Tables

As shown in Table 2, for every 6 females enrolled to Adult Literacy programme in Kabba/Bunu LGA, 5 males were enrolled (2008/2009), 16 females were enrolled for each male in 2009/2010, 5 females for each male were enrolled for the years 2010 to 2011 and 13 females were enrolled for each male enrolled to adult literacy classes in the local government. This connotes that more females were enrolled into adult education classes than males. The average non literate adult

female to male enrolment ratio for 2008 to 2012 was 10:2. Results show that the gender gaps in enrolment into adult literacy classes have been inconsistent and on the increase with the gender gaps for the years of study shown as 4.4%, 4.7%, 2.9% and 5.6% respectively.

Research Question 3: Are there location disparities in the access to Adult Literacy in Kabba/Bunu LGA?

Location disparity was determined by obtaining measures of how evenly the adult literacy learning centers are distributed between the rural and urban areas. Average enrolment in rural and urban learning centers in Kabba/Bunu LGA were calculated. Summary of results obtained is presented on Table 3.

Table 3: Location disparity of adult literacy centers in Kabba/Bunu LGA

Centers in Rural Areas	Enrolment	Rural Population as percentage of total population	Average enrolment per centre in Rural Areas	Centers in Urban Areas	Enrolment	Urban Population Enrolment as percentage of total	Average enrolment per centre in Urban Areas
4	368	38%	92	5	394	52%	78

Source: Agency for Adult and Non Formal Education, Kabba Area Office/Kabba/Bunu Local Government Adult Education Unit

As displayed in Table 3, 4 adult learning centers had an enrolment of 368 participants in the rural areas while 5 adult learning centers have a total enrolment of 394 participants in the urban areas. An average registered adult learners per centre in the rural areas was 92 while that for urban areas was 78.

Research Question 4: To what extent do learners acquire vocational skills from the Adult literacy in Kabba/Bunu LGA respectively?

A validated interview schedule was administered to 45 respondents randomly selected from 9 centers selected for the study. Their responses are shown in table 4.

Table 4: Adult learners' response to access to vocational skills acquisition

Skill	Percentage	Frequency Yes	Percentage		Frequency No
Clothing & textile		90	100	0	0
Entrepreneurship		90	100	0	0
Computer Appreciation		90	100	0	0
Hand Craft		90	100	0	0
Gari Processing		90	100	0	0
Carpentry		90	100	0	0
Baking and Confectionary		90	100	0	0
Barbing and Hairdressing		90	100	0	0
Soap and Pomade Making		90	100	0	0

As shown on table 4, sampled participants in the adult literacy programmes were not exposed to any form of vocational training. Thus access of non literate adults in Kabba/Bunu LGA of Kogi state to vocational education was nil.

Discussion of Findings

The purpose of this study was to evaluate the extent to which non literate adults have access to adult literacy in Kabba/Bunu Local Government area of Kogi state. The indices considered on access were enrolment in basic education. Differentials in access were also examined through

gender and location disparities in enrolment. Also, the extent to which adult learners acquire vocational skills from the programme were examined.

The average enrolment rate of non literate adults in literacy programmes between 2008 and 2012 was 2% of the non literate adult population in Kabba/Bunu LGA. To have such a low rate reveals the response of the populace in this area to adult literacy. The non-literate adults in Kabba/Bunu seem to be so engrossed with the pursuit of livelihood than to attend literacy classes. Also, the general feeling that once a person has missed the opportunity of formal education, hope of attaining literacy is lost may be responsible for the reluctance of non literate adults in enrolling in the adult learning centres. The general attitude of those who missed the opportunity of schooling and their acceptance of spending adulthood to acquire literacy as a goal that is belated to pursue may not be misplaced as their likelihood of using the certificates to be awarded for employment purposed is very remote. Their observation of the impact of adult literacy programmes on those who had completed in previous year may also be a source of discouragement to likely participants.

The average ratio of females to males enrolled in adult literacy programmes between 2008 and 2012 was 10:2. There is every indication that female adult non literates are more positive in embracing adult literacy programmes. Women tend to create more time to make up for what they have lost in terms of school while men to feel that pursuing that tend to be a needless waste of time. The high female to male ratio in favour of the females found in this study supports the findings in reports by UNESCO (2006) that more females are out of school and yet more of them also drop out of school. Enrolment figures reported by UNESCO (2012) still reveal that Nigerian schools have more registered male learners than their female counterparts. Closing the gender gaps of as high as an average of 61% in Kabba/Bunu LGA within the 2008 to 2010 suggests ineffectiveness of adult literacy campaigns in this area.

Exposure of non literate adult learners to vocational education was found to be nil. It may not be surprising to find that all resources in adult literacy programmes aim at basics of reading, writing and use of numbers since most adults tend to busy themselves with one vocation or the other. For those who have no form of training to practice the vocations, they might have settled for the traditional trades of crop and vegetable farming, gardening, weaving, backyard livestock keeping, iron smithing or trading including the buying and selling of foodstuff, clothing and other household needs. These vocations by convention could be acquired either through the family or by interest of the persons concerned. In addition, most non literate adults that do not leave their livelihood and family sustenance to chance readily expose themselves to apprenticeship training in such vocations as tailoring, carpentry and cabinet making, carving, painting, motor mechanic, welding, mason, weaving, hair dressing etc. As adults who are already into vocations therefore, emphasis of participation in literacy programmes may therefore just be to be able to read and write just as complementary knowledge for life and the pursuit of their trades.

Conclusion

The study of access of non literate adults to basic education in Kabba/Bunu LGA of Kogi State has revealed very low participation. The attention of an average non literate adult seems not to be on becoming literate but to eke out a living with whatever other skills they may have in spite of their not being literate. Needing more attention for sensitization and mobilization are the men who seem not to be interested in adult literacy programmes. Eradication of illiteracy as goal of the Nigerian government will only be attainable if men respond as well as women to the provision of adult literacy.

Recommendations

In line with the educational objectives as outlined in NPE (2004), Adult and Non-formal education in Nigeria aims to equip the adult with everything needed for life in order to be relevant in his society by helping to solve some of its problems. In view of the findings in this study, a need for invigorating the drive for enrolment in adult literacy programmes in

Kabba/Bunu LGA has been identified. In doing this, more attention should be given to enrolment of men since more male adults are out of the learning centres.

Whereas most responsible adults are already practicing one vocation or the other, there is need to integrate literacy with vocational training to ensure that adults are able to improve on whatever skills they already have. ANFE in Kabba/Bunu LGA and all over the country should consider the option of recruiting non literate adults through vocational skills improvement programmes. Their interest in survival and livelihood through skills acquisition will likely motivate them to avail themselves of the opportunity provided and through any of the vocations, literacy components embedded in them will make them to become literate. In this way, adult literacy will achieve the dual purpose of skills improvement and literacy. Programmes which can equip adult learners with vocational skills could be in such areas as clothing and textile, entrepreneurship, computer literacy, arts and hand craft, cassava processing, carpentry, baking and confectionary, barbing, hair dressing, soap and pomade making, crop farming, cash farming, livestock farming, fish farming etc.

Literacy by radio programmes should also be given a boost especially because of rural communities that are so remote for the reach of adult literacy classes. For non literate adults in such places, the radio could make up for their inability to attend classes since they do not have any in their immediate locality. At the same time, the radio lessons should be used to complement the regular classroom lessons organized for non literate adults. This will help them to take advantage of giving room for them to engage in their vocations and continue to learn hand in hand. The planning and synchronization of radio with classroom experiences should be well planned such that the integrated learning system will be beneficial to the adults.

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DO ALL COOPERATIVE LEARNING STRATEGIES HAVE THE POTENTIALS TO ELIMINATE GENDER DIFFERENCE IN STUDENTS' ACHIEVEMENT IN BIOLOGY? A FIELD REPORT ON STAD AND JIGSAW STRATEGIES

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Abstract
The study examined gender as a factor in the achievement of biology students taught using Students' Team Achievement Division (STAD) and Jigsaw cooperative learning strategies in Wamba Local Government Area of Nasarawa state Nigeria. The research adopted the non randomized, pretest – posttest control group quasi experimental design. A sample of 188 students comprising of 95 boys and 93 girls from 6 randomly selected schools was used. A 30 item instrument called Biology Students Achievement Test (BSAT) developed by the researchers with a reliability coefficient of 0.84 using Kuder-Richardson formula 21 was used for data collection. The schools were grouped into 3 and assigned randomly into 1 control and 2 experimental groups. The control was taught using Lecture method while cooperative learning was used in experimental groups. Intact classes were used in all the schools, students were pre tested, treated for 6 weeks and post tested. Data collected were analyzed using Mean, Standard deviation and ANCOVA at 0.05 level of significance. The result shows that the difference in the mean achievements of boys and girls in the 2 methods was insignificant. Teachers therefore should use the methods in teaching and seminar, workshops and conferences should be organized to train the teachers.

Keywords: Gender stereotype, culture, Achievement in biology, cooperative Learning, Students Team Achievement Division, Jigsaw

Introduction
For a nation to develop scientifically and technologically, it must effectively implement its science education curriculum to ensure that the citizens acquire the scientific skills, attitudes, knowledge and principles in other to apply same in solving problems leading to such development. While science is defined as the systematic investigation of nature, technology is the application of scientific knowledge and principles to solve human problem.

Biology as one of the science discipline, deals with the study of living organism. By studying biology, the individual studies him or herself and other organism as living things, the interaction between them and the non living things. Such knowledge is used to better the life of the individual. In agriculture for instance, it is used to improve food production; in the area of health, to prevent and control diseases. These are paramount to the development of the society. Hence the national curriculum (1985), spells out the major objectives of the biology syllabus as preparing the students to acquire adequate laboratory and field skills in biology, meaningful and relevant knowledge in biology, ability to apply scientific knowledge to everyday life in matters of personal health and agriculture and reasonable and functional scientific attitudes.

Achieving these objectives therefore means that every citizen must be taught the subject to understand and master all the concepts. However, gender stereotypes seem to be a major impediment to the achievement of these objectives. Oludipe, (2012) agreed that gender bias is very prevalent in Africa and particularly Nigeria. He argued that in Nigerian, harder tasks are assigned to males while females are given the relatively easy and less demanding tasks. This problem also exists in our schools where Gbaje (2007) says teachers maintain gender stereotypic view of their students and thereby perceives science as being difficult for the female students.

Stefanelli (on line) confirms that teachers ask boys higher level questions and engage them in conversation in the classroom than girls. These makes girls develop negative attitude and also reduces their motivation to learn science. Similarly, because of the self Perception resulting from the fixed stereotype carried to school by the students (Oludipe, 2012), some girls tend to become nervous on sighting some animals, blood or even models of some human parts.

One other obstacle to the study of science and particularly biology by the girls is Culture. According to Oldham (2000) cultures tend to discourage the girls from studying science in some societies. For instance, there are cultures in some African societies which prohibit girls from touching or having close look at certain animals or plants for superstitious reasons. Thus, where it becomes necessary for such items to be used for learning activities, the girls are left out. All these contribute to the less participation and consequently low performance of girls compared to the boys in biology and science generally. The implication is that the contribution of women to the development of the society becomes restricted.

Addressing this problem therefore, requires concerted effort of the teacher. Hence Gbaje (2007) suggests that teachers should give both boys and girls the opportunity to participate in the learning activities by giving all of them challenging questions while girls assigned leadership role to increase their confidence. This is because girls tend to learn best when they work together while boys learn best when challenged by peers.

Also Adesoji and Babatunde (2005) posited that creating a conducive atmosphere characterized by freedom of speech and expression which allows classroom interaction and participation irrespective of gender will bridge the gender gap. Barton (1998), Howes (2002), Sinnes (2006) as cited by Bassey, Joshua and Asim (nd) also agreed that if males and females are given the same opportunity in scientific inquiry, they will produce exactly the same result in science. According to Tweed (2005), classroom climate and teaching strategies must provide every student an equitable opportunity and therefore, teacher should use the teaching method that provides the opportunity for all students to participate fully in class activities, discussions and investigation (National Science Teachers Association NSTA, 2003). In this case, teachers' pedagogical skills and knowledge becomes paramount. This is why Utulu (2007) stated that as an effort to reduce or put a stop to the gender disparity, the Girls Education Project (GEP) has it as one of its objectives, to develop technical capacity of teachers' pedagogical skills to create girl friendly environment that enhances the participation of girls and improve their learning outcomes.

Many teaching methods are available for the science teachers to use. Some of which include: Lecture, discussion, demonstration, inquiry, field trip, Laboratory, others include scaffolding, concept mapping, Think - list –pair- share, cooperative learning. Unfortunately however, because of the over loaded biology syllabus, the current practice is that teachers in secondary schools make use of lecture method which they feel helps them deliver large amount of information to the students within a short period of time. However, this method fails to yield good result because students at this level are not matured for the method and the individual difference that exists among them is ignored. More so, it does not allow for active participation and interaction of students in the teaching and learning process. This creates students' anonymity and therefore quenches their interest in the subject. Besides, the method creates room for gender stereotypes in the class. This is because the teacher who dominates in almost everything, exhibit gender stereotypes either consciously or unconsciously. For example, calling on boys to help hold instructional aids, clean the board or even to answer questions considered more difficult while girls to answer simpler ones or sometimes left out. These eventually make girls' loss interest thereby discouraging them from full participation in the study of biology. It also encourage rote learning which perhaps account for the inability of our school leavers to apply biological concepts in solving their daily life problem as well as that of the society.

The cooperative learning, though a non conventional method seems to lend itself to this contemporary situation, because Stefanelli (1996) opines that girls thrive in cooperative learning situations and are more likely to acknowledge others' contributions. Hence Scholars such as Slavin (1998), Okebukola (1989), Esiogbu (2011) recommended its use in teaching science. This is probably because as the students learn in small groups, they all participate fully in class activities; interact among themselves and the lessons become interesting to them.

Moreso, the opinion of NTI (2009) that in a situation where culture prohibits some students, other students may carry out the activities while they watch is believed to work well in cooperative situation. This is because since all group members must go together in other to succeed, such students will be very attentive when watching their team mates carry out the exercise. Eventually, they will be encouraged to participate fully when they observe severally that nothing happens to their mates who touch the organisms. This may also reduce or even eliminate the superstitious beliefs affecting the learning of science hence full participation of all students and therefore achieving gender parity.

Cooperative learning is a teaching method where students study in small groups in their classes. Eight types of cooperative learning methods According to Johnson, Johnson and Stanine (nd), have been researched and found to be effective in teaching different subjects in different parts of the world. These include Students Team Achievement Division (STAD), Group investigation, Jigsaw approach, Constructive Controversy, Learning Together, Team Accelerated Instruction, Team Group Tournament Cooperative Integrated Reading and Composition.

This study examined the two cooperative strategies: STAD and Jigsaw because the Problem in Nigeria today calls for the education that will impart knowledge as well as bring our youths together to see themselves as one united and responsible for the nation's building thereby doing away with the Ethnic and religious differences. In these methods, students work in small groups and depend on one another for success. This creates in them, the spirit of love, tolerance and collective responsibilities which the may grow up with.

The Students Team Achievement Division (STAD) and Jigsaw Method

Slavin and Associate developed this method at Johns Hopkins University in 1978. In this method, students are divided into a four members mixed ability group (i.e. 1 bright, 2 average and 1 weak students). It consists of regular cycle of activities. First the teacher presents the lesson to the class using the traditional method. Then students in their groups work together and help one another to master the material by studying the materials and complete the worksheet together. According to CoeDubey, Dubey and Ndagi (1985), the brilliant students are expected to assist the weaker ones or those with learning difficulties. This is a way of reducing the gap in achievements of students due to individual difference in the class.

The jigsaw method was developed by Elliot Aronson and associate. In this method, the students are divided into small groups of five or six each (called the Jigsaw groups) and the concept to learn is broken into segments or subtopics. Each student in the jigsaw group is assigned a segment to specialize on as all students with same topics form expert groups. After the session, they reconvene in their jigsaw groups where each expert explain his /her topics to other members after which they take up quiz individually without help from group members. The scores of individual members are summed up to form the group scores which is used to reward the best group. In this method, each piece- each student's part is essential for completion and full understanding of the material. Because each student's part is essential, each student is equally essential.

The success story of cooperative learning is predicated on the Maslow's theory of needs hierarchy, that the students' love and acceptance by peers in their various groups motivates them to learn. Also by observing other group mates, those students prohibited by culture

observe, imitate and eventually join them in the activities. This agrees with Bandura's social learning theory.

However, empirical literature available on the method revealed conflicting reports on gender influence on academic achievements. For example, Abdullahi and Duyilemi (nd) compared the relative effectiveness of cooperative and competitive teaching methods in teaching biology at the secondary school showed that girls performed better than boys in cooperative learning method. Similarly, Kolawole (2008) carried out a study to investigate the effects of competitive and cooperative learning strategies on academic performance of Nigerian students in mathematics and reported that boys performed significantly better than girls in both learning strategies. One other study by Adeyemi (2008) on the effects cooperative learning and problem solving strategy on the achievement of Junior Secondary School social studies students shows that the effect of the teaching methods was gender sensitive. Also the study by Ajaja and Eravwoke (2010) aimed at determining how cooperative learning affects students' achievements in integrated science and how moderating variables such as sex and abilities influences students achievements in cooperative leaning shows that difference in the achievement between males and females was not significance in the cooperative learning group.

Although cooperative learning has been recommended for teaching biology, with these conflicting reports, it may be a costly mistake to claim that success will be recorded in the area of study without empirical support. Moreso, no study on cooperative learning particularly comparing the effect of the different methods on gender achievement in biology has been conducted in the study area. This study therefore investigates the effect of gender on the achievement of secondary school Biology students taught using two (STAD and Jigsaw) Cooperative learning methods in Wamba Local Government Area of Nasarawa state with a view to making them popular for use by teachers to address the gender disparity towards achieving the MDGs Education for All.

Research Questions and Hypotheses

The study is guided by these questions:

(i) To what extent does gender influence the achievements of biology students taught using Jigsaw cooperative learning methods.

(ii) To what extent does gender influence the achievements of biology students taught using STAD cooperative learning methods

The following null hypotheses served as guides to the study:

Ho_1: There is no significant difference between the mean achievements of male and female students taught biology using Jigsaw teaching method.

Ho_2: There is no significant difference between the mean achievements of male and female students taught biology using STAD teaching method

Method

The research adopted the non randomized, pretest – posttest control group quasi experimental design. Data was collected from a sample of 188 SS1students comprising of 95 boys and 93 girls from 6 randomly selected schools. A 30 item instrument called Biology Students Achievement Test (BSAT) was developed by the researcher and validated by two experts on test and measurement and one experienced biology teacher for construct and content validity respectively. The instrument was pilot test in one of the schools not included in the study and data collected was used to establish a test - retest reliability coefficient of 0.84 using Kuder-Richardson formula 21. The schools were grouped into 3 with 2 schools per group and assigned randomly into control 1 and experimental 2 groups. Three graduate biology teachers with at least five years of teaching experience were trained using the training package developed by the researcher. Each assistant was assigned a group to teach using the assigned method. The control was taught using the Lecture method while the two (STAD and Jigsaw) cooperative learning were used in experimental groups. Intact classes were used in all the schools in order

not to disorganize the schools' set up which the principals would not allow. Prior to the study, the students were pre tested using the BSAT and this was followed by treatment for 6 weeks after which they were post tested using the reshuffled BSAT. Data collected were analyzed using Mean, Standard deviation, ANCOVA at 0.05 level of significance.

Results

Research question 1: To what extend does gender influence the achievements of biology students taught using Jigsaw cooperative learning method?

Table1: The means and standard deviations of males and females students' scores exposed to Jigsaw method

Gender		Pretest	Posttest	Mean Gain
Male	Mean	13.4118	39.0588	25.647
	N	34	34	
	SD	4.73618	9.47386	
Female	Mean	11.4615	37.1538	25.6923
	N	26	26	
	SD	3.81818	6.64946	
Mean Gain Difference				0.0453

Table 1 shows that gender has no influence on the achievements of the students taught using Jigsaw method (the mean gain difference = 0.0453 in favour of females). The posttest SD of the females is lower than that of the males, an indication that the individual mean for male students in STAD deviated more from the group mean than that of females.

Research Question 2: To what extend does gender influence the achievements of biology students taught using STAD method?

Table 2:. The means and standard deviations of males and females students' scores exposed to STAD method

Gender		Pretest	Posttest	Mean Gain
Male	Mean	14.2143	44.3571	30.1428
	N	28	28	
	SD	4.49985	7.32431	
Female	Mean	13.2353	45.4118	32.1765
	N	34	34	
	SD	3.87735	5.77412	
Mean Gain Difference				2.0337

Table 2 shows that the mean gain of the females is slightly higher than that of the males (mean gain difference of 2.0337). This indicates that the performance of female students is a little higher than the males. The posttest SD of females is lower than that of the males, an indication that the individual mean for male students in STAD deviated more from the group mean than that of females.

Hypothesis 1: There is no significant difference between the mean achievements of male and female students taught biology using Jigsaw method.

Table 3. ANCOVA tests of between subjects effects for male and female students exposed to Jigsaw method

Source	TypeIII sum of squares	df	mean squared	F	sig.	Remarks
Corrected model	62.761	2	31.381	.441	.646	
Intercept	8704.637	1	8704.637	122.269	.000	
Pretest	9.295	1	9.295	.131	.719	NS
Gender	41.777	1	41.777	.587	.447	
Error	4057.972	57	71.192			
Total	91828.000	60				
Corrected Total	4120.733	59				

a. R Squared = .015 (Adjusted = -.019); S = Significant, NS = not significant

From Table 3, the F value for gender is .587 at degrees of freedom 1and 59 and it is not significant at .447 [$F_{1,59}$=.587; p > 0.05]. The Null hypothesis is therefore retained. This means that there is no significant difference between mean achievement of male and female students taught using Jigsaw method

Hypothesis 2: There is no significant difference between the mean achievements of male and female students taught biology using STAD method.

Table 4: ANCOVA tests of between subjects effects for males and females students exposed to STAD method

Source	TypeIII sum of squares	df	mean squared	F	sig.	Remarks
Corrected model	17.163	2	8.582	.199	.820	
Intercept	10287.606	1	10287.606	238.160	.000	
Pretest	.085	1	.085	.002	.965	NS
Gender	16.559	1	16.559	.587	.447	
Error	2548.578	59	43.196	.383	.538	
Total	127756.000	62				
Corrected Total	2565.742	61				

a. R Squared = .007 (Adjusted = - .027); NS = Not significant

From Table 4, the F value for gender is .383 at 1 and 61 degrees of freedom and is not significant at 0.538 [$F_{1,61}$=.383; P>0.05]. This means that there is no significant difference in the mean achievements of male and female students taught using STAD. Therefore the Null hypothesis is retained.

Discussion

The study investigated the effects of Jigsaw and STAD cooperative learning methods on the achievements of male and female secondary school biology students. The result shows that no significant difference exists in the mean achievement of boys and girls in both methods. Thus Table 1 shows that the achievements of male and female students is similar in the Jigsaw method (mean gain difference = 0.0453) while Table 2 shows a slight increase in the achievement of the females over the males in the STAD method (mean gain difference = 2.0337). However, Tables 3 and 4 shows that the difference is not significant which agrees with the findings of Peklaj (2003), Ajaja and Eravwoke (2010), Muraya and Kimamo (2011) and Oludipe (2012) which revealed gender equality in the mean gain in the cooperative learning method and also in line with the assertion of Etukudo (2002) cited by Kpaji (2011) that a good teaching method should be able to neutralize gender difference. It however, contradicts the findings of Adeyemi (2008) which shows that cooperative learning method is gender sensitive. Considering the mean gain difference of STAD, the result agrees with that of Abdullahi and Duyilemi (nd) that girls performed better than boys in cooperative learning method and

disagrees with Kolawole (2008) which shows that boys performed better than girls. The superiority of the STAD is expected because the students worked together in mixed ability groups to complete their worksheets. Here the brilliant students pulled the average and the weak ones so that at the end all of them achieved. Moreover, by presenting the materials in brief, the teacher provided the background as well as the focus for the students so that completing the worksheet was easy.

The slight inferiority of Jigsaw to STAD however, is probably because in the Jigsaw group, students worked in groups irrespective of their abilities. It might be possible that some Jigsaw groups have all members being dull. Such groups could not understand what they discussed in their expert groups thereby misinforming themselves in their Jigsaw groups when they reconvened. Another probable cause of the weakness of Jigsaw method is that since students were left on their own to search and study materials, they might have wasted much time searching for the materials and has little time left to study and master the topics. One other reason according to Al-badawi (2008) is that for Jigsaw to succeed, students must interact and treat each other as resources. It is possible that students were not used to working together cooperatively and were not able to treat each others as resources.

Conclusion

The result of this study revealed that the achievements of male and female students are the same in the Jigsaw method but differ slightly in favour of the females in the STAD method. This difference is however, insignificant. This indicates that if these two methods especially the STAD are used properly to give the girls opportunity to participate, they will perform even better than boys and the issue of gender advantage of boys over the girls that exists in biology classes and science in general as reported by scholars would be a thing of the pass. This will encourage the girls to study science and the popular outcry on the low enrolment of girl child in the science and related fields such as medicine, pharmacy, Engineer, agriculture and architecture would be put to rest.

Recommendations

Based on the findings, the following recommendations are made to the major beneficiaries in the areas:-

(i) Teachers should be trained on how to use the cooperative learning methods especially the STAD because it is more facilitative than the Jigsaw and be encouraged to use it in teaching biology for full participation and effective learning of biology by girls.

(ii) Teacher trainees should be encouraged to master the methods so that they become used to them. Similarly, practicing teachers should be encouraged to go on in-service training while workshops, seminars and conferences should be organized to equip them with the knowledge of the STAD methods so that they will find them easy to use and therefore welcome them

(iii) Book writers should review the biology textbooks by drawing out the activities in tune with the teaching methods so that both students and teachers can understand the concepts easily and better.

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NURTURING ENTREPRENEURIAL CHARACTERISTICS FOR FUTURE ENTREPRENUERS

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Abstract

In hard times when educated persons cannot get jobs and government do not have sufficient resources to support the unemployed workforce, self employment and entrepreneurship becomes the best solution. Discovering and exploiting entrepreneurial opportunities is not easy and within reach of everybody. Only a small part of a population succeeds in becoming entrepreneur. Many factors contribute to explain this fact. Among them is the existence of personal entrepreneurial characteristics that contribute to making a successful entrepreneur. Entrepreneurship requires a regular and permanent attitude as part of personality. Attitude can be based on personality traits and demographic characteristics; it can also be nurtured through education. The paper examines the concept of entrepreneur and entrepreneurship, entrepreneurial characteristics and how they can be nurtured through education. The paper also adopted the lifelong learning model created by Consortium of Entrepreneurial Education which recognizes the importance of nurturing the entrepreneurial spirit from early ages, and continuing it right through educational levels. The model has five distinct stages of development. They are Basics, Competency awareness, Creative applications Start-up and Growth. Recommendations that can help nurture entrepreneurial characteristics which include introducing entrepreneurship education at all levels of the educational system, developing a class model business and study of biography of successful entrepreneurs among others were proffered.

Keywords: Entrepreneur, Entrepreneurship, Entrepreneurial characteristics.

Introduction

For sometimes now, unemployment rate in Nigeria has increased. The grossly inadequate power supply and current security challenges have shattered all economic activities and created unemployment at a very large scale in Nigeria. According to the National Bureau of Statistics (2012) unemployment rate in Nigeria in 2011 stood at 23.9, 25.6, and 17.1 per cent at national, rural and urban levels respectively .The males recorded 23.5 per cent and females 24.3 per cent. To employ these unemployed persons is a big challenge for authorities and social security is non-existent. The extended family system is fast eroding and can no longer provide support for members. Many look up to their children for social security at retirement. Unfortunately, most of the children are either under- employed or unemployed. This increased unemployment is creating lots of challenges for both government and society, challenges such as insecurity, armed robbery, increased crime rate and many social vices.

The National Directorate of Employment (NDE) was established by the Federal Government and charged with the responsibility of creating more job opportunities for Nigerians. The Federal Government also launched National Economic Empowerment and Development Strategy (NEEDS) with its goal of poverty reduction, employment generation and wealth creation. The states are not left out in the fight against unemployment. Various organizations are also playing important roles in the national effort to create employment opportunities. The strategies employed are more of a palliative measure than a panacea to the disease of unemployment. Ahmad, Nawaz, Ahman, Shaukat, Usman, Rehman and Ahmad (2010) noted that the failure to solve the challenge of unemployment has encouraged many countries to think of new strategies. Entrepreneurship strategies as a new paradigm have been proposed by economists as one of the most effective alternatives.

Entrepreneurship works like an engine for economic growth/progress, job creation and social adjustment. The development of entrepreneurship has great potential for benefiting the broader society, as well as the individual entrepreneur. Realizing the importance of entrepreneurship for social and economic development of Nigeria, this paper examines the concept of entrepreneurship and an entrepreneur, characteristics of successful entrepreneurs and how to nurture the entrepreneurial spirit among future entrepreneurs.

Concept of entrepreneurship

The concept of entrepreneurship was first established in the early 1700. Ever since then, its definition has continued to evolve. The term comes from the French verb "entreprendre" and the German word "unternehmen" both of which mean "to undertake" (Anderson, 2005). In literature there is little consensus as to what constitutes entrepreneurship (Swedberg, 2000). Some writers identified entrepreneurship with the function of uncertainty, others with the co-ordination of productive resources, others with the introduction of innovations and still others with the provision of capital.

Gana (2001) defined entrepreneurship as the willingness and ability of an individual to seek out investment opportunities in an environment and be able to establish an enterprise successfully based on the identified opportunity. Kuratko (2003) defined entrepreneurship as a dynamic process of vision, change and creation. It requires an application of energy and passion towards the creation and implementation of new ideas and creative solutions. For Kuratko, entrepreneurship is more than the creation of business. It is an integrated concept that permeates an individual business in an innovative manner. To Kimani (2004), entrepreneurship is the process of creating business enterprise capable of entering new or established markets by deploying resources and people in a unique way. Aruwa (2005) observed that the numerous definitions can be expressed in terms of:

(i) The discovery of profitable investment opportunities;
(ii) Decision-making as to the exploitation of profitable opportunities;
(iii) Promotion and establishment of the business enterprise;
(iv) Aggregation of scarce resources required for production and distribution;
(v) Organization and management of human and material resources for attainment of enterprises' objectives;
(vi) Risk bearing;
(vii) Creation of an innovative economic activity; and
(viii) Improvement on the methods of doing things.

Concept of Entrepreneur

Modern use of the term "entrepreneur" is usually credited to Joseph A. Schumpeter who emphasized the role of innovation in transformation of economic systems and viewed the entrepreneur as an innovator. In his writings, the Austrian-American economist stressed the role of the entrepreneur as an innovator, the person who develops a new product, a new market, or a new means of production (Aruwa, 2005). An entrepreneur means different things to different people. To an economist, an entrepreneur is one who brings resources, labour, materials and other assets into combinations that make their value greater than before and also introduces changes, innovations and a new order. To a psychologist, an entrepreneur is a person typically driven by certain forces to obtain or attain something to experiment, to accomplish or perhaps escape the authority of others. To a businessman, an entrepreneur appears as a threat, an aggressive competitor to another entrepreneur. He may be an ally, a source of supply, a customer or someone who creates wealth for others, as well as finds better way to utilize resources, reduce waste or produce jobs others are glad to get (Ene-Obong, 2006).

Global Entrepreneurship Monitor (2010) defined an entrepreneur as someone who started a new business during the year or who ran a business that was less than three and half ($3^1/2$) years old and was still economically viable. Aruwa (2005) defined an entrepreneur as someone who

imagines opportunities instead of perceiving them. Entrepreneurs are believed to have specific abilities that make them think and act in an entrepreneurial way.

Personal Entrepreneurial Characteristics

Personal characteristics, defined as entrepreneurial traits, are attributes of business owners (Trevian, 2009). Martins (2012) identified the following as the characteristics most successful entrepreneurs possess:

(i) Passion and Energy - Capacity to work long hours without sleep shuffling between the family business duties and meetings;
(ii) Ability to take Responsibilities - Take responsibilities for your actions and decisions even in the face of failure. Do not blame the employees, instead take charge, correct the business mistake and move on;
(iii) Long Standing Commitment - A commitment to achieve stated goals not just for the moment but for years;
(vi) Self Belief - A high level of confidence. A strong believe in oneself and his ability to achieve set goals;
(v) Persistence - The ability to press on in the face of hardship;
(vi) Goal Setting - Being goal oriented. Set clear high and challenging but realistic and attainable goals for oneself;
(vii) Ability to take Risk - Business is a risk and to undertake it, you have to be daring;
(viii) Intelligent Use of Feedback - Have a smart team so as to get feedback about decisions taken and act on them. The feedback can be in form of criticisms, a bad news, opinion or advise;
(ix) Strong Self Imposed Standards - Laid down principles and do not compromise for any reasons. Is firm, strict and a man or woman of principles;
(x) Ability to Work Under Pressure and Uncertainty - Live with tension, seek it out and learn to thrive on stress;
(xi) Strong Internal Control - Firm control of cash flow and other business systems;
(xii) Intelligent Use of Resources - efficient utilization of limited resources;
(xiii) Ability to Quickly Learn from Failure - acknowledging business mistake learned from them, correct them and move on. Use failure as a stepping stone to success;
(xiv) Money as a Means of Keeping Score - use money as a land mark. A target and a sign to move on to other business challenges;
(xv) Delayed Gratification - hoping for greater reward in years to come;
(xvi) Desire to Create- Strong desire to originate an idea, product or to be innovative; etc.

These characteristics can however, be divided into three groups; the first relates to the entrepreneur's personality, the second to the entrepreneur's skills and the third to the entrepreneur's background experience. Furthermore, many of the various factors mentioned in the list were basically different facets of the same few main characteristics and can therefore, be consolidated into a much smaller set of profile dimensions (Kuratko & Hodgetts, 2004).Timmons (1990) opined that it is possible to whittle down the number of traits which should characterise an individual, for him/her to be deemed entrepreneur grade, limiting ourselves to traits related to the personality. He identified them as follows:- attitude towards risks; commitment and determination; creativity; independence and leadership; motivation to progress; and obsession with opportunity.

Most authors agree in naming these six traits among the distinctive characteristics of the entrepreneur. They should belong to any entrepreneur, wherever he lives and whatever his origin. The lack of one of them would cause a fatal weakness in an individual ability to act entrepreneurially. Indeed it was remarked that there is a close connection between personal characteristics of an entrepreneur and the economic success of the firm, as measured by growth and profitability (Cassion, 1982).

Nurturing Entrepreneurial Characteristics

Discovering and exploiting entrepreneurial opportunities is not easy nor within reach of everybody: only a small part of a population succeeds in becoming entrepreneur (Hindle, 2004). Many factors contribute to explain this fact. Among them is the existence of personal entrepreneurial characteristics that contribute to making a successful entrepreneur. Entrepreneurship is a set of behaviours and practices that can be observed and acquired. The behavioural approach to entrepreneurship suggests that the proclivity and facility with which an individual manifests these behaviours can be significantly strengthened in individuals by appropriate exposure and training. Basu and Virick (2012) found that education can affect students' attitudes toward entrepreneurial self-efficacy. Lack of entrepreneurial education leads to low level of entrepreneurial intentions of students (Franke & Luthje, 2004). An entrepreneur with entrepreneurial education can create higher profits from entrepreneurial businesses (Jo & Lee, 1996).

The Consortium for Entrepreneurship Education (2012) created the lifelong learning model (Fig.1) to demonstrate that entrepreneurship is a developmental process. They recognized the importance of nurturing the entrepreneurial spirit from early ages, and continuing it right through all educational levels. In most cases entrepreneurship is infused in classes where it provides the context for learning other basic skills and motivating students to want to learn. In more advance grades it also has become a separate course supporting the outcomes of the higher levels of the lifelong learning model.

The Consortium supports the concept that entrepreneurship is a lifelong learning process that has at least five distinct stages of development. This lifelong learning model assumes that everyone in the education system should have opportunities to learn at the beginning stages, while the later stages are targeted at those who may specifically choose to become entrepreneurs. Each of the following five stages may be taught with activities that are infused in other classes or as separate courses.

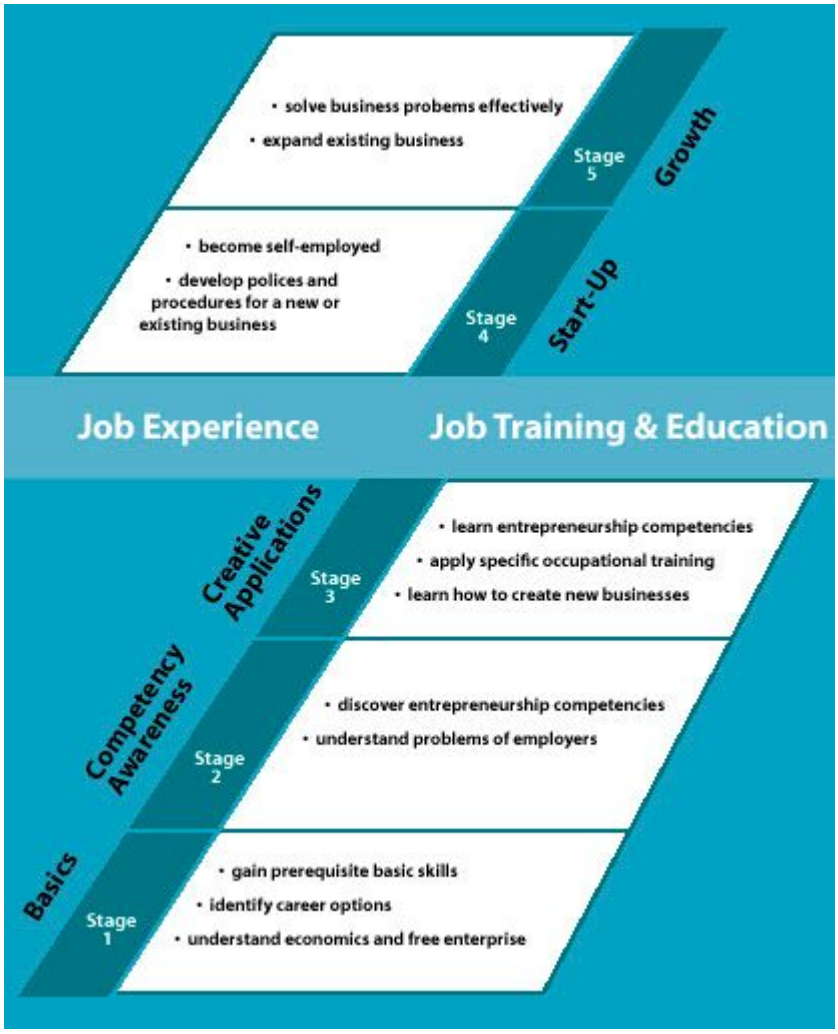

Fig.1: Lifelong Learning Process
Source: Consortium for Entrepreneurial Education

Stage 1 - Basics

In primary grades, junior secondary and senior secondary, students should experience various facets of business ownership. At this first stage the focus is on understanding the basics of our economy, the career opportunities that result, and the need to master basic skills to be successful in a free market economy. Motivation to learn and a sense of individual opportunity are the special outcomes at this stage of the lifelong learning model.

Stage 2- Competency Awareness

The students will learn to speak the language of business, and see the problems from the small business owner's point of view. This is particularly needed in career and technical education. The emphasis is on beginning competencies that may be taught as an entire entrepreneurship class or included as part of other courses related to entrepreneurship. For example, cash flow problems could be used in a math class, and sales demonstrations could be part of communications class.

Stage 3- Creative Applications

There is so much to learn about starting and running a business it is not surprising that so many businesses have trouble. We expect future doctors to learn their profession through years of formal study, yet we have expected small business owners to learn everything by attending weekend seminars. At this stage, students can take time to explore business ideas and a variety of ways to plan the business. Although, it is still only an educational experience, students must

gain a greater depth and breadth of knowledge than they may have from previous stages. This stage encourages students to create a unique business idea and carry the decision-making process through a complete business plan. The best programmes enable students to actually experience the operation of a business as well. This stage may take place in advanced high school career and technical programs, polytechnics where there are special courses and/or associate degree programs, and some colleges of education and universities. The outcome is for students to learn how it might be possible to become an entrepreneur and to practice the processes of business.

Stage 4- Start up

After adults have had time to gain job experience and/or further their education, many are in need of special assistance to assemble a business idea. Education programs focusing on business start up assistance should be made available in various institutions and forums.

Stage 5- Growth

Often, business owners do not seek help until it is almost too late. A series of continuing seminars or support groups can assist the entrepreneur in recognizing potential problems and how to deal with them in a thorough and timely manner. Many colleges and continuing education programs at universities/polytechnics offer such seminars and workshops for their business community. They recognize that the best economic development plan is to help the community's existing businesses grow and prosper (Consortium for Entrepreneurship Education, 2012).

Educators at each of these stages of entrepreneurship should focus on their own special outcomes, and reach out for partnerships with educators at other levels of this lifelong learning process. There is room for entrepreneurship in some way everywhere in our educational system.

Recommendations

To nurture entrepreneurial characteristics for future entrepreneurs the following are suggested:

(i) Develop an entrepreneurial education curriculum framework and create syllabi for all levels.
(ii) Introduce entrepreneurship education at all levels of our educational system.
(iii) Introduce a course in methods of teaching entrepreneurship education in all teacher training institutions.
(iv) Initiate a five-year project to implement a new policy requiring all serving teachers to complete a course in entrepreneurship education and mount the courses.
(v) Encourage schools to establish a small business centre to promote entrepreneurship culture.
(vi) Building of self confidence in students through pep talk.
(vii) Encouraging students to interact with big time businessmen through excursions to big firms.
(viii) Study of biographies of successful entrepreneurs.
(ix) Formation of business clubs in schools.
(x) Developing a class model business.
(xi) Inviting successful entrepreneurs as guest lectures.

Conclusion

The challenge to tackle poverty and unemployment is enormous. The people must be empowered to achieve their full potentials. The educational system in Nigeria, at all level has a part to play. Entrepreneurship offers great opportunity for self-reliance and economic development. Entrepreneurs are not born, they become through the experience of their lives. Therefore, it is important to nurture the entrepreneurial character from early ages and continuing it right through all educational levels. Young people can build confidence in their abilities to become entrepreneurs in their future as a result of a variety of entrepreneurial activities provided throughout education.

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RE-PROFILING EDUCATION TOWARDS PROVISION OF QUALITY EDUCATION FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

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Abstract

The fact that there can be no meaningful socio –political and economic development without the right type and appropriate quality education is the major reason why education is Nigeria is now recognized as an instrument "par excellence" for national development. This paper recognized quality education as an essential tool for achieving sustainable development of a nation. Quality education entails that the output of the institutions are acceptable, desirable, beneficial, efficient or effective. It was revealed that sustainable development is built on three independent and naturally reinforcing pillars namely; economic development, social development and environmental protection. Some of the principles identified as the basis for Education for Sustainable Development (ESD) comprised; transformation for change, education for all and envisioning a better future. Part of the recommendations stated that Nigeria universities should have collective responsibilities to lead education reforms, where the link between social and economic dimensions of life is given special attention. Also, Nigeria higher institutions must forge a close relationship with the private sector in order to make their research efforts relevant to the need of the industry.

Keywords: *Re-profiling, Quality, Education, Policy, sustainable Development*

Introduction

Education creates the future. Education including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. The ultimate objectives of United Nations Decade of Education for Sustainable Development is to promote and improve the integration of education for sustainable development into the education strategies and action plans at all levels of education in all Countries. Moreover, that there can be no meaningful socio-economic development without the right type and appropriate quality education is a dictum that has been accepted by various governments in Nigeria over the years. This is why education in Nigeria is recognized as an instrument "par excellence" for effecting national development.

Education has been linked with several other related concepts such as literacy, reform, knowledge, schooling, achievement, growth among others, it has been argued that each of this only tells a small part of the story. No wonder education has been described as a polymorphous concept (Babarinde, 2003; Federal Republic of Nigeria, 2004). The product of education is abundance of knowledge. When creatively and innovatively managed it results in wealth but when mismanaged it results in poverty, environmental degradation, unemployment, human rights abuse, corruption and lack of sustainable development. This could be the reason why every society from the indigenous to the contemporary exhibit great concern for the education of its citizens. The major educational institutions in our time (as far as western education is concerned) are represented by schools, colleges and universities.

Quality education is an essential tool for achieving sustainability. People around the world recognize that current economic development trends are not sustainable and that public awareness, education, and training are key to moving society toward sustainability. In fact, a national sustainability plan can be enhanced or limited by the level of education attained by the nation's citizens. It is curious to note that while we have difficulty envisioning a sustainable world, we have no difficulty in identifying what is unsustainable in our society; on this we can

create a laundry list of problems – inefficient use of energy, lack of water conservation, increased pollution, abuses of human rights, etc.

Today in Nigeria the educational system continues to witness enormous quantitative growth at the expense of qualitative development. Enrolment continues to soar at very frightening rates. By contrast funds for education has reduced drastically, school buildings has become dilapidated, teaching and learning materials are absolute and inadequate. There is a desperate craze for certificates that push the pursuit of qualitative process of education and skill acquisition to the background. Studies (Bertelsman, 2006; Obanya, 2003) have shown that, Nigeria has continuously ranked low (falling in bottom percentile) in several facets of social-economic development: life expectancy, infantile mortality, primary school enrolment, civil liberties, human poverty index, gender equity, per-capital income, and so on.

Obanya (2003), commenting on the state of education in Nigeria, observed that, Nigeria's performance in education is the poorest even by African standards. For instance, according to him, Nigeria ranked 18th among the 42 countries surveyed in Africa and falls far short of the level of educational development recorded by such countries as South Africa, Gabon, Namibia, Ghana, Kenya, Uganda and Tanzania. The relative underdevelopment of our educational system at all levels therefore contributes to the relative bottlenecks and strains experienced in Nigeria as opposed to a better performance in neighboring African countries, to say nothing of the developed countries.

The educational system in Nigeria, at the twenty-first century, can therefore not play the role of prime mover of political and social-economic development. Something drastic therefore has to be done, and urgently too, to remedy the situation; and to reposition the education sector to play its prime role as a positive tool for genuine human development. Education planners now have a collective responsibility to lead education reforms that will create a more sustainable future in terms of environmental integrity, economic viability and a just society for present and future generations.

Education for Sustainable Development (ESD) and International Education Priorities

In the last half of the twentieth century, four key themes emerge from the collective concerns and aspirations of the world's peoples, namely; peace, freedom, development and environment (Kates, Parris & Leiserowitz, 2005). Since then, there have been major conferences that were geared towards highlighting how the pursuit of one great value required the other. One of such global conferences is sustainable development, with its dual emphasis on the most recent concern, namely; development and environment.

The most widely known international definition of sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their needs; it enables, improving and maintaining the well being of people and ecosystems. It involves thinking differently about how we live and work and itself sustained by the skill, knowledge, innovation and creativity of citizens. This is probably why the topic has assumed a renewed force and is given top priority by societal organizations such as United Nations, World Bank, United Nations Development Programme (UNDP) and so on (Fikret, Carl & John, 2011; Kathis & Alexander, 2002).

A more fully developed paradigm of sustainable development was endorsed at the highest political level at the World summit on Sustainable Development in Johannesburg, in 2002. The Political declaration states that "Sustainable development is built on three interdependent and mutually reinforcing pillars – economic development, social development and environmental protection". The new paradigm of sustainable development establishes linkage across poverty alleviation, human rights, peace and security, cultural diversity, biodiversity, food security, clean water and sanitation, preservation of the environment and the sustainable use of natural resources (UNESCO, 2002). This view of sustainable development according to Akinboye (2003)

empowers the poor and generates growth which is equitably distributed. Such development preserves the environment rather than degrades it, and advances women instead of discriminating against them. The concept of ESD is very difficult to define. Even UNESCO that is responsible for the global decade of ESD from 2005-2014 has not provided a definition. It has however identified the following principles as the basis for ESD, namely; transformation for change, Education for All and lifelong learning, systems thinking, envisioning a better future, critical thinking and reflection, participation and partnership for change (International Alliance of Leading Education Institute, 2009).

The plan of Implementation from the World summit on sustainable development establishes the linkage between the Millennium Development Goals in universal primary education for both boys and girls, but especially girls, and the Dakar Framework for action on Education for All. The creation of gender-sensitive educational system at all level and all types of formal, non-formal to reach the disadvantaged is underscored as a crucial component of Education for sustainable development (Obanya, 2003; Akinjide, 2011). There are currently two major world initiatives in education; Education for All (EFA) and The United Nations Literacy Decade, (UNLD) 2003-2012 , other educational priorities such as education for rural people, education for peace, human rights and gender equality; are also integral to the United Nations Decade of Education for Sustainable development (Ahunaya, Osakwe & Uche, 2010; Ivbijaru, 2012).

The ultimate purpose of EFA is human development, personal and collective. ESD addresses important issues that can impede the future development of human beings, including the issues of growing poverty, security, renewable energy, preservation of environment, HIV/AIDS, etc. which are not yet fully or consistently addressed in EFA activities. ESD encompasses EFA, which must be understood as the foundation and catalyst for the achievement of sustainable development. The approach to EFA is human rights based. Sustainable development can be seen not so much as a technical concept but as an educational one. The goal of the UN Decade of Education for Sustainable Development is to have this vision of education integrated into education plans at all levels and all sectors of education in all countries (Toolkit, 2013).

Quality Education in the 21st Century in Nigeria

Quality of education refers to the worth of education (with reference to its input, the teaching – learning process and the output/outcome). Quality of inputs refers to the worth of teachers, trainees, textbooks technology of delivery, and task or curriculum. Quality of the process deals with the worth of the teaching – learning process that involves lesson plan, delivery methods, student - teacher interactions, makings, etc. Quality of outcome and output involves the academic achievement and attainment, value added through education, etc. Babalola (2007) The conventional definition remains important to understand quality education. It includes literacy, numeracy, and life skills, and is linked directly to such critical components as teachers, content, methodologies, curriculum, policy, planning and administration, (Arikewuyo, 2004; Dugumarti, 2004) and later extends to the “expanded vision” of education as articulated at the Jomitien Conference on Education for All in 1990 and re-affirmed at the Dakar World Education forum in 2000.

There is wide spread shortage of qualified teachers, shortage of classrooms, teaching materials and textbooks. All these gaps have combined with frequent teachers’ strikes in recent years to weaken the capacity of institutions to delivers quality education in Nigeria. Not only that, classes in the public schools, particularly those in the urban centre, are so bloated that teachers are no longer able to teach effectively (Durosaro, 2004; Fagbamiye, 2004). The Deteriorating quality of education which has continued unabated impinges heavy traumatic effect on Nigeria citizens and the nation as a whole. Indicators of declining quality and wastages include high dropout, failure rates, rampant examination malpractices and low performance in national survey of achievement (Adewuya, 2002; Alumode, 2006; Ezenuwafor, 2006 and Gidado, 2003). According to Igwe (2004) quality education entails that the output of institutions are acceptable, desirable, beneficial, efficient or effective.

Quality education according to Ajayi (2011) refers to the suitability of the educational system in relation to the educational objectives. It has to do with issues of relevance, validity, functionalism and efficiency in the accomplishment of education goals and priorities. The view of Fadokun (2005) was corroborative. Quality is to be characterized by efficiency, relevance to the human and environmental needs and pursuit of excellence. Studies (Akinboye, 2003; Malhotra, 2008) have established that education must ensure a safer, healthier, more prosperous and economically viable world and contribute to social, cultural and innovative progress. Quality education must ensure that the learning needs of all young people and adults are met, eliminate gender disparities in primary and secondary education, improve all aspects of the quality of education and ensuring excellence of all so that measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills.

Today, education is expected to make a contribution to addressing sustainable human development, peace and security, HIV/AIDS pandemic, and the quality of life at individual, family, societal, and global levels. To be factual, with the situation on the ground, Nigerian system of education is not rising to these modern or post modern challenges.

Issues in Education for Sustainable Development (ESD) in Nigeria

The major goal of the United Nations Decade of Education for sustainable Development (2005 – 2014), for which UNESCO is the lead agency is to integrate the principles, values and practices of sustainable development into all aspects of education and learning (United Nations 1992). Thus, there is need to discuss issues in ESD in order to sensitize educational institutions in Nigeria on their contributions towards ESD, in an attempt to reposition them for the 21st century.

Sustainable development should be looked at as a system. System theory implies that there is a strong interrelatedness and independency among the component parts that forms a whole. This means human beings and world resources interacting together harmoniously for the common goal. Economic development cannot be separated from social development and a concern for the environment. Further on related issues, there is need for envisioning a better future. The relevance of academic programme offered by universities has been identified as not ideal for technological advancement of the nation. NUC (2005) noted that Nigerians are dissatisfied with the output from the universities based on the 2004 “need assessment” in the labour market.

Knowledge has been identified as the most important factor for economic development in the 21st century. According to Akinboye (2003) Nomura institute of Japan recently declared that global economic activities have shifted from agricultural and industrial to knowledge and information. The essence of this transition is that knowledge must be seen as resources and other fundamental assets. However, Saint, Hartnett and Strassner (2004) observed that many developing countries have not articulated a development strategy in linking knowledge to economic growth and that Nigeria is a typical example. This implies that Nigeria universities and other higher educational institutions are not doing well in the areas of production of experts mostly needed for economic development of the country. Clark (2001) observed that in today global competitive knowledge economy, updating curricular needs to be an almost permanent undertaking.

Implication for Policy Formulation

A core principle behind sustainable development is the idea that economic, social and environmental conditions play a major role. It is evident that appropriate policy to stimulate and guide actions on the roles of quality education as a prime mover of sustainable socio-political and economic development is unavailable in the National policy on education (NPE). The absence of deliberate policy has created some problems for educational managers and the system in general. Therefore, there is need for developing a supporting policy context aimed at integrating development as a cross-cutting issue into education at all levels and should set our

policies and activities, identify needs, cost, means and schedule for their implementation, evaluation and review.

This also means that at the national and local levels, public and scholastic fora should discuss environmental and development issues and suggest sustainable alternative to policy makers. This will be an attempt in developing a supporting policy context to redress existing economic, social and gender disparities which interfere with sustainable national development.

Conclusion and Recommendations

Education for Sustainable Development requires the reorientation of many existing education policies, programmes and practices to address the social, environmental and economic knowledge, skills, perspectives and value inherent to sustainability. This implies a review of existing curricula in terms of their objectives and context to develop transdisciplinary understanding of social, economic and environmental sustainability. These also require the following recommendations.

Nigerian Universities should have collective responsibility to lead education reforms where the links between social and economic dimensions of life are given special attention and where democracy equity is mainstreamed throughout the education system. Even if the government does not have a sustainable development action plan for education and skills as a policy for its institutions of higher learning, practitioners who operate within the community of higher education ought to bear the concept of sustainability as a local content of their various curricula.

At the local level, schools, universities and colleges, cultural association and industry should work cooperatively to identify local sustainable development challenges, integrate local knowledge and skills into Education for Sustainable Development. The corporate sectors could include sustainable development in their education and training programmes. Therefore, programmes at postgraduate levels should include specific courses aimed at sustainability compliance.

Government should prepare strategies aimed at integrating environment and development as a cross-cutting issue into education at all levels. The strategies should set our policies and activities, and identify needs, cost, means and scheduled for their implementation, evaluation and review.

Relevant authorities should ensure that every school is assisted in designing environmental activity work plans. Schools should involve school children in local and regional studies environmental health, including safe drinking water, sanitation and ecosystems and in relevant activities.

Nigerian higher institutions (especially the universities) must forge a close relationship with the private sector in order to make their research efforts relevant to the need of the industry.

The issue of funding in Nigeria educational system needs an urgent attention. Because of the assumption that with more money other inputs will be readily available. Therefore United Nation recommendation of 26% budgetary allocation must be recognized.

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CONCEPTIONS OF THERMODYNAMICS HELD BY CHEMISTRY STUDENTS OF COLLEGES OF EDUCATION IN NORTH CENTRAL GEOPOLITICAL ZONE, NIGERIA

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Abstract

This study was undertaken to identify conceptions of Thermodynamics held by Chemistry students of Colleges of Education in North Central geopolitical zone of Nigeria. The study was a descriptive one of the survey type. Five Colleges of Education in the zone were randomly selected for the study. A total of one hundred and forty students formed the sample for the study. The instrument for data collection was a 10 item Thermodynamics Conception Test (TCT) which was validated by three senior lecturers in Department of chemistry in Federal University of Technology, Minna. The reliability co-efficient of the instrument was found to be 0.84 Two hypotheses were formulated and data collected were analyzed using mean, standard deviation, t-test and analysis of variance (ANOVA). The findings of the research revealed that most students misconceived thermodynamics. A total of 630 misconceptions in Thermodynamics were identified. It is recommended that there must be good quality teachers to deliver correct and accurate knowledge to help students' in the colleges of education to have a good knowledge of thermodynamics or any topic in Physical chemistry.

Keyboard: Conceptions; Thermodynamics; Chemistry; Colleges of Education;

Introduction

The world is dominated by activities of science and technology and as such Science affects the socio - economic development of nations. Adeyegbe (2003) reiterated the importance of science and technology by stating that it is the fundamental and basic tool for man's process and development. Man lives in a science driven world that is both exciting and challenging, making great demands on individual and societies. The importance of chemistry as a requirement for technological development therefore, cannot be over-emphasized. It is one of the bedrocks of all scientific and technological breakthroughs. Chemistry as an integral aspect of physical science has been considered as a pre-requisite for students' admission into tertiary institutions to pursue medicine, pharmacy, architecture, engineering, geology, biochemistry, agricultural science, home economics and food science and nutrition, etc. Besides, it is a functional subject which is applicable to different industrial processes like manufacturing of herbicides, drugs, cosmetics, iron products and fertilizers (Oyelekan, 2002).

The role of chemistry in national development is acknowledged in the world (Petrucci, Harwood & Herring, 2002). The significance of chemistry in all field of science and technology has made chemistry imperative to be included in the curriculum of senior secondary school to be offered as a subject. Objectives of chemistry curriculum if achieved, would prepare a student to adapt to the technologically developing world, understand her economic aspirations and be in a better position to positively contribute to her development. The typical secondary school chemistry curriculum consists of various branches: Physical, Organic, Inorganic, Analytical, and Industrial Chemistry.

The quality of chemistry teaching and learning in secondary school has a great influence on the performance of students at the higher institution especially Colleges of Education. The general objectives of studying chemistry at the N.C.E level are the production of highly qualified middle-level manpower who are knowledgeable in the field of chemistry and posses the ability to inculcate this knowledge in the students (NCCE 2002). N.C.E Chemistry students are therefore expected to have competencies in chemistry including the ability to:

(i) Develop functional knowledge of chemistry concepts and principles
(ii) Observe and explore the chemistry environment
(iii) Apply the skills and knowledge gained through the study of chemistry to solve day-to-day problem.
(iv) Develop scientific attitudes such as curiosity and precision.
(v) Manipulate simple apparatus for the purpose of demonstrating chemistry processes, and
(vi) Improvise simple equipment from available resources in the environment for the teaching and learning of chemistry.

The objective of producing chemistry graduates at the NCE level, in essence, is to turn out competent, effective and efficient personnel into the teaching profession. To achieve this goal, the Federal Government of Nigeria stated that the minimum qualification a teacher should have in Nigeria is Nigeria Certificate in Education (NCE), (FRN 2004). This is to ascertain that the teachers produced are trained as professionals. In an attempt to have a qualitative science education, chemistry education inclusive, the Federal Government had done the following:

(i) Establishment of the Teacher Registration Council of Nigeria (TRCN) in 1993. The Council ensures that all (including science teachers) that have been trained as teachers are registered.
(ii) Upgrading of some schools to special science secondary schools, with specific focus on the teaching and learning of science. These schools are specially equipped with materials and human resources to boost the study of science
(iii) At the NCE level, the curriculum and objectives of science education were put on a uniform pedestal through the NCCE minimum standard. The NCCE supervises the Colleges of Education, to improve and standardize all areas of academic studies including chemistry education.

Despite the proceeding plan and efforts of the government to improve science education at different levels of education, the performances of students in chemistry have not been encouraging. For example, table 1 shows the declining trend in the performance of final year chemistry students in some Colleges of Education in North Central geopolitical zone.

Table 1: NCE (III) Chemistry Results of Colleges of Education in Kwara and Niger States

Year	No Enrolled	Physical No with Credit Pass and (%)		Organic No with Credit Pass &(%)		Inorganic No With Credit Pass & (%)	
2005	96	39	(41)	49	(51)	66	(69)
2005*	29	17	(59)	18	(62)	18	(62)
2006	119	53	(45)	53	(48)	72	(61)
2006*	31	18	(58)	16	(52)	25	(81)
2007	82	40	(49)	40	(49)	33	(40)
2007*	84	40	(48)	48	(57)	68	(81)
2008	96	56	(58)	71	(74)	58	(60)
2008*	105	53	(50)	58	(55)	53	(50)
2009	106	51	(48)	59	(56)	58	(55)
2009*	90	50	(55)	51	(56)	56	(62)
2010	84	40	(48)	48	(57)	68	(81)
2010*	110	51	(46)	50	(45)	70	(64)
Average for Kwara State		48.16		55.83		61	
Average for Niger State		52.66		54.5		66.66	

Source: Examination Office, Colleges of Education Kwara and Niger States

The total credit pass in Table 1 reveals that 50% of the Chemistry students in Kwara and Niger States Colleges of Education had credit pass in the chemistry examinations from 2005-2010. A critical look at Table 1 reveals that for the years considered, for College of Education Kwara and

Niger State respectively, the percentage credit pass was lowest for physical chemistry with an average of 48.16%, and 52.66%, whereas organic was 55.83 % and 54.5 and inorganic 61% and 66% respectively. This implies that physical chemistry which includes (Thermodynamics) is one of the difficult aspects of Chemistry. At the NCE level, physical chemistry is offered in the second semester of year III. For a country like Nigeria, which is yearning for technological breakthrough, poor performance cannot contribute positively to scientific advancement in the nation. Scholars such as Adeyegbe (2004), Elizabeth and Esther (2010) and the West African Examinations Council (WAEC) Chief Examiners' Reports (2006) revealed that sources of students failure varied. For example, in a study conducted by Adeyegbe (2004), students were found to perform poorly in chemistry at G.C.E 'A' level due to the difficult nature of some chemistry topics attributed to students and in some cases teachers. According to Adeyegbe (2004) teachers lacked the competence and skill to communicate such topics just as students found it difficult to comprehend.

The factors identified by different scholars as responsible for students poor performance include: the difficulty in understanding chemistry concepts such as quantum mechanics, electrochemistry, chemical bonding and thermodynamics (WAEC, 2004). By implication, topics not understood cannot be applied to problem solving. Of all the reasons suggested by the scholars and corporate bodies for the poor performance of the students, students inability to understand chemistry concepts as well as inability to apply the knowledge learnt featured prominently and are of importance to this study.

The classroom teacher is therefore faced with the challenge of teaching to attain an effective conceptual change, since any incorrect conception whether misconception or alternative conception would hinder effective learning. Conception has been defined previously in this study as the process of organizing experience into a particular mode of thought or ideas. Conception is a stage which the learner has to attain in order to learn meaningfully since it involves understanding of an idea or concept. It has been found that there is a relationship between conception and prior knowledge of students,(Novak, 1978 in Elizabeth & Esther 2010). .Misconception is an idea that is at variance with accepted view by chemistry experts .It is an idea held about a concept that is considered wrong and clearly in conflict with acceptable scientific explanations and hence, it is wrong. While an alternative conception is a student's idea/ knowledge, which has its own value and cannot be considered wrong. Misconception and alternative conceptions are carry-overs from wrong conceptions from previous knowledge and both impact negatively on students understanding of a concept. It is therefore pertinent that a teacher should have knowledge of student's conception in order to enhance the handling of the problem of incorrect previous ideas. Based on this knowledge, the teacher will be able to select what could foster better understanding of a given concept. Many concepts are viewed differently by students, if students are given a problem to solve, they might understand the concepts involved and difficulties often arise when students' idea differ from the definitions idea accepted by experts.

In the present study, effort was made to identify student's conception of chemistry of thermodynamics. There are three types of conceptions: correct, misconception and alternative conceptions. Educators and psychologist have explored learner's conceptions of learning and epistemological beliefs about the nature of knowledge (Hornby, 2000 & Hurst, 2002, Adamu, 2010). These researchers provided evidence that conceptions or beliefs have a profound influence on the learning process (Oversby, 2000, Petrucci, 2002, Kurt & Somchai, 2004). These studies have revealed that students have a variety of conceptions of learning that may thus be related to their approaches to learning itself. Thermodynamics is a difficult aspect that students do not do well in examination. Thermodynamics is the branch of chemistry concerned with interrelationship and inters conversion of different forms of energy. Students' understanding of heat and thermal phenomena otherwise known as thermodynamics has been subject to considerable investigation in the science education literature. Research on students' conceptions of entropy has revealed various misconceptions among several students. Difficulty imagining

"reversibility" is another problem area for students, who come up with many alternative explanations to work around their lack of understanding. Many students fail to see state changes, dissolution and other physical changes as reversible. For example (Hewson 1977) observes that students fail to see that recrystallized sugar is the same as the sugar which was added to the water originally. This contributes to the student's difficulty in distinguishing physical changes from chemical changes. The reversibility of chemical reactions poses serious conceptual challenges to the students, leading to an inability for example to grasp the reciprocal relationship between acids and bases and the concept of an equilibrium At a still deeper level, inability to grasp reversibility may be related to students difficulties in picturing two things going on at once.

The knowledge of science is very important for science and technological development of any nation. Chemistry is a major area of science. It is an important and relevant part of the study of science in Colleges of Education. The performance of students in science generally and chemistry in particular has been unsatisfactory (Maikano, 2007). The report of the Chief Examiners (WAEC, 2004 & 2007) revealed that students' performance was poor in area of thermodynamics. They further reported that the poor performance is as a result of poor understanding of some general principles and concepts like heat, work, and thermodynamics. This poor performance as indicated by their results can be attributed to many factors which includes lack of understanding of the concepts.

Studies were conducted by Nigerian researchers on conceptions of chemistry in the area of quantum chemistry, organic chemistry, nature of matter and chemical equilibrium (Jimoh, 2000 & Musa, 2004). However, not much work was done in the area of conceptions of thermodynamics at NCE level and in North Central geopolitical zone. The researcher therefore found it necessary to focus on the different conceptions of thermodynamics held by NCE students in North Central geopolitical zone of Nigeria.

Purpose of the Study

The purpose of the study was to determine the conceptions of thermodynamics held by students of chemistry in selected College of Education in the North Central geopolitical zone. This was done by identifying conceptions of thermodynamics held by the N.C.E students and determining whether there is gender difference in the student's conception in thermodynamics

Research Questions

The study specifically sought answers to the following questions:

(i) What are the conceptions of thermodynamics held by chemistry students in the Colleges of Education in North-Central geo-political zone of Nigeria?

(ii) Is there any gender difference in the conception of thermodynamics held by N.C.E Chemistry Students?

Hypotheses

To guide this research, the following hypotheses were formulated

Ho_1. There is no significant difference in conceptions of thermodynamics held by NCE chemistry students.

Ho_2. There is no significant difference in the conceptions of thermodynamics held by male and female NCE chemistry students.

Methodology

A descriptive survey method was used for this study. The design was used because it determines and reports the way things are. This study sought to determine conceptions of thermodynamics held by students of chemistry in North Central Geopolitical Zone Colleges of Education. The population of this study was all Colleges of Education chemistry students in North Central geopolitical zone of Nigeria. The Colleges of Education are fourteen and have a total of four hundred and seventy nine (479) chemistry students .Random sampling techniques were used to obtain five (5) Colleges of Education from the population. The sampled schools are similar in

terms of recruitment of teachers, admission of students, equipment of chemistry laboratories, curriculum, and are coeducational. A total of one hundred and forty (140) NCE III final year student studying chemistry (76 boys and 64 girls) were involved in this study.

Instrumentation

The instrument used for data collection was a Thermodynamics Conception Test (TCT) designed by the researcher to determine the different conceptions of thermodynamics held by students. The tests items required students to give detailed and concise explanation of the ten chemistry concepts covering the whole area of thermodynamics. The concepts are system, internal energy, heat, work, first law of thermodynamics, change in enthalpy, spontaneous change, entropy, second law of thermodynamics and application of thermodynamics in real life. The test items were preceded by demographic information such as the name of the school, sex of students and level of the students and subject combination. The Thermodynamics Conception Test (TCT) with the marking schemes were validated by five senior lecturers in the department of Science Education, Federal University of Technology, and two Principal lecturers in the Department of Chemistry College of Education, Based on the observations, necessary corrections were made.

Results and Discussion

Hypothesis One

Ho_1: There is no significant difference in conception of thermodynamic held by NCE chemistry students. In order to test this hypothesis, ANOVA was used.

Table 2: ANOVA Results on Different Conceptions in Thermodynamics

Source of variation	SS	df	MS	F	P
Between Groups	2189.094	2	1094.547	5.390	.011
Within Groups	5482.909	27	203.071		
Total	7672.003	29			

*Significant at P< 0.05

Table 2 presents the ANOVA results. The results showed that analysis of variation for the data on conception yielded an F - ratio of 5.390 and a significant value of 0.011. This indicates that there is statistically significant difference in the conceptions (correct, alternative and misconception) of Thermodynamics held by NCE chemistry students (F = 5.390, df = 29, P<0.05). To determine the main sources of difference, the data were subjected to Scheff's Post-hoc Test as show in Table 3.

Table 3: Scheffe Multiple Comparisons Results of Correct Conception(1), Alternative Conception(2), and Misconception(3)

(I)1, (J) 1, 2 2 & 3 & 3		Mean Difference (I-J)	Std Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
1	2	5.42920	6.37292	.699	-11.0769	21.9353
	3	-14.78560	6.37292	.086	-31.2917	1.7205
2	1	-5.42920	6.37292	.699	-21.9353	11.0769
	3	-20.21480*	6.37292	.014*	-36.7209	-3.7087
3	1	14.78560	6.37292	.086	-1.7205	31.2917
	2	20.21480*	6.37292	.014*	3.7087	36.7209

*The mean difference is significant at P< 0.05 level

1,2,3, represent correct, alternative conception and misconception. Scheffe's analysis on Table 3 indicated that the observed significant difference was between alternative conception and misconception with the highest mean differences of 20.21 and highest upper boundary of 36.72 at 95% confidence level. On this basis, hypothesis one is rejected. There is therefore significant

difference in the NCE chemistry student's conception of thermodynamics. This significant difference was between 2 & 3.

The result of hypothesis one (Ho_1) showed that there is a significant difference in the correct conception, alternative conception and misconception of thermodynamics held by N.C.E. chemistry students. The finding of this study is in agreement with the earlier finding of Akpani (1996) in Elizabeth (2010) Sozbilir and Bennett (2007) who found that there is a significant difference in the conception of students in thermodynamics. This finding also agrees that of Greenbowe & Maltzer (2003) who also found that there is a significant difference in the conceptions of students in chemistry.

Types and Number of Different Conception

On separating the different conceptions into correct, alternative conception and misconceptions, the number of each conception was determined/obtained as follows:

Correct Conception	283
Alternative Conception	347
Misconception	630

Table 4: Examples of alternative Conceptions

S/N	Concept	Alternative Conception
1.	System	1. Process where there is a change
		2. A container on which various material is acting upon.
2.	Internal Energy	1. Energy required in producing motion.
		2. Energy produced in a system.
3	Heat	1. Rate of coldness or hotness of matter
		2. Rate of flow of heat per meter per second

Table 5: Examples of Misconceptions

S/N	Concept	Misconception
1.	System	1. Process which undergoes a chemical reaction.
		2. Process which is doing work.
2.	Internal Energy	1. Is the heat change of a system.
		2. Is the energy which produces kinetics energy.
3.	Heat	1. Total change in the temperature of a system by 1^0c
		2. Is the transfer of forms of energy.

Ho_2. There is no significant difference in the conceptions of thermodynamics held by male and female NCE chemistry students.

To test this hypothesis, means, standard deviation and t-test were used.

Table 6: t-test Analysis of Gender on Thermodynamics Conceptions

Variable	N	df	X	SD	t-value	P	Remarks
Male	10	9	17.30	6.06	1.67^{ns}	0.13	Not Significant
Female	10		13.30	5.83			

ns = not significant at p> 0.05

The result on Table 2 presents the t-test result of male and female NCE students conceptions on Thermodynamics. The t-test was conducted to determine if the mean difference of 17.30 for males and 13.30 for females is significant or not. The t-value of 1.63 was however found not significant at 0.05 level (t = 1.67, df = 9, P>0.05). It means that there is no significant difference in male and female NCE student's conceptions of thermodynamics. Hence, the null

hypothesis 2 was upheld. As such, there is no gender difference in NCE chemistry student's conception of Thermodynamics.

The results of hypothesis 2 showed that there is no difference in NCE Male and Female student's conception of Thermodynamics. This results is in agreement with those findings of Fouchugh (2006), Agommouh and Nzewi (2003), Aiyedun (2000), Adebayo (2002), Osborne (2003) and Iliyasu and Rilwan (2006), who reported that there was no gender difference in students conception of chemistry concepts. On the contrary, this finding disagree with the findings of Ukwungu (1996), Mari (2004), Omosewo (2006) and Okwo and Otubah (2007) who found that there is gender effect on the conception of NCE in Thermodynamics. Hence, finding on the effect of gender on conception of NCE students in Thermodynamics remains inconclusive. Finding of this study support the submissions that gender has no significant effect on the conception of Thermodynamics held by chemistry students.

Conclusion

Based on the findings of this study, the following conclusions are drawn;.

(i) There was significant difference in the conception of NCE chemistry students in thermodynamics.
(ii) There is no gender related difference in NCE chemistry students conception of Thermodynamics.

Recommendations

In the light of the finding of this study, the following recommendations were made:

(i) To help students in the Colleges of Education to have proper knowledge of thermodynamics and there must be quality lecturers to deliver correct and accurate knowledge to them. Such lecturers must be knowledgeable, creative and innovative.
(ii) Chemistry lecturers should identify students' prior knowledge and use such to correct misconceptions.
(iii) Science lecturers could mount courses, which focus on students' misconceptions and alternative conceptions in order to correct wrong ideas.
(iv) In the regular review of the NCE curriculum organized by the NCCE, (National Commission for College of Education), attention should be paid to concepts to be included or removed as curriculum is being reviewed. Experienced chemistry lecturers should be invited to have an input in the curriculum review.

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ETHIC, MORALITY AND VIOLENCE IN NIGERIA EDUCATIONAL INSTITUTIONS: SOCIOLOGICAL PERSPECTIVES

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Abstract
The main thrust of this paper is to examine the concept of ethics, morality and violence as it affects all level of national development. The paper further x-rayed causes of violence in educational institutions in Nigeria like selfishness, injustice, poverty and love of money by leaders in sensitive leadership positions. It critically reviewed some fundamental principles of morality like faith, love and honesty. The paper recommends and concludes that teachers should be exemplary and good role models to learners. People privilege to be in leadership position should exhibit good leadership qualities and shared evenly the dividends of democracy to arrest all moves that will escalate violence in National life.

Keywords: Ethic, Morality, Violence, Sociological, Perspectives

Introduction

There are some rules without which no civilized society could survive and few values could be achieved. The rules against killing and promise breaking are of their kind and this may be the reason why they have been supposed to be self-evident. There can be no falsehood where there is no objectivity and there is no room for personal uncertainty as long as the individual has a single unwavering attitude (Dzurgba, 2007). Moreover if ethical conclusions are true or false in the same sense that factual statement are, then it would seem to follow that they have as good a claim to objectivity as factual statement do (Dzurgba, 2007). This scenario or statements explain how germane ethical issue and morality could address social violence in educational institution in Nigerians. When the citizenry obey the rule of the law, the society would be a better place to live in.

The Concept of Ethics

The concept of ethics can not be defined in absolute terms because ethic has been subsume in the dose of theoretical analysis and varied school of thoughts which seek to explain, judge and ascertain the meaning of ethics in the perspective of objectivity, thus, one school of thought, propelled by Stephen and Pearls (2004) believes that ethics produces concrete factual, testable, verifiable, valid, and reliable knowledge just as the rest of humanities or behavioural subjects such as sociology and psychology. Therefore, ethic cultivates positive and objective knowledge.

However, on the contrary, another school of thought led by Ajere (2006) denies that there is an objectivity in ethics, their argument is anchored on the premise that ethical judgments or statements are expression of human feelings or emotions without facts and ideas. Nevertheless, for the purpose of this write up, Dzurgba (2007) definition could be adopted to capture the conceptual framework of what ethic stand for in the realm of academic discourse, morality and violence as applicable to educational institutions which are charged with the sole responsibility to developing the total man, soul, mind and body. He also submitted that ethical judgment statements or expressions are relatives to the person, place, time and circumstances or conditions in which they are made because ethics does not have permanent perpetual, supracultural and universal ideas, facts and principles or basic truths.

On the objectivity of ethic, he further explained it through the following theories, that is, relativism, imperativism, utilitarianism, emotivism, theories of punishment and moral principles. Ethical issues comprises political ethics, morality of science, ethic of peace, general professional ethics, conservative and liberal perspectives on contemporary ethical issues such as for better for worse: Christian marriage vow, poverty in Africa, today business ethic and gender in Nigeria.

It is important to note that the applicability of this theories to education which is general believed to be a veritable instrument of societal transformation and development can check the unexpected violence been experienced in various part of Nigeria as peace seem to be elusive and conflict is been triggered by political economic and socio-religious factors which make fundamental human right and freedom a mirage.

In the same vein, objectivity in ethics "Good" and "Bad" are inherently interwoven in human language everyday uses of "good" and "bad" form of layer of mundane common place and spontaneous social consciousness, so when we say that an action, a decision, a policy an event is "good" we accept it has a value on its own account and that value is positive and it is beneficial to mankind. The reverse of the situation will be symbolized as "bad". Therefore for anything to be either good or bad does not depend on its potential or actual consequences for instance pleasure or pain. On the contrary, utilitarian especially those of hedonistic utilitarianism are of the belief that there is only one thing, one thing alone which is good in itself, good for its own sake and this is "pleasure" conversely one thing and only one thing is bad that is "pain". If anything else is good, it is because it increases pleasure or minimized pain. But "good" does not mean "pleasure" while bad does not simply means pain. The notions of "good" and bad are ideologically objectives and independent of consequences (Abogunrin, 2003).

In this sense good and bad are objective moral values which if explored would go a long way to minimize violence in Nigeria society. We can adduce from the above analysis of good and bad to reposition critical issues in ethics, morality and violence as they affects the educational sector of the nation. The core message is that the stakeholders, teachers, parents, government agencies, school managers, proprietors, NGO's, student and other vested interest groups should sermonize the benefits of non-violence approach to implementation of policies so that the stated objectives of the school system could be achieved.

Negative social vices are internalized by the youngers ones as there are witness to the contradiction, confusion and abuse of power by the elders who are expected to be an embodiment of piety and righteous life style. Inability on the part of the older generations to convinced the younger ones, compel them to embrace violence as a means to address wrong policies, ideological and religious doctrines which the educational institution such as schools, colleges and universities serves to inculcate towards a better society.

The Concept of Morality

Morality comes from Latin word "more" meaning manners or patterns of behaviour that conforms to the standards of a group. Jimoh (2001) refers to morality as behaviours or actions that are considered by most members of a group to be right" Landu (2001) defines morality as a set of principles or ideas that help the individual to distinguish right and wrong and to act on this distinction. Morality therefore, connotes pureness of heart and mind. It is synonymous with goodness, integrity, virtue, righteousness and godliness.

Immorality by extension means failure to conform to the norms of a particular society concerning sex or sexual intercourse. It also include sexual experimentation before marriage which is also regarded as sexual immorality. Any sexual relationship between young males and females which could result into unwanted pregnancy, murder (abortions) infertility diseases with serious complications (AID) ectopic pregnancies, raping, prostitution, homosexual and lesbianism, lust and indecent dressing. Inability of the parents to counsel and educate children forces them to learn from others agents of socialization like the peer groups and their cultural group behaviour.

The printed and unprinted medias could also teach any lessons on sexuality and education to the younger ones.

Moral deviances are stimulus to violence as a moral belief is what we call a "principle" or simply an "idea" or a "rule" a moral belief is a metaphysical belief. A metaphysic is a branch of philosophy which deals with the nature of existence, truth and knowledge. Metaphysical deals with abstractions. Abstract means a visionary idea. It is an idea of a quality apart from its material accomplishments. Abstraction is a formation of such an idea or such ideas. Therefore, a moral idea is an abstract idea. To avoid violence in or society, it is necessary to obey the moral principles and values that are regarded as objective which could strengthened human relations build on trust, confidence, order, security, peace and stability which the society required.

In Ajayi (2005), moral education has been spelt out as a process of enlightening the young people in or society about good and bad behaviours or characters, encouraging item to uphold good and discouraging them from bad so as to live a meaningful life worthy of emulation. It is in furtherance of these noble objectives that this paper concentrates on the principles inherent in morality. Principle is meant here to explain the foundation, the pivot, the bedrock, the pillar and cornerstone which our lives are build. Just as we have principles that control the physical world, so also we have principles that rule the moral and the spiritual world. In other words we have laws that operate on the universe like the law of gravity. Sometimes one is appealed by savings that "I will break the law and get away with it" but can one break the law of gravity and go away with it? No. if you, let yourself fall from a high rise building with the intension of demonstrating the futility of the law of gravity. The law of gravity will keep on operating weather you like it or not. The foregoing is applicable to the moral and spiritual world.

It is very important for the teacher to make the leaners aware that their future actually depend on the principles which their life revolves. Just as some one has said "you sow a thought and you reap an habit, you sow an habit, and you reap a character, you sow a character and you reap a destiny (life 2004, pg. 35) what the foregoing is pointing at is that a little thought leads to an action, then action repeated over and over again becomes an habit and habit when formed over a long period of time shapes our character and character determines destiny.

People life revolves around many things in this world for example some are "stuff centered" that is struggling to amass properties while some are "pleasure seekers" always running after pleasurable things, some are enemy centres always attributing what ever happen to them to the hand work of their enemies. Some are friend centred, self centred, hero centred and some are hobby or sport centred. Addition to what life revolves greatly determine the final destiny of man. In other words learners should be educated on what they are living for and they should be made aware that it is the moral and the spiritual principles that give meaning and purpose for living. The mission in life and which above all charts their destiny.

To avoid violence and live in peaceful co-existence despite our diversity, the way of righteousness, tolerance, love, kindness, contentment, humility, holiness, fruitfulness, faith, patience, forgiveness, courage, sympathy, justice, generosity, hard working, cleanliness, patriotism, cooperation and appreciation and avoiding such path ways of stealing, lying, murder, abortion, hooliganism, bribery, corruption, examination malpractices, sexual abuse, drug addition, armed robbery and other social vices should not be tolerated in all facet of life.

Fundamental Moral Principles

Faith: If someone has faith in someone or something that person have confidence abo the other person's ability and goodness. In the Holy Bible, Faith is defined as "being sure of what we hope for and certain of what we do not see. (Mark 11-22) By faith Abraham in the Bible, when called to go to a place he would later receive as his inheritance, obeyed and went even though he did not know where he was going. By faith he made his home in the promised land like a stranger in a foreign country, he lived intents, as did Isaac and Jacob, who were heirs with him of the same

promise. For he was looking forward to the city with foundations, whose architect and builder is God.

By faith Abraham, even though he was past age, and Sarah herself was barren – was enabled to become a father because he considered him faithful who had made the promise (Hebrew 11, 1, 8-11). Having faith in God is very important in Christian religion. Whatever the problem may be, Christian should always have faith in God. Whenever the Christian prayed they should have faith that their prayers will be answered. They should have faith in God all the time, even when their paths way is lonely. They should have faith in God who sees and know all the way one is trading. Christian should always pray with faith for anything they want. God is omnipresent everywhere and can answer their prayer expressly.

Faith in Islam requires believing in God as the omnipotent, the omniscient and omnipresent. In the Angels as the creatures of God; in the messengers of Allah; in the divine Books. In the Day of Judgment and is the destiny. The above items are regarded as the "Articles of Faith" in Islam. No Muslim is considered faithful until he/she strongly believes in the six articles and all his or her characters must be tailored towards them.

The Qur'an says: "verily, those who purchase disbelief at the price of faith, not the least harm will they do to God. For the, there is a painful torment (3:1777). It must be noted that faith also requires patience and ability to face different challenges and temptations. All faithful do not lose their faith simply because they face hardship or difficulty. The following prophetic tradition enjoins us to stand by our faith at all time in spite of challenges and temptations:
"On the authority of Sufyan Ibn Abdullahi who said:

> *"I said to the prophet: O messenger of Allah, tell me something in Islam concerning which I shall not ask anyone else". The prophet said: "say, 'I believe in God; then stand by your faith' (Hadith).*

Love: Greek language has three different words for love, namely, 'EROS' 'PHILIA' and 'AGAPE'. 'EROS' has been described as "that powerful force that draws two sols together. It has been defined as sex love on conjugal love. 'PHILA' has been described as "an intimate communion with another person. 'AGAPE' is described as the type of love that is always and every where a disinterested and efficacious benevolence "or the fight and a sacrifice of the self for the love one.

Other writers divided love into six categories. The first one which is physical ("EROS" type) is the type that is primarily concerned with kissing, caressing romancing, sexing and various other forms of love making. The second categories is platonic love which is somehow the opposite of physical love. This is the type of love that exists between two people without a desire for the physical love. The third category is parental. The next type is Marital love. In an ideal situation, there should exist between a man and his wife a love full of faithfulness, truthfulness, kindness, trust, obedience, protection, intimacy, perseverance, forgiveness and a host of other positive values. In this situation the couple lives a happy and harmonious life. In Ephesians, chapter 5, verse 25 the Holy Bible, God made it mandatory for husbands to love their wives "Husbands, Love your wives just as Christ loved the church and gave himself up for her".

The next type of love is 'coercive or forceful love. This is a situation where somebody is forced into love affair by an external factor. In most cases it is one of the party involved (mostly, the female) that is coerced into accepting the other as her partner in love. There are several cases where a girl is forced to love and even marry a man for selfish reasons. Lastly, there is love-at-first-sight category. This involves developing an urgent or instant feeling, passion for somebody at first sight; may be as a result of beauty or wealth, social class, honour.

One of the most beautiful things Christ brought to this world is love. Naturally, human love can be wonderful but it has much limitation. The new life of divine love of Christ is all grace Christ speak about love and manifested or demonstrated it. He instructed us to love our neighbor as ourselves and that we should be our brother keeper. Whatever people are, we have been

instructed to love, pray for and do good to men, even our enemies, every gift God gives us is meant to be used to be our brother keeper.

Love is sincere, gentle, strong, patient, fitful, prudent and long-suffering, love is circumspect, humble, upright, not weary not seeable nor intent on vain things, sober, steadfast, quiet and guarded in all the senses. Love ever gives, forgives, outlives and stands with open hands. In the Holy Bible, John 3:16, we read *"for God so loved the world that he gave his only begotten son, that whosoever believeth in him should not perish but have everlasting life"*. This love of God, this kind of God love should absorb our attention. We should have the type of love God has for us for our neighbor and brothers.

Islam also teaches Muslims to love mankind in general. They are enjoined to love their Muslim brothers, their neighbours whether Muslim or non-Muslim and their fellow human beings regardless of their differences in race, colour, creed etc. The prophet of Islam said: "whosoever has the means of helping his brother (Muslim or non-Muslim) should do so". He also added: *"None of you is a true believer until he loves for his brother (whether Muslim or Non-Muslim) what he loves for himself".* (Hadith).

Honesty: Someone who is honest about something is completely truthful about that thing. Honesty therefore can be described as one being really and truthfully believe what one is saying. Saying nothing but the truth. God wants us to be honest in all things. The world honesty is almost synonymous with the word truthfulness, which means that which is consistent, faithful and dependable. Islam describes honesty as a virtue that is inevitable for every Muslim to acquire and hold fast to. In fact, it is one of the major characteristics which qualify every Muslim for a higher religious station (i.e. faithfulness-Iman). The Qur'an has the following to say:
"O you who believe: betray not Allah and His messenger, nor betray knowingly things entrusted to you" (8"27).
"Verily, Allah commands that you should render back the trusts to those to whom they are due" (4:58).

Patience: Anyone who is patience is able to stay calm and never get annoyed about anything. For example when someone is waiting for something, that person should be patient.

Optimism: Means feeling of being hopeful about future. Someone who is optimistic is hopeful about the future. In Islam, patience and optimism are regarded as important tools which all Muslim need to attain the religious and secular goals. Islam promises the good doers paradise (AL-HANNAH) in the hereafter, but this beautiful abode can not, according to the declaration of the Qur'an, be given to anybody except that person has been seriously tested and tempted and his/her faith remains unshakable in the face of challenges and difficulties. This position can never be achieved except with the aid or application of patience and optimism. Concerning the two characters, the Qur'an says:
"O you who believe I endure and be more patient…" (4:200)
"And be patience's; verily Allah wastes not the reward of the good doers" (11:115)
"…and be patience. Surely, Allah is with those who exercise patience" (8:46)
"…and ear with patience whatever befalls you" (31:17)
"So do not become weak nor be sad and you will be superior in victory if you are indeed true believers" (31:139)
"…despair not of the mercy of Allah" (39:53)

Violence: According to the Collins internet linked Dictionary of Sociology (2002), violence means infliction of physical harm to the human body or to human property by physical force, using the body or weapons. The ability to Marshall physical force is often a determining factor in social actions for example in domestic relations between husband and wives or parents and children. In politics the sustaining of a claim to legitimate monopoly of central over the means of violence within a territory (including defence of the realm) is a defining feature of the state. Equally

however the threat of recourse to violence against rules by the ruled acts as a major constraint on the power of the rulers.

Violence therefore simply refers to when conflict involves violence toward persons or properties. Violence ranges from the symbolic burning of buildings to ethnic cleansing and targeted assassinations depends on the capacity and the will of those who employ violence. When violence takes on a life of its own, it can reach the level of irredentist movements, civil war and even genocide. Examples include election and post-election violence religion violence, ethno-religion violence, farmers and Fulani crises and so on.

According to Ideyi (2010), the term violence is derived from another term violate which is its verb form. To violate means among other things; to hurt, injure, break, disobey, infringe, invade, desecrate, pollute, profane, abuse, debauch, defile, deflower, intrigue, ravish, transgress, and damage, etc. Each of these synonyms of 'to violate' brings out the meaning of violence. Thus, violence simply means an act of destruction – any act of man that involves willful destruction. Man's belonging which could be destroyed range from his dreams, his rights, his dignity, his moral principles, his life, his beliefs to other things he values, cherishes and works for their enhancement, advancement and protection or they could be things imposed on him such as harmful ideas, unjust principles, warped beliefs, laws, practice, structures etc. which depreciate his human worth enslave and dehumanize him to the level of toys and beast of burden.

He sees that as detrimental to his cherished values and decides to wage war against them in order to restore him endangered liberties and dignity. Both of them are victims of violence because willful destruction of what the victim has is involved. However, throwing more light on the concept of violence Robert McAfee Brown (1987) reported in Ideyi (2010) define violence as:

> *What ever violates another, in the sense of infringing upon or disregarding or abusing or denying that other, whether physical harm is involved or not, can be understood as an act of violence. In the broadest sense then an act that depersonalize would be an act of violence, since it transforms a person into a thing (p. 88).*

In other words, violence could be physical or non-physical but it involves damage of what the victim hold dear and thus reduces him or her to a level of a thing to a sub-human being if not outright destruction.

Major Causes of Violence in Nigeria

There are many factors that can be described as the major causes of violence in Nigeria. For instance Ideyi (2010) identified the following as causes of violence in Nigeria: selfishness, greed, injustice, do-or-die politics, love of money, wealth, accumulation of wealth, revolt, repression, immorality and ignorance. In addition, Ideyi (2010) shed more light on some of the causes.

(i) Selfishness is a subtle but fertile soil for violence, man is a social being, a being that lies, works and grows in the midst of others, a being that needs the assistance and encouragement of others to attain his goal. For that reason, he has to consider others interest in taking actions and everything he does. But when selfishness takes over him, he ignore totally or considers less important aspect of his social actions often become offensive to others and arouse in them negative reactions which must be violent in varying degrees.

(ii) Greed is a social cancer said to be at work in a person. When that person has excessive desire for something be it food, money, wealth or anything else, which in reality he/she does not need or needs as much. Often it is excessive and selfish desire for money or wealth, power influence, etc. without thought about the after effects. Nothing is so much turning, soul sapping, morally revolting and violently provoking like the victims of these social viruses at parade.

(iii) Injustice, the common runs of mankind hold the view that nothing that makes easier and quicker a destruction of human society more than injustice. Once by omission or

commission. It is allowed to rear its ugly head in the society, it first port of attack is the web of human relations, second is the moral values like trust, integrity, honesty, equity, peace, love, sincerity, respect for life and human dignity for common patrimony, live and let live etc. being the building bridges of the edifice called society, and third is justice which is the foundation of every human society. Society was built on the store of justice and members of the society work to continue to maintain a justice society. If out of negligence selfishness, greed or the lies, justice develops winds and flees, the shores of the society in question for injustice to take its place the society becomes vulnerable to violence and its disintegration is just a question of time. When a citizen of Nigeria who is qualified for a job on the basis of merit but he or she is deprived of it on the basis of his or her state of origin sex, religion, tribe, lack of godfather or any other variable, it is a naked injustice.

(iv) Poverty simply defined is a lack of what a human needs to live a normal true and genuine life. It is seen as a disease because it distorts person's worth and destroys his dignity and pushes him or her to live a miserable life. Poverty is a situation where a person or a country lacks basic needs of life such as food, shelter, clothing, access to health and education. In Nigeria where poverty is accommodated and crowned as a king, courtesy of bad managers of the country's abundant resources the bitterness it arouses in the people has made the country vulnerable to violent eruptions with enormous costs in terms of lives and property. pp. 98-102.

Furthermore, Dubey (2002) reported in Salawu (2010) that: A major causes of ethno-religious violence in Nigeria has to do with the accusations and allegations of neglect, oppression, domination, exploitation, victimization, discrimination, marginalization, nepotism and bigotry. In every nation (Nigeria inclusive) there is no complete agreement on how to effect necessary changes and reforms. This is because, different groups and individuals have diverse interest in which case, some groups will have not. What this means is that, violence (ethno-religious one inclusive) usually occur when deprived groups and individuals have diverse attempt to increase their share of power and wealth or to modify the dominant values, norms, believes or ideology.
However, in Nigeria and from the various examples of ethno-religious violence, it seems to be diverse interplay of politics, ethnic and religious which has consequently led to the rising nationalism and militancy of various ethnic and religious movements. It is interesting to note that the overall consequence of this is the escalation of various ethno-religious violence that are witnessed all over the country which are meant to correct any perceived form of marginalization, oppression or domination.

In addition, Salawu (2010) argued that, the failure of the Nigeria leaders to establish good governance forge national integration and promote what can be called real economic progress, through articulated policies, has led to mass poverty and unemployment. This has result into communal, ethnic, religious and class violence that have now characterized the Nigeria nation. Salawu (2010) further stressed that one of the major cause of ethno-religious violence in Nigeria is the breakdown of such agents of social control that characterized the traditional African societies such as the family, education, law, religion and political system that are for the well-being of all citizens. Indeed, the malfunctioning of these institutions has significantly increased ethnic and communal violence in Nigeria.

Recommendations

(i) The school curriculum should be structured to accommodate civic education, citizenship education where learners would be taught the need to avoid violence.

(ii) The teacher should be a good role model for students to emulate by practicing what they preach/teach in schools – Act of violence by students should be dealt with.

(iii) Guidance and counseling centres should be establish in schools to rechanneled students thinking in career choice in life and living a decent life style and crime free habits.

(iv) Punishment and reward should be used judiciously to deterred all act of criminality and deviant behaviour which could spark of violence.

(v) The spirit of nationalism and national consciousness should be inculcated in the learners, this will enable them shun ethnicity, tribalism and nepotism which are indices that could trigger off violence.

(vi) Political thuggery, economic sabotage, corruption, religion fanactism and immorality should be preached against in all designated places of worship, (Churches and Mosques).

Conclusion

The paper discussed the concept of ethic, morality, violence, causes of violence and fundamental moral principles that has sociological implication in human relationships towards a peaceful co-existence in the human society. It offers recommendation and conclusions on how to minimized violence in our society so that every strata of development, that is politically, economically, socio-culturally and technologically will not be paralyzed.

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USING WEBSITE TEACHING PARADIGM IN TRANSPORTING NIGERIA FROM NEGATIVE TO THE POSITIVE SIDE OF THE INTERNATIONAL DIGITAL DIVIDE

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Abstract
This work seeks to make available information to facilitators who have shared interests in the website pedagogical e-learning platform. The website teaching paradigm allows educators to place course contents and other related materials on a website and utilize them to supplement face to face teaching in the teaching-learning process. This paradigm provides an inertia stride to the positive side of the international digital divide; desiring to create easy to use, pedagogically useful, visually pleasing and easy to maintain course website for the e-learning paradigm. The work presents website pedagogical benefits and gives constructivism as its theoretical consideration. The concepts of International Digital Divide; Website and choice of its authoring soft ware; needs assessment for starting a Website course teaching and steps in producing and utilizing Website in instruction process are discussed. It also presents the process of transporting Nigeria from negative to positive side of the International Digital Divide using Website teaching. Recommendations are given to education stakeholders including that; Nigeria as a country should formulate e-learning policy for her education system and institutions of learning should organize for general e-learning governance plan as well as establish training outlets to train her staff on how to create and use this in the teaching-learning process.

Keywords: Website, Teaching Paradigm, Transporting, Negative side, Positive Side and International Digital Divide.

Introduction
Paradigm shift refers to a move from one way of thinking to another. It is a sort of metamorphoses; a revolutionary transformation, driven by change agents; a radical change in underlying beliefs or theory. According to Wikipedia (2007), it is scientific advancement with a "series of peaceful interludes, punctuated by intellectual violent revolutions", which "one conceptual world-view is replaced by another". That is a shift in a paradigm. In education, e-learning specialists with the use of e-resources serve as agents of change or the shift in the more traditional chalk, talk and text method to e-learning paradigm. A shift in the format of information presentation, a shift from teacher centred-knowledge-emitter education to learner centred where the learner assumes responsibility for his learning process.

Modern theories have anchored current learning practices with the use of e-resources that in the paradigm shift have placed learner in charge of arranging his learning environment, managing it and constructing his learning ideally at his pace. Monereo, Fuentes, and Sanchez, in Ikyumen (2012), emphasized that, "lack of ability in e-resources use in learning process (e-learning) that provides e-literacy, defines a new type of illiteracy and alienation from the modern society", polarizing global world into positive and negative digital divide.

International Digital Divide
The use of e-resources in instructional process is a new trend globally and has become part of the rapid communication technological advancement, for e-learning (Ikyumen, 2012). The practice has formed the current paradigm in the global education system, pushing all countries of the world to redesign and provide for the e-learning format to equip their citizenry with the skills, abilities and enthusiasm to utilize the e-resources in everyday life. According to Ikyumen (2011) and Ikyumen (2012), the countries that have provided e-resources, platform for its use in education are referred to as being on the positive side of the international digital divide, while

those that are not using the platform in instructional process are on the negative side. It becomes imperative for every country to equip their teachers with skills that would make them relevant to meet the changing education and development of the societal needs.

Theoretical Framework

This study is based on the constructivist theory of Bruner, which learning is considered as an active process in which learners construct new ideas or concepts drawing from their past/present knowledge. Here the learner will have to select, transform information and make decisions based on his cognitive structure like schema, imagery, memory and mental modes to provide meaning and organization to learning materials provided on the website beyond the given information. Learners have the opportunities to discover principles by themselves as the facilitator in designing the website translates information to be learned into a format appropriate to the learner's state of understanding.

Website

The "Web" refers to interconnected sets of e-resources found in different geographical locations, owed by different individuals and institutions, which when diagrammed, looks like a spider's web. It specifically refers to the World Wide Web and is normally captioned "the Web". Website refers to a definite Internet resource located with a Web address, which the searcher can quest or click on the link to 'return' the event; 'the Website' (Ikyumen, 2013).

When used in teaching, the resource person prepares the entire relevant and needed course materials and hosts on an institution Website with relevant links and reference buttons, which provide links for more information (Horton, 2000). The Web is produced with the Web authoring tools, refers to as the 'Web authoring soft ware'. These are of two main types; the text editor and the visual layout tools. According to Horton (2000), the text editor is used in writing the HTML in the text mode, and use a browser to preview the page layout, while "What You See Is What You Get" (WYSIWYG) layout tools is meant for designing pages in the layout mode. To him, with the use of the WYSIWYG tool, you can position text and images on the page, and software generates the needed codes to display the page in the Web browser. The Institution should make use of qualified and experienced Web authoring personnel to choose software(s) for campus computing department that is easy to use, and can serve on the average, the whole institution as a community.

Of paramount importance, any institution implementing e-learning should create a training outlet to train her educators on creating Websites and using it in facilitating learning, (Ikyumen, 2012). They should also motivate and encourage educators to utilize the Websites in the teaching-learning process. It is also important to determine how the Website will be used in relation to the time available and the total components parts of the learning activities. How a Website would be used in teaching affect it's planning and design. If you wish to use the Website in communication (discussion areas and other feedback mechanisms), it should be considered from the design and development stage so that provision will be made adequately for it. It will also affect the time made available to students for such interactions (Horton, 2000). This will demand very often updating of the Website for optimum functionality and coping with arising challenges.

Needs Assessment for Starting a Website Course Teaching

For an individual or group of facilitators to succeed in designing, developing, producing, hosting and utilizing a website, they have to carry out the following needs assessment:

(i) Define your objectives for the website.
(ii) How would the curriculum be incorporated into the course web?
(iii) What impact would the website make on the learner and course of study?
(iv) What support do you need from the computer department for computer based project or how ready is your Institution to support it from another Institution?
(v) What software for designing the website has the Institution provided for course website development?

(vi) What facilities are available for the course web development in your Institution?
(vii) What is the source of funding of the website?
(viii) Seek to develop the project on formats that are compatible with portable e-resources (Ikyumen, 2012); hence learners find it more convenient to access information on these resources than to be tied down in the school or commercial cafes.

The steps in producing and utilizing websites for course webs which are designed to supplement face-to-face teaching as suggested by Horton (2000) are:
(i) Planning the project with care,
(ii) Converting course materials and developing new contents,
(iii) Develop the website,
(iv) Incorporating the website into your teaching method
(v) Evaluation.

The process of producing Website has to start with the digitization of both the course and related or reference materials. This will entail typesetting texts and graphics on the computer (or any digital device), importing objects from other sources and seeking copyright permission where required, captioning images on the digital camera or scanning photo objects. It involves recording audio materials on digital media, or transferring needed audio or visual clips for multimedia production that need incorporation of narration. It requires incorporation of different media on the designed course website, which is capable of providing the learner with visual, audio and other multimedia learning experiences. To provide the learner with extended versatile rich leaning experiences, you can add various links for supplementary as well as complementary websites (Horton, 2000). In this way, you will succeed connecting your learners to one another and other rich web resources around the world.

Transporting Nigeria from Negative to Positive Side of the International Digital Divide using Website Teaching

Website is just a means of integrating technology into the classroom or in the learning environment and process. There are several e-resources that are versatile in application in the process of learning, singularly or in multimedia approaches; in assisted form or in an enriched form (Ikyumen, 2012). We also have course management softwares like the MODULE and several online scholarly facilities like video conferencing, teleconferencing and skype in education (Ikyumen, 2009). These constitute the various components that make up the e-learning; the current paradigm shift in education across the world. It is of paramount importance to acknowledge the fact that, the more traditional chalk, talk and text paradigm that constituted the analogue and teacher centered approach had been in custody of practitioners that have the will power to either accept or reject the shift in the paradigm.

Any new paradigm, according to Wikipedia (2007), "is always opposed, ridiculed, grudgingly accepted, and then finally adopted – usually after the generation in power has left the stage". The paradigm is not simply the current theory, but the entire "world-view" in which the paradigm exists, and of the implications which come with it. In the current paradigm shift, learners play active and proactive roles with the e-resources tools to create their subjective constructs of reality. Obviously this is based on the features of landscape of practice that educators can identify around them. The present world educational practice constitutes of practitioners and custodians of the established, prevailing teacher centered as well as 'teacher as the knowledge emitter' paradigm and a shift that encompasses learner centered, active and proactive learning environment creation, and knowledge seeking episode will pose treats to the existing system.

The custodians of the existing paradigm had invested their whole lives developing the paradigm, and fashioned their profession, fortune and hope around the paradigm, which act as the core and giants whose shoulders new generation should stand. That is to say, they should protect it and be ready to resist any change that will frustrate this investment and hope with all vehemence. Like with the scientific revolutions, there are anomalies for the paradigm with

various levels of significance to the practitioners of the time that can be brushed away as acceptable levels of error, or simply ignored and not dealt with (Wikipedia, 2007).

The process of implementing Website instructional paradigm will therefore have to be developed along with other components of the e-learning implementation plan. This process includes but not limited to manageable governance plan of Design and delivery, support services and business services. According to the E-Learning Implementation strategy and plan for the University of Zuliland (University of Zuliland, 2009), will comprise of programme planning, product design, development and assessment and user support. All issues will be coordinated by and reported to the institution director of E-learning. That will incorporate the existing administrative structure that will carry along every functional member of the academic community, fostering acceptability and adoptability of the paradigm.

Conclusion and Recommendations

The work made case on the use of website teaching paradigm in transporting Nigeria as a country from negative to positive side of the international digital divide. Key concepts were considered, with the work anchored in the theoretical foundation of constructivism. Having presented relevant issues on the paradigm and considering the fact that Nigeria as a country has neither developed her e-learning policy nor reviewed her curriculum to integrate e-resources in the teaching-learning process, has fallen on the negative side of the international digital divide. The following recommendations are made:

(i) Nigeria as a country should formulate the e-learning policy and review the curriculum to integrate e-resources particularly website teaching paradigm in the teaching-learning process.
(ii) Every institution should formulate their e-policy and structure their e-learning implementation plan.
(iii) Every institution should employ and train the e-learning specialist to oversee the activities of e-learning generally and website in particular.
(iv) Every institution should acquire web authoring tools, particularly the Web authoring soft ware to be used by the whole institutions' staff.
(v) Every institution should conduct the needs assessment for starting a website course teaching and implement accordingly.
(vi) Every institution should integrate the Website teaching method in the teaching-learning process.
(vii) Institutions should mount the institutional training outlets to develop the e-resources potentials of their academic community.

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STATUS OF BIOLOGY PRACTICAL IN SENIOR SECONDARY SCHOOLS IN EDATI LOCAL GOVERNMENT AREA OF NIGER STATE

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Abstract

The study investigated the status of practical biology in secondary schools in Edati Local Government Area of Niger state. The sample of the study consisted of 27 biology teachers and 120 SSIII students randomly selected from the six schools. The instrument used for data collection was a survey questionnaire named Status of Biology practical work Questionnaire (SBPWQ) constructed by the researchers. Two research questions and two null hypotheses were formulated to guide the study. The research questions were answered using mean and standard deviation, while the null hypotheses were tested at 0.05 level of significance using t-test. The results showed that the status of practical biology in the schools used for the study was so poor and insufficiently carried out. Facilities for practical biology are inadequate, for instance, there are poorly-equipped laboratories& libraries,inadequate laboratory staff etc. It also revealed that teachers often use lecture method during biology practical instead of practical oriented methods and there was no active and constant participation of students in practical classes. It was recommended among others that the government and other stakeholders in education should provide facilities and equipment for biology practical . Conferences, workshops and seminars should be constantly organized by the government and schools for biology teachers as to update their knowledge and skills in practical biology, which in turn will improve teaching and learning of practical biology in secondary schools.This could go a long way in reducing the epidemic poor performance in WAEC and NECO examinations.

Keywords: Biology, Practical work, Practical biology, science process skills

Introduction

The teaching of science is incomplete without practical works. Practical works enable students to be exposed to science process skills which include observing, experimenting, measuring, communicating, manipulating, questioning, predicting, controlling variables, inferring etc. These science process skills are fundamentals in the teaching and learning of sciences such as biology, without which, effective teaching and learning of sciences can never be enhanced (Ugwu, 2005). Some of the areas in which biology is important include its position as the science of life which enables man to know more about himself. It also contributes to socio-economic development of man, society and the nation as it is applied in plants and animals breeding to raise improved breeds. It is also applied in food processing, food conservation, storage, development of drugs and vaccines for curing and preventing diseases (Ramalingam, 2000). The subject offers wide range of career choices for secondary students at tertiary level of education which include medicine, pharmacy, nursing, bio-technology, zoology, botany, micro-biology, biochemistry among others (Larku, 2011).

Practical work is any teaching and learning activities that involve students in observing or manipulating real objects and materials. Isa (2007) described practical work as observable skills, knowledge and attitudes. Practical work can take place in the laboratory, workshop or in the field where students do exercise with real or improvised materials. In the laboratories and workshops, students interact with tools and materials in order to put theoretical work into practice for proper understanding of science subjects of which biology is one. It helps students to link between the domains of knowledge comprising of the domains of objects, observable properties and events as well as the domain of ideas. Isa (2007) states that some possible intended learning outcomes include: helping students to identify objects and phenomena and become familiar with them, learn facts and concepts, relationships, theories and models from the foregoing observations.

Biology is an important science subject which by the nature of its concepts needs to be studied in details through practical work experience. Ango (2000) stated that biology comes alive when students are engaged in practical work. Danmole (2012) asserted that teaching of biology is only effective with practical work and also learning and retention of its concepts are impossible without exposure to practical work. Biology therefore, is a pure practical science, thus, appropriate biology practical is the key to enhanced learning classification and consolidation of theories.

However, biology practical can be sabotaged by some factors, for example, Dan-Ologe and Shittu(2013) highlighted some factors hindering learning of biology which include poor biology laboratory condition or status, inadequate staffing and non-availability of laboratory materials. Aganga (1998) reported that students in schools with adequately equipped laboratories performed better than those in poorly equipped laboratory schools. This signals success in students performance in biology S.S.C.E. if laboratories are to be well equipped as reported and in addition, if practical biology is well carried out in senior secondary schools.

Statement of the Problem

It has been revealed that there has been consistent massive failure in biology in senior secondary School Certificate Examinations over the years in Nigeria. (WAEC, 2000-2010). Reasons attributed to that among others is non-availability and utilization of instructional materials (Shehu, 2006). However, Nwachukwu and Nwosu (2005) reported that students' poor performance in practical biology examination was in part, due to inadequate exposure to practical biology and their non- acquisition of relevant skills. Isa (2005) stated that science teachers use lecture method in teaching science instead of using the activity oriented methods. However,biology is a science subject that relies heavily on practical work activities for greater understanding of its concepts (Ango,2000;).This ofcourse, by implication, reveals that if biology practical is hindered by any factor, the whole biology teaching and learning activities are also prone to be affected. This prompts the emergent need for checking the condition of biology practical activities in secondary schools to have a clear picture of its efficiency and quality.

Purpose of the Study

The main purpose of this study was to investigate the status of teaching and learning of practical biology in the secondary schools in Edati Local Government Area, Niger state. Specifically, this study sought to:-

(i) Determine the availability and adequacy of resources for practical biology in secondary schools.
(ii) Determine the adequacy of resources for practical biology in the secondary schools.
(iii) Determine other factors that hinders smooth learning of practical biology in the secondary schools

Research Questions

This study tended to provide answers to the following research questions:

(i) How available and adequate are the resources for teaching and learning biology in the secondary schools?
(ii) What are the facts hindering smooth teaching and learning of practical biology in the schools?

Research hypotheses

The following null hypotheses were formulated to guide the study and was tested at 0.05 level of significance:

Ho_1: There is no significant difference between the mean responses of biology teachers and students on the availability and adequacy of practical biology in Secondary schools in Edati local Government.

Ho_2: There is no significant difference between the mean responses of less-experienced and more experienced biology teachers on the factors hindering teaching and learning of biology practical.

Research Method

The design of this study was a survey research. The population of the study comprises of all 27 biology teachers and Senior Ssecondary class III (SSIII) students (2,260) from the six secondary schools in Edati Local Government, Niger state. Purposive sampling technique was used to select all biology teachers from the schools as they are few in number. Among the teachers, ten teachers have less than five years of teaching experience and are called less-experienced teachers, and twelve of them have worked for more than five years and were called more experienced teachers. Stratified random techniques was used to select 120 S.S.III students, 20 students each from the six secondary schools in the local government.The instrument used for the data collection was questionnaire constructed by the researchers and designated as status of Biology practical work Questionnaire (SBPWQ) constructed by the researchers. The SBPWQ consists of four sections namely: Section A comprises biodata, section B contains status of teaching and learning of practical biology items; while section C contains items on adequacy of resourses for biology practicals. Five Likert scale was used to assess the responses of biology teachers and students. The data collected was analyzed using mean, standard deviation and t-test analyses. To establish the validity of the instrument for the study, the instrument was subjected to both face and content validation by the experts in the science education department, Federal University of Technology, Minna. The questionnaire was pilot tested using samples other than those used for the study.Cronbach Alpha of 0.75 was obtained as reliability coefficient.

Results

Table 1: Number and percentage of teachers and their years of teaching experience

Biology teaching experience in years.	No of teachers	Percentage	Remark
<5 years	12	44.4	Less-experienced
≥5 years	15	55.6	More-Experienced
Total	27	100	

Table 1: shows that 44.4% of the biology teachers used for the study were less experienced while 55.6% were more- experienced.

Research Question One: What is the quality of biology practical in the secondary schools of Edati Local government?

Table 2: Mean responses of teachers on the quality of practical biology

S/No	Questionnaire Items (Teachers)	Mean	SD	Remark
1	Biology practical is always carried Out in my school	2.04	0.58	Not Agree
2	Enough biology practical is carried Out in my school	2.13	0.72	
3	Biology teachers engage more in Lectures than practical during practical Biology	2.43	1.22	Not Agree
4	Verification experiments are always Carried out during practical biology	3.14	0.49	Agreed
5	Practical works done in my school enable students to solve past WAEC Practical biology questions.	3.02	0.94	Agreed
6	Investigation experiments are often Carried out during practical biology in My school	2.23	0.92	Not Agree
7	The quality of practical work in Biology in my school is satisfactory.	2.41	0.73	Not Agree
8	Practical work in biology in my School is made	3.11	6.66	Agree

	interesting.			
9	Group work is encouraged during Practical biology in my school.	2.16	1.12	Not Agree
10	There is active participation of Students during practical biology.	2.22	0.71	Not Agree
	Grand mean	2.30	0.81	

Table 2: shows the mean responses of teachers on the quality of practical biology in the schools under study. The grand mean of all responses fall below 3.00 which is the criterion. This means almost all teachers are dissatisfied with the quality and quantity of practical biology in the schools. Meanwhile, as indicated in item 5, they agreed that the little biology practical carried out enable the students to solve some past questions of WAEC and NECO biology practical. Also only verification experiment is the major practical events not experimentation

Table 3: Mean responses of students on the quality of biology practical.

S/No	Questionnaire Items (Sudents)	Mean (N=27)	SD	Remark
1	Biology practical is always carried Out in my school	1.92	0.56	Not Agree
2	Enough biology practicals are carried Out in my school	1.87	0.59	Not Agree
3	Biology teachers engage more in Lectures than practical during practical Biology	3.25	1.92	Agree
4	Verification experiments are always Carried out during practical biology	2.72	0.57	Agreed
5	Practical works done in my school enable students to solve past WAEC Practical biology questions.	2.02	0.67	Not Agree
6	Investigation experiments are often Carried out during practical biology in My school	1.94	0.61	Not Agree
7	The quality of practical work in Biology in my school is satisfactory.	2.06	0.68	Not Agree
8	Practical work in biology in my School is made interesting.	2.04	0.64	Not Agree
9	Group work is encouraged during Practical biology in my school.	1.96	0.63	Not Agree
10	There is active participation of Students during practical biology.	1.82	0.62	Not Agree
	Grand mean	2.12	0.65	

Table 3 shows the mean responses of students on the adequacy of resources for practical work in biology. The grand mean of the responses is 2.12 which is far below the average of 3.00.Almost all the items fall below the criterion except item 3.This means that they are all dissatisfied with the quantity and quality of biology practical in the schools.On the other hand they agreed that teachers talk more in practical class than engaging fully in practical activities.

Research Question Two: How adequate are the resources for smooth teaching and learning of practical biology in the schools?

Table 4: Mean responses of Less-experienced teachers on adequacy of resources for biology Practical

S/No	Questionnaire Items (Less-Exp.)	Mean (N=27)	SD	Remark
1	Equipments and chemicals for biology Practical in my School are adequate.	2.06	0.49	Not Agree
2	There is a well equipped library in my school.	2.15	0.52	Not Agree
3	There are enough qualified laboratory Personnel in my school.	2.31	0.61	Agree
4	There are enough professional biology Teachers in my school.	2.26	0.76	Not Agree
5	Practical works done in my school enable students to solve past WAEC Practical biology questions.	1.86	0.66	Not Agree
6	There is enough space in biology laboratory in my school.	1.92	0.63	Not Agree
7	Biology practical work in my school is allocated enough time in the time table.	2.31	0.79	Agreed
8	Seminars, workshops and in-service training are always organized for our teachers.	1.62	0.43	Not Agree
9	Biology practical text books are abundant and cover biology syllabus in my school.	2.52	0.78	Agreed
10	There is constant,electric &water supplies and enough security gadgets in biology lab	2.48	0.76	Not Agree
	Grand mean	2.06	0.76	

Table 4 illustrates mean responses of less-experienced teachers on the adequacy of resources for biology practical .The grand mean of all responses is 2.06 which is below 3.00.This indicates that biology practical resources ranging from lighting, water, electricity,chemicals and equipments among others are unsatisfactory and inadequate.

Table 5: Mean response of more-experienced teachers on adequacy of resources for biology practical

S/No	Questionnaire Items (More-Exp.)	Mean (N=27)	SD	Remark
1	Equipments and chemicals for biology Practical in my school are adequate.	1.98	0.48	Not Agree
2	There is a well equipped library in my school.	2.01	0.55	Not Agree
3	There are enough qualified laboratory Personnel in my school.	1.87	0.72	Agree
4	There are enough professional biology Teachers in my school.	2.21	0.69	Agreed
5	Practical works done in my school enable students to solve past WAEC Practical biology questions.	1.52	0.64	Not Agree
6	There is enough space in biology laboratory in my school.	1.71	0.59	Not Agree
7	Biology practical work in my school is allocated enough time in the time table.	2.24	0.81	Not Agree
8	Seminars, workshops and in-service training are always organized for our teachers.	1.60	0.39	Not Agree
9	Biology practical text books are abundant and cover biology syllabus in my school.	2.57	0.82	Not Agree
10	There is constant,electric & water supplies and enough security gadgets in biology lab	3.01	0.72	Not Agree
	Grand mean	2.15	0.72	

Table 5 shows the mean responses of more-experienced teachers on the adequacy of resources for biology practical in the schools.The grand mean of responses however, fall below 3.00 indicating dissatisfaction of the respondents on the adequacy of such resources.they only agreed with item 10, which means lighting water and electric supplies as well as security gadgets are available and adequate.

Hypothesis One

HO1: There is no significant difference between the mean responses of biology teachers and students on the quality of practical biology in Secondary schools in Edati local Government.

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Table 6: Independent t-test results of teachers and students' responses on quality of practical Biology

Group	N	df	Mean	SD	t-cal	Sig. (2-tailed)
Teachers	27		17.78	0.81		
		145			1.15	0.196^{ns}
Students	120		11.08	0.66		

ns= Not significant at 0.05 level

Data in table 6 shows the t-test result of teachers and students' responses on the quality of practical biology. t (1.15),df = 145, p< 0.05.This implies that there no significant difference between the responses of teachers and students on the quality of practical biology. The null hypothesis is therefore not rejected.

Hypothesis Two

Ho_2: There is no significant difference between the mean responses of less-experienced and more experienced biology teachers on the adequacy of resources for teaching and learning of practical biology in Edati secondary schools.

Table 7: Independent t-test comparison of responses of more-experienced and less-experienced teachers on adequacy of resources for practical biology.

Group	N	df	Mean	SD	t-cal	Sig. (2-tailed)
More-Exp.	15		17.78	2.06		
		25			0.315	0.160^{ns}
Less-Exp.	12		11.08	2.15		

ns =Not significant at 0.05 level

Table 7 shows t-test result of less-experienced and more-experienced biology teachers on the adequacy of resources for practical biology. t (0.315),df = 25, p< 0.05. This implies that there is no significant difference between the responses of less -experienced and more-experienced teachers. Therefore, the null hypothesis is not rejected.

Discussion of Findings

The study was to survey the status of practical biology in secondary schools in Edati Local Government of Niger State. From the results, table 1 reported the proportion of teachers base on their years of experience in teaching profession. Out of 27, 12 teachers (44%) spent less than five years in teaching, while, 15 teachers (56%) spent five years and above. Experience is regarded as effective in practical techniques , work and management (Egbunomu & okeke, 2005).

Table two reported teachers' responses on the quality of practical in the schools studied.It revealed that almost all teachers are not contented with the quality, frequency and nature of the biology practical activities in the schools. The grand mean was 2.30 and SD = 0.81, which is

below 3.00 scale average. The results corroborate the position of Nwachukwu and Nwosu (2005) who posit that students' poor performance in practical biology was in part due to inadequate exposure to practical biology and non-acquisition of relevant skills. Indeed the situation is devastating as biology comes alive only if students are engaged fully in practical work, as it heavily relies on practical activities for greater understanding of its concepts (Ango,2000).

Table 3 revealed that the grand mean of students' responses was 2.12, SD = 0.65 which is below 3.00. This shows that they are of the opinion that practical biology activities are not well carried out in the schools. In other words, the quality, quantity and nature of biology practical activities are not satisfactory. This situation is a great nuisance to the teaching and learning of biology, as it can never be effectively learnt without practical biology (Ango, 2000; Nwachukwu & Nwosu, 2005). The students revealed that teachers talk more than doing practical activities during biology practical. This supports the assertion of Ali (1984) and Isa (2005) who revealed that science teachers use lecture method in teaching sciences instead of activity oriented methods. Science process skills can never be effectively acquired through lecture method, and they are pre-requisites for effective teaching and learning of sciences (biology inclusive) (Ugwu, 2005).

Table 4 reported the responses of less-experienced teachers on the adequacy of resources for biology practical. The grand mean was 2.6, SD = 0.76 which indicated that they disagreed with the adequacy of the resources for biology practical in the schools. These resources range from equipment, chemicals, spacious laboratories, professional biology teachers, lab staff, libraries, among others. They also agreed that there are available security gadgets, water and electricity supplies in the laboratories. Water, electricity supplies and security gadgets are necessary in any standard laboratory, but of no avail if other resources are inadequate or even lacking. Among the factors that hinders learning of biology are poor biology laboratories, inadequate staffing, and non-availability of laboratory materials (Dan-Olege &Shittu, 2013).

Table 5 revealed the responses of more-experienced teachers on the adequacy of resourses for biology practical. The grand mean was 2.15, SD = 0.72, indicating that they were dissatisfied with the adequacy of all the resources for biology practical in the schools. But, in their responses, they agreed that water, electricity and security gadgets are available and adequate

Table 6 reported t-test results of teachers and students' responses on the quality of practical biology in the schools. It revealed that there was no significant difference between the opinion of teachers and students on the quality of practical biology in the schools, t (1.15), df = 145, $p < 0.05$, hence ,the null hypothesis is not rejected.obviously,both teachers and students are not satisfied with the way biology practicals are carried out.

Table 7 reported the t-test results of the opinions of more-experienced and less-experienced teachers on the adequacy of resources for practical biology. where, t (0.315), df = 25, $p < 0.05$, indicating that there was no significant difference between the responses of more experienced teachers and less-experienced teachers on the adequacy of resources for biology practical, hence, the null hypothesis is not rejected. This simply shows that the old teachers and new teachers have the same opinion on the subject matter. It simply indicates that these problems have been there for a long time in the schools.

Conclusion

Biology is an important science subject which offers wide range of career choices for students at tertiary level that benefit humanity. The importance and relevance of studying biology both theoretically and practically can never be over-emphasized. Practical biology enables students to acquire science process skills which are important in scientific investigation to arrive at knowledge. From this study, it is obvious that the quality of biology practical activities are declining in secondary schools and urgently needs to be given more attention in order arrest the situation. Students are not well engaged in to practical activities and as well, the resources for

practical biology are not adequate in the schools. For students to acquire science process skills which will enhance their performances in biology WAEC and NECO examinations, they should be well engaged in practical activities in well equipped laboratories.

Recommendations

The following recommendations were made based on the findings of this study.

(i) Facilities or resources for biology practical should be adequately supplied to schools by the government and other stakeholders in education so that students can be actively engaged during practical.

(ii) Enough funds should be provided to schools to purchase needed materials for biology practical.

(iii) Teachers should ensure that the biology practical they organize can enable students solve past WAEC biology practical questions. This will make their work purposeful and realistic and will also make the students have confidence that they are learning.

(iv) Teachers should not use the period of biology practical for lecture. They should ensure that they teach biology as an enquiry and not as theory only.

(v) Teachers should ensure that investigative experiments are carried out instead of frequently carrying out verification practicals.

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ASSESSMENT OF THE MAINTENANCE OF EQUIPMENT FACILITIES IN TELEVISION TRANSMISSION STATION IN OYO TOWN OF OYO STATE

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Abstract
Maintenance is a highly skilled craft combining art and science. It requires technical knowledge as well as real understanding of engineering and critical performance of transmission equipment and machine for adequate performance of the required output. The population for the study was made of up of 52 engineering staff in the television transmission station, due to the small number all the engineering staff was adopted as the sample for the study. Questionnaire was used to elicit responses from the respondents, the arithmetic mean was used as a statistical tool to obtain the results. The findings showed that eleven out of thirty-five preventive maintenance activities was inadequate while twenty-one activities of corrective maintenance was found not suitable, while two out of managerial strategies was found to be disagreed on the maintenance of television transmission station in Oyo town. It was hereby recommended that installers and repairers of Nigerian Television Authority (NTA) should have good eyesight and colour perception to work with the intricate component used in television transmission station for effective performance.

Keywords: Assessment, Maintenance, Equipment Facility, Television, Transmission Station

Introduction
Maintenance of resources is crucial for preventing wastages and attaining maximum utilization through availability and longevity of the resources. According to Oedewald (2002), the aim of maintenance is to guarantee the safe, reliable and cost-effective production, which includes preventive maintenance, planned outages and repairs.

Maintenance in engineering is the function that should be carried out at scheduled time in order to keep the plant or engineering equipment in good operating condition. It is an important aspect of every establishment be it manufacturing or production industry. A breakdown is the result of inadequate maintenance of machine and equipment in all workplaces which will definitely lead to delay in the performance of the establishment or frustration in the production sector.

For any equipment, machine or appliance to function properly and to last long, it is important that one acquires reasonable knowledge of how it works and, most importantly follow the guidelines provided for its maintenance. The knowledge of the working mechanism of the equipment will give one a sense of appreciation of the importance of every item of maintenance so that one will know the actual time to carry out the maintenance exercise.

Transmission involves the radiation of waves into space from the point of generation and their reception at another point, this principle make use of communication or broadcasting in transmitting messages, speeches or music from one place to another by radio, or television. The radio wave must first be generated before they can be transmitted and received in radio and television set which may be located several kilometers away from the source of generation (Bamiro, Nurudeen & Akuru 2004).

For a transmission station to function at all. It will consist of these principal elements

(i) A microphone which is used to control the radio waves in accordance with the information to be transmitted.
(ii) A radio signal transmitter that will generate the radio frequency.
(iii) A transmitting aerial to send out the waves into space.

An aerial must be fed with radio frequency (r.f) power to emit radio waves effectively (Duncan, 1985) but speech and music produce audio frequency (a.f) voltage and current. The transmission in broadcast television occurs when the video signal is transmitted by amplitude modulation of a carrier in the ultra high frequency u.h.f band.

Maintenance is an activity carried out for keeping equipment, appliances and other peripheral of the communication and transmission gadget in good working condition for present and future use. Alkinson (1990) defined maintenance as the process of sustaining construction and production elements in safe and usable condition. Also, FEC (2009) opined maintenance as the process of taking approved steps and precaution to care for a piece of equipment, facility, machinery and ensure that it attains its maximum functional self life.

Maintenance is the act of keeping assets in acceptable condition or at a prescribe level of performance (Rautheon 2003). Maintenance can be conceptualized as the process of restoring equipment, machine, electronic gadget and facilities in good working condition to ensure that it attains maximum functional self life. According to Elekwa; Bamiro; Olujide; Ladoye, Nurudeen Akuru & Olapade (2007) maintenance of any engineering equipment can be placed under three general headings predictive, preventive and corrective maintenance.

Predictive maintenance is the method of using modern devices to predict, or foresee an impending breakdown in a machine. By this prediction, an immediate intervention to arrest the situation should be adopted to prevent the breakdown of the machine, equipment and the facilities. While preventive maintenance is any activity carried out on any equipment or machinery even before the need arises. It forestalls the possibility of a major or total breakdown of the equipment or machinery, such activities involves checking equipment or machinery before time envisaged, servicing and overhaul of the equipment. Adequate lubrication, painting of buildings and cleaning of equipment before it is over due. The most important part about preventive maintenance is that it must be planned and be consistent. Corrective Maintenance is the repair work carried out when equipment has broken down. it is an activity designed to restore a machine, equipment or facility to its initial standard. It involves minor and major repairs necessary through troubleshooting and replacement of bad element or worn-out parts of the machine, equipment or facility (Bruce & Jenny 1998). The goals of reliability, condition base, predictive and preventive maintenance are all the same which is to keep assets working in optimal condition for the longest period of time at the lowest overall cost to an organisation

Assessment is the process of ascertaining the value of work of a performance of certain facility over a period of time (Ogunniyi 1999). Therefore to sustain the functionality of equipment, machine and other facilities in the television transmission station their operations and performance must be evaluated periodically. Federal Government of Nigeria has enjoyed a boost by the establishment of a number of television transmission station in towns and cities in the country across the state. To bring the activities of the federal government to the grassroots and to disseminate valuable information and quick-orientation of masses. Nigeria Television Authority (NTA) established a local television transmission station at Oyo town in Oyo State of Nigeria. It was located at Apitipiti Area in Oyo-East local government of Oyo State. It is transmitting at channel 37 with 593 MHZ. Frequency by virtue of its duty in disseminating information to the grass root. It is imperative to assess the maintenance of equipment, machine and other facilities in television transmitting station.

Statement of the Problem

The television transmission station is a rare communication facility, which almost disappoint the viewers and the subscribe that patronize the stations. So many educative, culture and religious programme scheduled for viewing get failed due to the poor maintenance of the television station, on so many occasions, the transmitting station do off on air series of apology have been tendered for failure to appear on the air.

Purpose of the Study

The study was designed to assess the maintenance of equipment, machine and other facilities in Nigeria Television station, Oyo. Specifically, the study:

(i) ascertain how adequate is predictive maintenance carried out on transmission equipment and machine in the television station.
(ii) determine how suitable is preventive maintenance carried out on transmission equipment and machine in the television station.
(iii) determine the strategies that can enhance maintenance of transmission equipment, machine and facilities to satisfy the society.

Research Questions

Three research questions were formulated based on the three specific purposes thus:

(i) How adequate is predictive maintenance of transmission equipment and machine being carried out at NTA Oyo?
(ii) How suitable is corrective maintenance of transmission equipment and machine being carried out at NTA Oyo?
(iii) What are the strategies that can enhance maintenance of transmission equipment and machine facilities at NTA Oyo?

Methodology

A descriptive survey design was adopted for the study since it involves the engineering staff of Nigerian Television Authority (NTA), Oyo and the activities been carried out in the maintaining of the television station purpose sampling method was adopted since it involves the engineering staff only in the transmission station.

The population of the study comprised all the 52 staff in Engineering section of the 10 existing transmission television station in Oyo State. Questionnaire was the instrument used for data collection. It contained a total of eighty-six (86) items drafted based on the purpose of the study and to answer the research questions posed for the study. The instrument was validated by two experts in the Department of electrical/electronic engineering Ladoke Akintola University of Technology (LAUTECH) Ogbomoso, Oyo State. The reliability test for internal consistency was carried out using Alpha coefficient and thus yielded a coefficient of 0.82. this indicated that the instrument was reliable for the purpose of the study.

The instrument was administered by hand with the help of two research assistants. A return rate of 92% was recorded. Analysis was done using a statistical package of mean. Any items with a means of 2.50 and above was considered as despondences adequate or suitable or agree and below was considered not adequate or not suitable or disagree.

Results

Research Question 1: How adequate is predictive maintenance of transmission equipment and machine are been carried out?

Table 1: Mean responses on how adequate is predictive maintenance of transmission equipment and machine carried out in the television transmission station.

S/N	Items	X	Remark
1.	Clean the body of instrument after use	2.5	Adequate
2.	Select correctly the frequency required	2.62	Adequate
3.	Adjust the transmitter to fit the station channel	2.76	Adequate
4.	Protect the encoder from dust	2.56	Adequate
5.	Adhere to the standards of equalizer effectiveness	2.52	Adequate
6.	Accurate setting of modulator	2.57	Adequate
7.	Consistently adhering to position of synthesizer	2.61	Adequate
8.	Earthling appropriately the transmitter equipment	2.78	Adequate
9.	Effect the metal contact part of the equipment	2.52	Adequate
10.	Audio Mixer Inspection and examination of the cables and selection knob	2.37	Not adequate
11.	Adjusting of the control knob or switches	2.52	Adequate
12.	Maintaining the regular voltage and current supply	2.63	adequate
13.	Vision Mixer Utilizing proper point with appropriate buttons	2.30	Not adequate
14.	Maintaining the proper connection rate during the transmission process	2.57	Adequate
15.	Consistently adhering to the use of protective device		
16.	Maintaining the constant Electrical Engineers regulations	2.52	Adequate
17.	Inspection and examination of earthling regulation	2.62	Adequate
18.	Maintaining appropriate brightness or intensity on the equipment	2.57	Adequate
19.	Constant checking of proper connection in line with colour coded-cable to appropriate terminals	2.72	adequate
20.	DVD Machine Proper contact of the cable terminals	2.33	Not adequate
21.	Consistently adhering to the use of cable rubber grommet where they enter metal-case	2.31	Not adequate
22.	Cleaning the moving part of the machine	2.33	Not adequate
23.	Adjust DVD machine to suite the production	2.51	Adequate
24.	Inspection of the output signal	2.57	Adequate
25.	Insert correctly the USB or memory card required	2.62	Adequate
26.	Picture Monitor Inserting correctly the monochrome required for the exercise	2.63	Adequate
27.	Utilizing proper point with appropriate feed	2.35	Not adequate
28.	Cleaning the appropriate part for the required performance	2.56	Adequate
29.	Adjust properly for accurate matching of the feed loads or input	2.61	adequate
30.	Consequently adhering to transmission code regulation	2.36	Not adequate
31.	Inserting the recording attachment for proper production	2.52	Adequate
32.	Maintaining the impedance, by carrying out the voltage measurement	2.32	Not adequate
33.	Reduce the appropriate control knob to obtain required picture	2.41	Not adequate
34.	Cleaning the tube and appropriate buses	2.60	Adequate
35.	Regulate the supply to the equipment	2.58	Adequate

Table 1 shows that the mean of items numbers 1, 2 ,3, 4, 5, 6, 7, 8, 9, 12, 14, 15, 16, 17, 18, 19, 20, 24, 25, 26, 27, 29, 30, 32, 35 and 36 exceeded the criterion level of 2.50 and their values lie between 2.50 to 2.72 which is considered adequate. While the mean items numbers 13, 21, 22, 31, 33, and 34. These depicts that the above factors are instrumental to in adequate predictive maintenance of television transmission in Oyo State.

Research Question 2: How suitable is corrective maintenance of transmission equipment and machine been carried out?

Table 2: Mean responses of Television transmission staff on how suitable is corrective maintenance is carried out on equipment and machine in a television transmission station

S/N	Items	X	Remarks
1.	Replacement of worn-out or burnt component parts with spare part	2.50	Suitable
2.	Correct use of synchronizer component	2.64	Suitable
3.	Remedy breaking of scanning component	1.87	Not suitable
4.	Correct earthing and arcing protection	2.00	Not suitable
5.	Correct catastrophic fire alarm breakage equipment	1.70	Not suitable
6.	Correct wrongly feed of frequency signal generator	2.13	Not suitable
7.	Correct wrongly position of sidebands carrier Frequencies	2.50	Suitable
8.	Correct wrongly fixed encoder attachment	2.13	Not suitable
9.	Remedy wrongly fixed or position equipment	1.92	Not suitable
10.	Correct position of modulator	1.83	Not suitable
11.	Correct installment of synthesizer	2.25	Not suitable
12.	Audio Mixer	2.73	Suitable
	Correct poorly position of audio mixer		
13.	Prompt replacement of worn-out knob	2.13	Not suitable
14.	Correct the burnt socket plugs	2.62	Suitable
15.	Correct the sound detector unit	2.62	Suitable
16.	Correct the wrongly regular supply of voltage and current supply	2.53	Suitable
17.	Correct the wrongly generated vestigial sideband transmission	2.12	Not suitable
18.	Replace worn-out microphone	2.55	Suitable
19.	Replace the kink cord or cable strip	2.52	Suitable
20.	Vision mixer camera	2.03	Not suitable
	Replace the broken lens promptly		
21.	Correct the scanning of a particular line	2.80	Suitable
22.	Tighten the loose screws on the camera case	2.10	Not suitable
23.	Correct the field pulse sent into the camera	1.95	Suitable
24.	Correct the interlaced scanning in the camera	2.55	suitable
25.	DVD Machine		
	Repair minor faults	2.45	Not suitable
26.	Remedy the scan coil	1.90	Not suitable
27.	Correct replacement of Harmonic filter	2.80	suitable
28.	Picture monitor	2.55	Suitable
	Reduction the light-brightness in the tube		
29.	Remedy the electron gun of a cathode ray tube	2.08	Not suitable

30.	Correct the interlaced scanning in the camera	2.06	Not suitable
31.	Overhaul the picture monitor	2.18	Not suitable
32.	Replace the USB cable in the monitor	1.90	Not suitable
33.	Overhaul video detector	2.09	Not suitable
34.	Correct the wrongly exist of video amplifier	2.61	suitable
35.	Remedy the video channel transmission	2.52	Suitable
36.	Remedy the synchronize separator	2.08	Not suitable
37.	Overhaul the line oscillator	2.00	Not suitable

Data presented in table 2 revealed that the mean of items number 1, 2, 7, 12, 14, 15, 16,18, 19, 21, 24, 25, 32, 33 and 42 exceeded the criterion level of 2.50 and their mean values lie between 2.50 aqnd 2.80 which is considered suitable, while the mean of items 3, 4, 5, 6, 8, 9, 10, 11, 13, 17, 20, 22, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 38, 39, 40 and 41. Their values lie between 1.70 and 2.48. this shows that the above factors contributed to inadequate corrective maintenance of television transmission station by the engineering staff

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Research Question 3: What are the strategies that can enhance maintenance of transmission equipment and machine facilities?

Table 3: Mean responses of television transmission staff on strategies that enhance maintenance of equipment ad machine facilities in Oyo state.

S/N	Items	X	Remark
1.	Ability of the manager to assist in solving maintenance problem	3.18	Agree
2.	Good management support by television station authority e.g. finance	3.00	Agree
3.	Clear definition of responsibility by management	3.10	Agree
4.	Engineering staff exhibit engineering expertise	2.94	Agree
5.	Formulation of ambiguous goals by the transmission authority	1.78	Disagree
6.	Employment of Electrical/Electronic experts in the television transmission station	3.04	Agree
7.	Create job opportunities for technician to acquire more skills	3.06	Agree
8.	Good reinforcement given to technician for workshop or job hazard allowance	3.02	Agree
9.	Good communication of maintenance requirement between technician and television station authority	3.11	Agree
10.	Promotional opportunities provided to technician by the government	1.57	Disagree
11.	Proper planning of maintenance schedule	2.92	Agree
12.	Professional recognition of technician staff by the government	2.80	

Data presented in table 3 revealed that the mean of items number 1,2,3,4,6,7,8,9,11,12,and 12 exceeded the criterion level of 2.50 and their mean values lie between 2.86 and 3.18 which is considered agree while the mean of items numbers 5 and 10 were below the criterion level of 2.50 their values lie between 1.57 and 1.78 which is considered disagree. This depicts that the both factors cannot enhance the maintenance of television transmission station in Oyo state.

Conclusion and Recommendations

Based on the analysis and findings, the technician at the Nigeria television Authority (NTA) transmitting station rarely pay attention to preventive and corrective maintenance of the

television station in Oyo state. The federal government of Nigeria should be wiry that information is very important and delayed in rightful information through the appropriate channel is dangerous to our society, therefore, all necessary spare part should be adequately provided, among other maintenance, operation and maintenance should be handled with all seriousness, and value engineers should be employed and positioned at all existing television transmission station who will carry out the costs, consistent with specify performance maintainability, aesthelics, safety and security criteria.

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MDGs AND BASIC SCIENCE AND TECHNOLOGY TEACHERS CAPACITY BUILDING: RHEOTORICS AND CHALLENGES FOR NIGERIA VISION 20:20

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Abstract
The nations overall educational development is extricable tied to effectiveness of teachers at all levels especially at primary school level. Unsatisfactory status of basic science and technology (BST) teachers in Nigeria at present necessitates a reappraisal of our BST teachers, preparations towards meeting the Nigerian vision 20:20. This paper takes a critical look at Millennium Development Goals (MDGS) retraining of BST teachers the rhetoric's of retraining BST teachers MDG workshops. Some of the rhetoric's include number of participant to be trained, period of the workshop and funding. In spite of the effort by the Nigerian government in trying to meet up with the rest of the world in the area of science and technology where basic education is the cradle, it is still faced with lot of challenges such as lack of science based basic schools, lack of qualified BST teachers, poor curriculum content and materials. To achieve development in the area of science and technology through Nigerian vision 20:20, it was recommended that science based basic school should be established and its curriculum content and material restructured.

Keywords: Basic Science & Technology, MDGs, Teachers, Rheotorics, Capacitry Building, Vision 20: 20

Introduction

Development has more often than not been associated with scientific and technological breakthrough of various nations in question. Jayeola-omoyemi (1995) asserts that scientific breakthrough have tremendous impact in revolutionizing many of the industrial social activities of mankind. If this assertion is true, one would equivocally admit that there will be no scientific and technological development without education. However, the primary driver which is the teacher becomes more important in the process of transmutation of the required scientific and technological know-how for appropriate development.

The importance of the teacher and the role they play in the education process is central particularly in a developing country like Nigeria. It is in realization of this fact that the National Policy of Education NPE (2004) explained that teacher education will continue to be given major emphasis in all educational planning. This is because no education system can rise above the quality of its teacher and no nation can rise above the quality of its educational system .This is further buttressed by Tahir (2006) who opines that to produce a virile science education teachers, science teachers need to be properly trained and retrained in adequate number of functional competence which enable them teach effectively. This even becomes more important as scientific approaches to researches have resulted in knowledge explosion and in rapid renewal of technological device that pose challenge to both survival and higher life goals. For Nigeria to achieve its goals for national development, the first task is to assist teachers to demystify science and technology. High quality and professional development in science and technology is therefore very vital to retaining teachers in this area as well as improving students' performance. The need to focus in the area of teacher retraining most therefore be pursued if the nation's desire of vision 20:20 is to be realized.

This paper attempts to look at the retraining of Basic Science and Technology (BST) teachers through the Millennium Development Goals Project (MDGs) It also assessed some of the rhetoric's and challenges this retraining workshops poses to the realization of Nigeria vision 20:20.

The Millennium Development Goals (MDGs) Capacity Building Efforts in Nigeria

Following the United Nations Millennium declarations adopted at the millennium summit held between 6th and 8th September 2000 in New york, Nigeria has been committed to the realization of the MDGs by year 2015(Soludo 2004) These goals were targeted for making measureable improvement in the lives of the world's poorest citizens. The participating countries were expected to articulate policies, plans and strategies which will facilitate the achievement of eight MDGs.

The eight goals are:

(i) Eradicating extreme poverty and hunger
(ii) Achieving universal primary education
(iii) Promoting gender equity.
(iv) Reducing child mortality.
(v) Combating HIV/AIDS, malaria and other diseases.
(vi) Ensuring environmental sustainability.
(vii) Improving mart anal health
(viii) Developing global partnership for development

The Nigerian government in its desire towards realization of the universal Basic Education goal launched the Universal Basic Education (UBE) programmed in September 1999. The UBE is a nine year basic educational intervention program aimed at addressing the problem of inequality and educational opportunity at basic levels both in terms of access and quality in Nigeria The UBE program was launched due to distortion and inconsistencies in basic educational delivery and to reinforce the implementation of National Policy on Education, NPE,(2004)

The UBE program has recognized the continual deepening of knowledge and skills of teachers as an integral part of the development of nine year basic education program in Nigeria. Considering the global emerging issues in education it has equally recognized that competent and dynamic teaching personnel would ultimately produce efficient and effective human resources for national development. This teacher factor remains vital in the teaching and learning process. This goes to show that whatever resources that are deployed to improve education it might not yield the desired result unless priority is given to training and retraining of teachers. To ensure quality teachers especially for the nine year basic education program, the entire education sectors and agencies should be involved. One of such agencies is the National Teachers Institute (NTI).The Federal Government under the MDG Project directed NTI to re -train primary school teachers across the country. The re-training exercise took the form of workshop, which focused on the following areas;

(i) Innovative techniques of teaching the four core subjects (i. e English, Mathematics, Basic Science and Technology and Social studies)
(ii) School Based Assessment and
(iii) Improvisation of instructional Materials

The objectives of the workshop are to

(i) Update teachers' knowledge in some strategies and methods of teaching BST
(ii) Update teachers' knowledge on the resources for teaching BST
(iii) Update teachers knowledge on the techniques of school base (NTI-MDG project 2007).

For effective coverage of the workshop the country was zoned into six assessment geopolitical areas, ten centers were created from each state. Participants were drawn from primary schools in all the Local Government Areas in the country. Azubair (2009) observed that MDG-NTI has trained 302,566 serving primary school teachers including BST teachers .The re-training workshop lasted six days, this availed participants the opportunity to cover at least 75% of the training manual.

The re-training manual was written in form of modules and each of the modules covers one of the objectives of the workshop. Each of the modules had three units with its objectives, activities and exercise for the participants. Resource persons for the training workshop were drawn from Universities Colleges of Education and Polytechnics with at least a minimum qualification of Master's degree. This is aimed at ensuring quality and effective deliberation during workshop exercise.

Rhetoric's of MDGs BST Capacity Building workshop

The emergence of MDGs has provided dramatic changes in teacher professional development in general and BST teachers in particular. This is because the BST teachers have more access to variety of continuing professional development programme more than ever before. This was further buttressed by Tahir (2006) who observed that the MDGs programed has made provision to address the problem of teachers quality and effectiveness through regular training and re-training. This he said is aimed to build and sustain capacity for teacher to effectively operate the education program. However the quality of students that have graduated from this nine year basic education intervention program into Senior Secondary School still show poor performance especially in external examinations in science related subjects(WAEC & NECO 2011) that a lot need to be done in the re-training of BST teachers through the MDG programme. This is because a lot of issues outlined to be addressed were not rhetorically implemented. Some of these rhetoric's include:

(i) Number of teachers to be retrained.
(ii) Period of retraining workshop. Trained
(iii) Curriculum content covered by the training manual.
(iv) Funding of the workshop.

Number of teachers to be retrained: Although 145,000 primary school teachers were expected to be each year 2006, 2008 & 2009 as indicated in the training manual, only 141,134 teachers were trained in 2006, 157,566 teachers were trained in 2008 and 120, 000 in 2009 (Sharehu 2009). From these data it can be observe that there is inconsistency in the number of teachers proposed to be trained as against the actual number of teachers trained the number in 2009 is relatively low as compared to the previous years.

Period of training workshop: The re-training workshop normally last six-days. This is grossly inadequate if the objectives of the workshop are to be achieved. The re-training is made up of module, with each module having some objective. Members are expected to interact among themselves and the resource person to serve as a guide. As a result of the limited number of days the workshop is usually another lecture class where the resource person does most of the talking and in the end the objective of the workshop as stated in the training manual is not achieved.

Curriculum content covered by the training manual: The content of the BST curriculum as contained in the training manual was relatively small. The manual does not cover some aspects of the BST curriculum let alone numerous global and natural issues like HIV/AIDS, ICT, Environmental, Education, Poverty , Girl child Education etc. (NTI-MDGs 2007).

Funding of the workshop: Although a large sum of money was released for the re-training of the BST teachers, a lot still need to be done in this respect. The amount released for the training was not enough for the training exercise. It is also observed that the number of teachers involve in re-training exercise across the country including BST teachers is gradually reducing. In the year 2006 ,141,134 157,566 in year 2007 and only 120,000 in 2009 teachers were involve in the re-training exercise across the country including BST teachers. The amount of money set aside for the re-training exercise also account for limited number of days for the workshop which adversely affect the way the workshop was conducted and hence the curriculum content coverage.

The challenges for Nigeria vision 20:20

For Nigeria to be among the first twenty most developed economies of the world by the year 20:20 the following challenges must be addressed in order to strengthen BST infrastructure.

(i) Massive and Adhoc Pivotal Training of BST teachers
(ii) Massive Re-training of Serving BST Teachers
(iii) Restructuring BST school structure and its curriculum materials
(iv) Establishing BST based primary schools
(v) Strengthening the capacity of Colleges of Education and Universities to produce quality BST teachers
(vi) Special Salary scale for BST teachers as an incentive.

Massive and Adhoc Pivotal Training of BST teachers: It is no gain saying that BST teachers are inadequately trained to handle the current BST curriculum .Most of the BST have not been trained in this area to close this gap there is the need to massively train secondary school leavers and Diploma graduate in BST for at -least two to three years at pivotal centre to obtain BST teaching certificates. These teachers could be given employment as BST teachers in other to close the gap created as result of the dearth of qualified BST teachers.

Massive Re-training of Serving BST Teachers: To achieve the MDGs in the area of re-training of BST serving teachers should be massively trained on the job. For effective re-training of BST teachers, the workshop should for three weeks which should be continuous basis year in year out .This will also allow for adequate coverage of the BST curriculum .More BST teachers should involve in the re-training exercise, this will keep them abreast in current methods, strategies and technique in the teaching and learning of BST in schools.

Restructuring BST School Structure And Its Curriculum Material: The current six year structure of primary school is inadequate after 40 years of conception and implementation. This is reflected in the quality of primary school output inspite of concomitant problem of quality of teachers teaching material methodologies and psychologically associated problems such as motivation of teachers and curricular needs of the pupils Therefore there is the need to have a structure of nine year basic education that pupils could spend more time in school for better training and skill acquisition .The curricular and the curricular materials should be deeply contents driven with considerable pupils activity embedded to ensure participatory learning.

Establishing Basic Science Based Schools: Having recognized the importance of STM education in national development, there is the need to establish Science Based primary schools. This will assist in massive training of scientist and technologist which is vital in catering for massive need of innovators and inventors in this field and therefore closing the gap between Nigeria and the rest of the world in the area of science and technology development.

Strengthening the capacities of College of Education and Universities to produce quality science teachers: College of education and universities have problems of dilapidating infrastructure such as collapsing, inadequate office accommodation for staff, lack of adequate research and development infrastructures, lack of adequate teaching and learning materials, laboratory equipment and chemicals, lack of adequate funds and motivation of serving teachers. If all these are adequately provided, these institutions will be capable of training science teachers that would adequately provide quality man power for Nigeria's science education system.

Special salary scale for primary science teachers as incentives for retention on the job: In order to motivate BST teachers there is the need to provide them with special salary scale that would motivate absolute dedication to their duties and consequently retain them on their job rather than looking for greener pasture. It will also motivate those outside the teaching system to want to join the profession. This is capable of boosting the image of teachers in the society and consequently make them more dedicated . Through this the country will be a better

place especially in the area of quality BST education, this could also be done using existing MDGs funds.

Conclusion

This paper has so far identified gaps in the re-training of basic science and technology. Teachers through MDG. It explained how the MDG work is organized for the re-training of the BST teachers. Despite efforts and the resources put in place by Government and stakeholders in education to see the success of the re training workshop, the result of students in external examination still shows low performance in science related subjects . This is a clear indication that the children lack the basics of science at the lower level. Therefore it was recommended that more funds should be made available to train more primary science teachers so as to make Nigeria one of the first twenty most developed economies countries in the world by the year 2020 in the area of science and technology.

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COMPARATIVE EFFECT OF IMPROVISED AND STANDARD INSTRUCTIONAL MATERIALS ON SECONDARY SCHOOL STUDENT'S ACADEMIC PERFORMANCE IN BIOLOGY IN ILORIN, NIGERIA

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Abstract
This paper examined the effects of standard instructional materials and improvised instructional materials on secondary school students' academic performance in Biology in Ilorin, Nigeria. Forty five (24 male and 21 female) SS1 students from three secondary schools in Ilorin, Kwara State Metropolis made-up the sample. Standard instructional materials (SIM) and improvised instructional materials (IIM) for teaching biology concepts was determined using Pretest – Posttest experimental group design. The reliability coefficient of Biology Performance Test was 0.84 using Kuder-Richardson (KR-21) formula. The schools were randomly assigned to two experimental groups and control group. The experimental groups were taught selected concepts of biology using SIM, IIM, while traditional method was used for the control group. Results revealed that the students taught with SIM performed better than IIM and control groups respectively. The SIM and IIM were found also to be gender friendly. Based on the findings, recommendations were made.

Keywords: improvised instructional materials; standard instructional materials; biology; gender academic performance.

Introduction
Biology is a branch of natural science for study plants and animals in relation to their environment. Diseases of plants and animals are also studies so that curative and preventive measures can be adopted to enhance the health of these living things (Gambari, Yaki & Olowe, 2013). The importance of Biology cannot therefore be over emphasized, as scientific discoveries need to be understood and appreciated as a way of life. Teaching and learning of Biology at the secondary school level require a lot of handling of equipment and materials by students in order to make the learning meaningful and worthwhile. However, the depressed state of Nigeria economy made it too exorbitant to purchase many of these equipment and materials and this led to improvisation of such equipment and materials (Daramola, 2005).

Biology remained one of the most interesting but difficult subjects in the school curriculum (Gambari, Yaki & Olowe, 2013). West African Examination Council (WAEC) chief examiners' report revealed that the performance of Nigeria students in Ordinary Level Biology was generally poor (WAEC, 2011, 2012 & 2013). One of the factors responsible for poor performance is lack of instructional materials for teaching biology concepts at senior secondary school level in Nigeria. The teaching of Biology should be based on students' environment and this call for the use of instructional materials, which could be locally produced (improvised), or the use of standard instructional materials. Improvisation is the act of bringing in novelties or making changes. It is the act of using alternative materials or resources to facilitate instruction whenever there is lack or shortages of some specific first hand instructional material. James (2007) defined improvise as the production of equipment from simple inexpensive locally available materials a substitute for the unavailable expensive conventional equipment (Standard Instructional Materials) by the teacher.

Improvisation in science teaching is probably as old as experimental science. A more systematic approach to improvisation in science was improved in response to the acute shortage of laboratory equipment after the world war (II) to help needy schools in war torn countries improvise their equipment needs (UNESCO source book title" suggestions for science teachers in devastated countries").

In teaching biology effectively, the use of instructional materials and equipment are needed. Science concepts can be taught effectively with different types of models and Pisces of apparatus. The materials play vital roles in the teaching of Biology in that they arouse the interest of students during teaching and learning processes, they extend large number of students to be taught at a time, they enhance the total participation of the students in class and also they make teaching less monotonous. Therefore, Biology is best taught in secondary schools with the use of teaching aids and materials so as to realize the above advantages (Gambari, Yaki & Olowe, 2013).

In the teaching of Biology, almost everything can be improvised. For instance, chromosomes, gene pool and DNA model can be made from grains glued with plastering. In ecological studies an aquarium can be made from any moderate size wide mouthed glass containers. Insect net cab be constructed form a circular stiff wires to which a small wooden pole is attached with mosquito netting materials as the net. Also living animals' cages for keeping a few living animals in the laboratory can be made from empty boxes or a stiff wire made into a box. Thus, the teacher's professional commitment, creativity, ingenuity and imaginative ability are all indispensable towards effective improvisation of Biology materials. When Biology is taught in rooms in which there are no facilities of electricity supply and gas supply, lanterns and stoves can be used as substitutes (Balogun, 2008).

In addition, glassware is no doubt expensive especially when breakage is high; as a result, there is now a move towards alternative with plastic wares e.g. plastic basin or bucket replacing through and watch glass. Since many materials needed in teaching Biology occur abundantly in the environment, it is argued that the materials needed have to be improved in the absence of standard' instructional materials for effective teaching to take place. Improvisation of science materials has been known for quite some time to science educators (Akinsola, 2000).

In Nigeria schools, chalk and talk method of teaching is commonly used by teachers which is no longer effective with the modern day teaching and learning of science. The use of instructional materials provides first-hand experiences that are acquired through the sensory organs of sight, smell, touch, taste and learning. It has been found that these sensory organ do not function at the same level in all children (Nwaorgu, 2007). Emphasis should be placed on the use of different types of instructional materials that could stimulate as many senses as possible in the science classes. When relevant standard instructional materials are used in the classroom work, the rate of assimilation by the students will be greatly enhanced (Gambari & Gana, 2005).

Several Researches had shown that instructional materials enhanced students' performance than traditional method of teaching (Gambari, Yaki & Olowe, 2013; Ibrahim, 2008; Nsofor, 2006). However, research findings in gender have been inconclusive. The results of Tolu (2009) and Umar (2011), revealed that there is no significant difference in the performance of male and female students in biology concepts, while Kuta (2010) reported that male students performed better than their female counterpart in biology concepts.

It should be noted that the instructional materials aids cannot substitute the teacher rather the teaching could be made more effective and more meaningful through the effective use of instructional materials. More so, the standard instructional materials (SIM) and improvise instructional could improve students understanding of biology concepts. Therefore, this study examined effect of standard and improvised instructional materials on secondary school student's academic performance in Biology in Ilorin, Nigeria.

Research Hypotheses

(i) There is no significant difference in the performances of students exposed to standard instructional materials, improvised instructional materials and those taught with traditional method.
(ii) There is no significant difference between the male and female students exposed to standard instructional material.
(iii) There is no significant difference between the male and female students exposed to improvised instructional material.

Methodology

The research design adopted for this study was pretest, posttest experimental group design. Senior secondary class one (SS1) students from the sampled schools were assigned to the experimental conditions namely: improvised, standard and control groups. The groups were pre-tested using the same instrument. Then, the experimental groups were exposed to treatment. Table 1 shows the design layout.

Table 1: The design layout

Group Pre-test	Pre-test	Treatment	Post-test
Experimental I	O_1	X_1	O_2
Experimental II	O_3	X_2	O_4
Control Group	O_5	X_o	O_6

The interpretations of the design are as follows:
O_1 = Pretest scores of the experimental group (1)
O_2 = Pretest scores of the experimental group (2)
O_3 = Pretest scores of the control group
O_4 = Post test scores of the experimental group (1)
O_5 = Post test score of the experimental group (2)
O_6 = Post test scores of the control group
X_o = No Treatment

The independent variables in this study are the standard instructional materials, improvised instructional materials and conventional method of teaching. The dependent variable is the students' scores. All the secondary schools in Ilorin, Kwara State constitute the target population of the study. Three schools were randomly sampled from 237 secondary schools in Ilorin, Kwara State. The sample comprised of Forty five students (24 male and 21 female) from SS1 class. The schools were randomly assigned to three groups (improvised, standard and control). Each group comprised of fifteen students.

The justification for the selection of SS1 students is based on the fact that two units of Biology (the blood circulatory steps and structures shapes of mammalian blood) for instruction considered in this study were taught in SS1. The instrument employed in this study was a researcher designed Biology Performance Test (BPT). The PTB consists of 20-item, multiple choice objective test of four options (A-D). The test items were carefully drawn to ensure that the items fall within both the scope of the SS1 syllabus, and the specific areas were selected for the purpose of this study. The PTB measured the performance of students at both pre-test and post-test.

The BPT was validated by experts from Science Education Department, University of Ilorin and its reliability coefficient determined as 0.84 using Kuder Richardson (KR-21). The study lasted for three weeks. The objectives and the modalities of the experiments were specified and operational guide was produced before the commencement of the treatment.
Two concepts of Biology were taught using the following procedures:

(i) *Experimental groups 1 (improvised group):-* This group were taught the concepts using improvised instructional materials. The students were asked to collect different sizes of orange balls or any similar round seeds and sticks of pencil thickness. The students will were also asked to bring a cardboard paper each. The Biology teacher together with the researcher used the orange balls of different sizes to build Hearteria models of mammalian heart of hear with synthetic, materials, water, diamond and graphite. The cardboard paper was used to draw the mammalian blood and molecular structure of items listed above. This exercise took the researcher and the Biology teachers five day to organize.

(ii) *Experimental group 2 (standard group):* This group was taught the two concepts using imported mammalian heart and graphics available in the biology laboratory.

(iii) *Control group:* This group was taught the concepts using chalk-and talk method of teaching.

Results

Biology Performance Test (BPT) was used as a pre-test for determining the academic levels of both experimental and control groups. Pre-test data for the groups were analyzed using One-way Analysis of Variance. The results of the analysis are presented in Table 1.

Table 1: ANOVA results of experimental and control groups

Sources of Variation	Sum of Square	df	Mean Square	F-value	p-value
Between groups	5.911	2	2.956	0.401^{ns}	0.672
Within Group	309.733	42	7.375		
Total	315.644	44			

ns = not significant P>0.05

Table 1 shows one-way ANOVA results of students taught biology using Biology Performance Test in Biology (BPT). From the table 1, the results revealed that there was no significant difference in the mean achievement scores of students in the three groups (F_{value} = 0.401; p = 0.672). This indicates that there is no significant difference in the performance of experimental groups and the control group before the experiment started.

Hypothesis One: There is no significant difference in the performances of students exposed to standard instructional materials, improvised instructional materials and those taught with traditional method.
To test this hypothesis, one-way ANOVA was employed as shown in Table 2A.

Table 2: ANOVA results of experimental groups and control group

Sources of Variation	Sum of Square	df	Mean Square	F-Calculated	p-Value
Between groups	2526.711	2	1263.356		
Within Group	826.933	42	19.689	64.166*	0.000
Total	3353.644	44			

*Significant at P< 0.05

Table 2 shows ANOVA results of the mean performance scores of students in the experimental and control groups. The results revealed that there was significant difference in the mean performance scores of students in the three groups (F_{cal} = 64.166, p = 0.000). On this basis, hypothesis one is rejected. Therefore, there is significant difference in the performance scores of students exposed biology using standard, improvised and non-improvised instructional materials. In other to ascertain the location of the significant difference between the three groups, Scheffe's Post-hoc test was conducted on the data. The result is shown in Table 3.

Table 3: Scheffe's post-hoc analysis of the groups means scores

Groups	Mean Scores	Group I (Standard)	Group II (Improvised)	Group III (Control Group)
Group I (Standard)	72.60		*0.000	*0.000
Group II (Improvised)	64.20	*0.000		*0.000
Group III (Control Group)	54.26	*0.000	*0.000	

* The mean difference is significant at the 0.05 level.

The results in Table 3 indicates that there is significant difference in the posttest mean scores of students exposed to standard instructional material (X = 72.60) and those exposed to improvised instructional material (X = 64.20) in favour of experimental group I (standard). It also indicates that significant difference exists in the posttest scores of students exposed to improvised instructional material (X = 64.20) and those exposed to non-improvised instructional material (control Group) (54.26) in favour of experiment group II (improvised instructional material). Significant difference was also established in the posttest scores of students exposed to standard instructional material (X = 72.60) and those exposed to non-improvised instructional material (X = 54.26) in favour of standard instructional materials.

Hypothesis Two: There is no significant difference between the male and female students exposed to standard instructional material.
To test this hypothesis, t-test statistic was employed and the result is presented in table 3.

Table 3: t-test results on gender (experimental group I)

Variable	Number of sample	df	Mean (X)	SD	t – value	p-value
Male	7		72.86	4.87		
		13			0.227^{ns}	0.824
Female	8		72.38	3.29		

ns = not significant P>0.05

Table 3 revealed that the mean achievement scores for male students and female students taught with standard instructional material (Group I) and improvised instructional material are 72.86 and 72.38 respectively. The mean achievement scores for male did not differ significantly from that of their female counterparts when both groups were taught biology with standard instructional material (t_{value} = 0.227, df = 13, p = 0.824). On this basis, hypothesis 2 is not rejected. Therefore, there was no significant difference between the mean performance scores of male and female students taught biology with standard instructional material.

Hypothesis Two: There is no significant difference between the male and female students exposed to improvised instructional material.
To test this hypothesis, t-test statistic was employed and the result is presented in table 3.

Table 3: t-test results on gender (experimental group I)

Variable	Number of sample	df	Mean (X)	SD	t – value	p-value
Male	8		64.00	6.85		
		13			0.145^{ns}	0.887
Female	7		64.43	3.99		

ns = not significant P>0.05

Table 3 revealed that the mean achievement scores for male students and female students taught biology with improvised instructional material (Group II) are 64.00 and 64.43 respectively. The mean performance scores for male did not differ significantly from that of the female counterparts when both groups were taught biology with improvised instructional materials (t_{value} = 0.145, df = 13, p = 0.887). On this basis, hypothesis 3 is not rejected. Therefore, there is no significant difference between the mean performance scores of male and female students taught biology with improvised instructional material.

Discussion of Findings

The results of hypothesis one reveals that there is significant difference in the performance of students taught biology with standard, improvise instructional materials and those taught with traditional method in favour of the group taught with standard instructional materials. This result agrees with the findings of Gambari, Yaki & Olowe (2013), Ibrahim (2008) and Nsofor (2006) which confirmed that instructional materials has been effective in enhancing students' performance than conventional classroom instruction in biology. The higher achievement by the experimental group could be attributed to the advantages of using instructional materials which is not present in traditional teaching method. Instructional materials whether standard or improvised was found to captivate the attention of the students.

The results of hypothesis two and three show that there is no gender effect on the performance of male and female students taught biology concepts with standard instructional materials and improvised instructional materials. This finding is in agreement with the results of Tolu (2009) and Umar (2011), which revealed that there is no significant difference in the performance of male and female students in biology. Therefore, gender has no effect on students' academic performance when taught with standard and improvised instructional materials. However, it contradicts the finding of Kuta (2010) which revealed that male students performed better than female students when taught biology with community resources.

Conclusion

The paper has critically examined the importance of instructional materials in teaching biological concepts and its problems especially within the secondary school level in a rapidly changing world. It is the view of the authors that there is still a wide gap to be bridged in the area of teaching and learning. The use of standard and improvised instructional materials seems to be the answer. A standard instructional material was more effective in teaching the biological concept and is also gender friendly.

Recommendations

As a result of the fore going discussions and conclusion, the following recommendations were made as regards to improve the quality use of both standard instructional materials and the improvised instructional materials in the teaching of Biology in Secondary Schools:-

(i) Teachers should be encouraged to use instructional materials to teaching abstract concepts to improve students' performance.

(ii) Teachers should be encouraged to be more resourceful in materials selection and planning. This will reduce the cost of procuring the standard instruction. This could be achieved by organizing seminars, workshop and in-service training for them.

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STUDENTS' ATTITUDE AND BEHAVIOURAL INTENTION ON ADOPTION OF INTERNET FOR LEARNING AMONG AL-HIKMAH UNIVERSITY STUDENTS IN NIGERIA: A TEST OF TECHNOLOGY ACCEPTANCE MODEL

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Abstract

This study was conducted to find out the students' attitude and their behavioural intention to adoption of the internet for learning. In order to achieve the purpose of the study, two hundred (200) copies of questionnaires were administered to undergraduate students of Al-Hikmah University, Ilorin to gather the data of the study. Out of which one hundred and sixty-four (164) were found usable for the study. The study was theoretical driven. Structural equation model (SEM) was used as a statistical tool for analyzing the hypotheses of the study. The findings of the study revealed that perceived usefulness was the strongest determinant to adoption of the internet for learning. Also, students' attitude was found to significantly influence their adoption of the internet for learning. However, facilitating condition was found to be statistically insignificant in influencing the student adoption of the internet for learning. These findings have implication for users of the internet and the provider of the internet for educational related activities.

Keywords: Internet, student' attitude, behavioural intention, facilitating condition, and adoption

Introduction

The invention of the Internet has brought a radical change to how teaching and learning is implemented in today's world of learning. The internet has virtually changed the education landscape, because it has greatly altered the skills requirements for the world of work. The Internet according to Leiner (2009) is an international network of networks. It is a repository of information for all fields of knowledge. The richness of information from the Internet and other evolving resources has attracted educators to its use for pedagogical activities in the recent time (Shittu, Kamal, Nik-Abdulrahman, & Ahmad, 2011). According to Rosenberg (2001) as quoted in Khan (2005) stated that, "Internet technologies have fundamentally altered the technological and economic landscapes so radically that it is now possible to make quantum leaps in the use of technology for learning." A study has revealed that the students were able to learn through the Internet in a similar way to face to face interaction regardless of characteristics such as academic background, ethnicity, computer skill, gender, and academic aptitude (Navarre & Shoemaker, 2000).

The modern day students are described as digital native, internet savvy student because they hardly do anything without surfing the net. Despite the tremendous influence of the internet on how knowledge is being constructed, acquired and disseminated, yet, the issue of digital divide is still a contending one among researchers in education and information technology. This explain why some researchers were of the opinion that not all the present students can be classified as digital native, and that some of them cannot operate a computer device not to talk

of using the internet especially students from third world nations (Nganji, Kwemain, & Taku 2010).

In education, the use of the Internet has become a global phenomenon. Educators are exploiting the power inherent in Internet to leverage teaching and learning to students either directly or indirectly. In developed countries, most universities encourage their faculty members to adopt blended learning method to teach their students. Blended learning involves the use of face to face and online interaction with the students in order to provide them with all the required skills to function both in and outside the school. While the students and faculty members in these developed nations have adopted the new innovation for their teaching and learning, students in less developed countries like Nigeria are still groping with how to productively use the emerging technology to leverage their learning. Many higher institutions of learning in the country are trying as much as possible to create internet friendly environment for students learning including the University of this Study. The Nigerian government also encourages all higher institutions of learning to provide technologically rich environment for student learning. Whether the opportunity created in the provision of the Internet is being optimally utilized for learning by the student is still a subject of research. For instance, in United State of America, college students were reported to use Internet to communicate with their classmates and their teachers. They utilized the Internet to conduct research, and to access material from the library (Pew Internet and American Life Project, 2005). Similarly, Shamsudin (2009) reported that secondary school students in Malaysia schools use the Internet for social interaction and learning.

All over the world, educators have identified the potential of the Internet in teaching and learning process and thereby taking advantage of it. Despite the awareness on the significance of the Internet for the implementation of curriculum, an overview of research on application of internet for educational purposes in Nigeria has not received adequate attention it deserves. Though, Nigeria students were found using the Internet through mobile appliance for social interaction and communication (Shittu, Kamal, Fakomogbon & Liman, 2012), whether they use it to supplement their learning still need a research search-light. Similarly, not many studies have been conducted on factors influencing the use of the Internet for educational activities from theoretical point of view among Nigerian students compared to studies from United Kingdom, United State of America, Australia, Asian and other parts of the globe. It is against this backdrop that the study tries to probe into factors that may influence the use of Internet for learning among the students of Al-Hikmah University Ilorin, Nigeria from the technology acceptance theory perspective.

Theoretical Background

Many researchers have tried to look into those factors that influence the present generation of students usage of Internet for academic purpose from different theoretical view point. Theory and model have been developed mostly in UK, US, Australia and other advanced countries of the world to explain acceptance of emerging technology. Yet, researchers still continue to modify, extend, and revise some of these theories due to rapid change in technological advancement of the world and the environment of users (Kripanont, 2007).

The most prominent theories used for understanding users' acceptance of information system (IS) includes technology acceptance model (TAM) developed by Davis (1983). Innovation diffusion theory of Rogers (1989), Theory of reason action developed by Fishbein and Ajzen (1975), Social influence theory of Kelma (1954), and the Theory of planned behavior of Ajzen (1991). All these theories have been empirically tested by researchers and found to possess explanatory power on reasons advanced by users for adopting information technology. Research studies had revealed that many institutions of learning have expended huge investment in providing wireless internet service for their students and faculty members, yet these facilities are either not use for the intended purpose or under-utilized because of limited user acceptance. The most widely used parsimonious theories for understanding user acceptance is technology acceptance model (TAM), the theory stated that acceptance to use any technology is a function

of the following factors: perceived ease of use (PEOU), perceived usefulness (PU) and user's attitude toward the technology itself (Davis, 1983). Many information and instructional technology researchers have positive disposition to these three factors as a mean of measuring users adoption of technology related to information system. Davis, Bagozzi and Warsaw (1989) opined that a user's perception on system ease of use and usefulness resulted from behavioural intention of users either to use or not to use such system. Available literature also shows that Davis (1989) TAM can explain user behavioral intention when it comes to use of technology and new innovation, because it can explain the link between user's belief in terms of ease of use, usefulness to actual use of technology.

Thus, this study aims at understanding the attitude and behavioral intention of students to acceptance of Internet for academic activities among students in a private university in Nigeria. This will enable us to re-examine the earlier developed model of Davis (1986) using the following factors: Ease of use, Perceived usefulness, Behavioural intention, Attitude and Facilitating condition. Re-examining the model will bring to fore some germane issues relating to adoption of new innovation for education among students and reasons for acceptance or resistance as the case may be to internet use among student despite the huge investment that was put into providing the facilities in our higher institutions of learning. The study has become imperative because we cannot extrapolate the findings from study conducted in developed countries to the present setting of this study and most importantly Masron and Hussein (2008) were of the opinion that user acceptance of IT resources is a phenomenon which is not yet well understood. Hence the need for this study in order to gain more insight into what influence acceptance of internet for education among students in Al-Hikmah University Ilorin, Nigeria.

Technology Acceptance Model (TAM) was employed for this study because of the following reasons: TAM has been identified to be a robust and parsimonious theory for understanding technology acceptance; TAM is simple to study initial, future and continuous intention of users on acceptance to use new innovation: and so far, limited study has been conducted in the present setting that uses TAM as a theoretical base for understanding acceptance of IT for learning. The original TAM is shown in Figure 1 below.

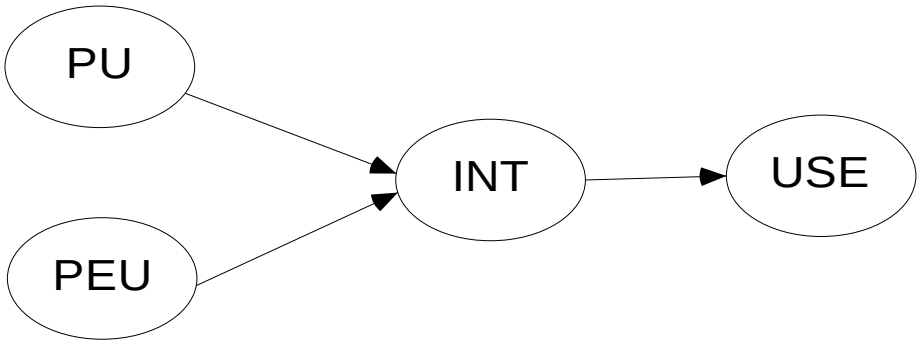

Fig.1: The original Technology Acceptance Model (TAM)

Davis (1986) developed Technology Acceptance Model (TAM) by adapting the theory of reason action. In an attempt to further probe to know what constituted user acceptance of IT, Venkatesh and Davis (2000) developed TAM2 which is a theoretical extension of the earlier TAM. In doing this, additional factor was added to the existing factors. The factors include: social influence and subjective norm.

Furthermore, Venkatesh, Morris, Davis and Davis (2003) introduced the Unified Theory of Acceptance and Use of Technology (UTAUT). The theory was used to explain that acceptance of IT was a function of the following factors: performance expectance; effort expectance; social influence and facilitating condition. UTAUT shows a refined view on how the determinant of intention and behavior evolve over time (Kripanont, 2007). While some studies reported that the original TAM is sufficient enough to predict user's acceptance of IT, some argue that other

factors should be considered most especially with newer technology and that Perceived Usefulness and Perceived Ease of Use may not be sufficient to explain technology acceptance (Ahmad, Basha, Marzuki, Hisham, & Sahari, 2010). Similarly, several studies encourage researcher to extend TAM in order to increase it explanatory strength. For instance, Eastin and Larose (2000) study on computer self-efficacy of internet use between experienced and novice user, reported that computer self-efficacy and facilitating condition is a determinant factor in bridging the digital divide between groups of users. In the context of this study, we try to look at student attitude and their behavioural intention on internet use for learning by extending the original TAM to include facilitating condition. Davis (1989) defined perceive ease of use as "the degree to which a prospective user of a technology expects that using the technology will be free of effort" Davis (1989) defined perceived usefulness as the extent to which an individual believes that using the technology will enhance his or her performance. PU has been identified as a determinant of users' behavioural intention to use IT resources and internet based systems. This assertion has been well reported in many studies (Adam, Nelson, & Todd 1992. Burton-Jones, & Hubona 2005. Igbaria, Zinatelli, Cragg & Cavaje 1997. Shittu et al 2010).

In a study conducted by Sumak, Hericko, Pusnik and Polancic (2011) on factor affecting acceptance and use of Moodle, an internet based software, it was reported that the actual use of Moodle depends on behavioural intention and attitude towards using it. Also, the study reported that PU was found to be the strongest and most important predictor of attitude toward using Moodle. In another study that involves the use of TAM, the study was on acceptance of mobile internet. The findings of that study showed that PU and PEU are strong determinant of attitude toward use of mobile internet which in-turn influences actual use (Lee, Kim & Chung 2011). A study on usage of technology among student of Utara University Malaysia shows that PU is the highest predictor of technology use among the student (Raman 2011). In this study, we postulate that PU will have significant influence on the use of internet for learning among Al-Hikmah university students.

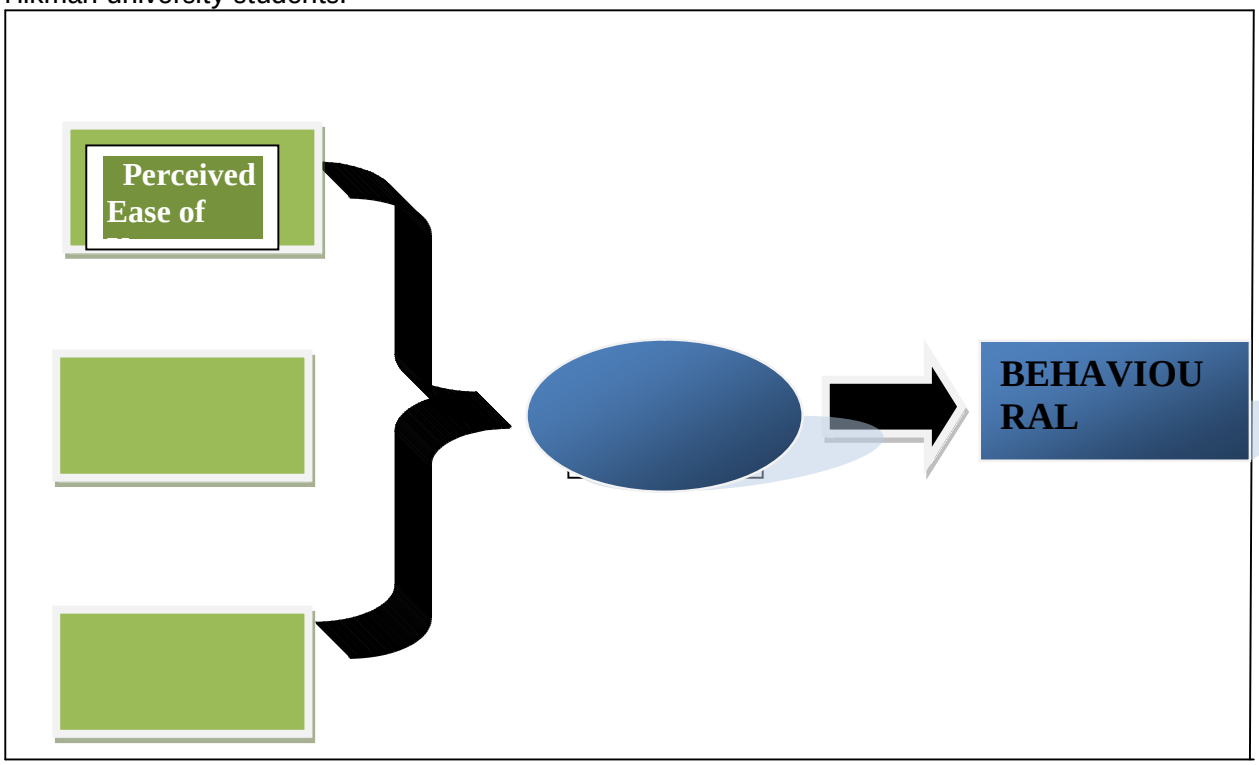

Fig 2: Research model of the study

Purpose of the Study

The purpose of this study was to determine the influence of the following independent variable (Perceived ease of use, perceived usefulness and facilitating condition on the two dependent

variables (Attitude and Behavioural intention) of students to internet adoption for learning. The study tries to examined the influence of the independent variable on dependent variable, and also sought to examined the relationship that exists among the variables selected for the study. Other objective includes understanding the rate of use and purpose of use of the internet for learning.

Research Questions

Based on the objective of the study, the following research questions were drawn.

(i) What is the influence of perceived ease of use on students' attitude to internet adoption for learning?
(ii) What is the influence of perceived usefulness on students' attitude to internet adoption for learning?
(iii) What is the influence of facilitating condition on students' attitude to internet adoption for learning?
(iv) To what extent is the relationship between perceived ease of use and usefulness of internet for learning among students?
(v) To what extent is the influence of students' attitude on behavioural intention to adoption of internet?

Research Hypotheses

Base on the above stated questions, the following hypotheses were generated and tested in this study:

(i) Perceived ease of use will significantly influence students attitude to adoption of internet for learning
(ii) Perceived usefulness will significantly influence students attitude to adoption of internet for learning
(iii) Facilitating condition will significantly influence students attitude to adoption of internet for learning
(iv) Students' attitude will significantly influence their intention for adopting internet for learning
(v) Perceived ease of use will significantly influence students behavioural intention on adoption of internet for learning

Methodology

The participants of the study comprise of one hundred and sixty-four (164) undergraduate students of Al-Hikmah University Ilorin, Nigeria. Of this number, 101 (61%) were male and 63 (39%) were female. The entire participants were randomly sample for the study.

The instrument used for the study was adapted and modified for the purpose of the study. Before final administration of the instrument, construct validity was conducted. Construct validity according to Cronbach, (1951) is the degree to which a variable measures what it is intended to measure. Similarly, the reliability of the instrument was ascertained. Factor analysis was carried out to determine the dimentionality of the construct. Principal Component Analysis (PCA) was used for extraction, Varimax was employed as rotation method. The Kaiser-Mayer-Olkin measure of sample adequacy (KMO) value was greater than 0.6 as recommended by Pallant, (2007). The Barllet's Test of Spericity value was significant (P=0.000). The Eigen value was greater than one. The total variance explained was 62%. In all, five factors were extracted for the study. The reliability of the instrument was conducted with Cronbach's Alpha. The result shows 0.73 alphas, which indicated good internal consistency reliability.

Data Analysis

The data of the study was analyzed with the following statistical method. Structural Equation Modeling technique (SEM) with AMOS 16 Software was used to analyze all the hypotheses of the study. SEM is a statistical tool that allows a researcher to test a set of multivariate. SEM enables a researcher to carry-out path analysis, confirmatory analysis, factor analysis, regression analysis

and analysis of variance (Masron & Hussein 2008). Based on the robustness of this tool and its use in studies that involve cause and effect, SEM has gained considerable popularity in the last decades among researchers in education, medicine and IT related field. Table (1&2) below showed the demographic data, descriptive statistics and valid items of the study as well as their correspondents loading with the Cronbach Alpha.

Table 1: Demographic information and Descriptive Statistic

GENDER	FREQUENCY	PERCENTAGE (%)
Male	101	61.2
Female	63	38.2
AGE OF RESPONDENTS	FREQUENCY	PERCENTAGE (%)
15-20	99	60
21-25	50	30.3
26-30	14	8.5
36-40	1	0.6
PURPOSE OF USE OF THE INTERNET	FREQUENCY	PERCENTAGE (%)
Research	27	16.4
Entertainment	3	1.8
Education	96	58.2
Communication	20	12.1
Collaboration	8	4.8
Social Interaction	10	6.1
FREQUENCY OF USE OF THE INTERNET	FREQUENCY	PERCENTAGE (%)
Daily	69	41.8
2-3 Times a week	55	33.3
2-3 Times a month	11	6.7
Once a month	27	16.4

Table 2: Valid items and their corresponding Loadings, Alpha Values and Average Variance Explain

Perceived Ease of Use	Items Loading	Average
PE1:Learning to use the Internet for learning would be easy	0.7	
PE2: I would find it easy to get Internet to do what I want it to do	0.71	
PE3: My interaction with Internet would be clear and understandable	0.61	
PE4: I would find the Internet to be flexible to interact on	0.63	AVE: 0.7
PE5: It would be easy for me to become skilful at using the Internet	0.7	
PE6: I would find it easy to search for learning material on the Internet	0.71	
Total Reliability: 0.86		
Perceived Usefulness		
PU1: Using the Internet would make it easier for me to learn	0.61	
PU2: Using the Internet would improve my learning performance	0.6	
PU3: Using the Internet would enhance my effectiveness in learning	0.64	
PU4: Using the Internet would improve my efficiency in my learning	0.65	AVE: 0.7
PU5: Using the Internet would give me greater control in my learning process	0.62	
PU6: I would find internet useful for online learning	0.61	
Total Reliability: 0.83		
Attitude to Internet Use		
AT1: Using the Internet for learning would be a very good idea	0.81	

AT2: Using the Internet for learning would be a very bad idea	0.76	
AT3: In my opinion it would be very desirable to use Internet for learning	0.74	AVE: 0.6
AT4: I like the idea of using internet for learning	0.67	
AT5: I dislike the idea of using internet for learning	0.6	
Total Reliability: 0.70		
Behavioural Intention		
BI1: I intend to use the internet whenever possible	0.81	
BI2: I intend to increase my use of the internet in the future for learning	0.67	AVE: 0.5
BI3: Instantly i would adopt the Internet for learning	0.65	
BI4: I would adopt the Internet for learning in the future	0.64	
Total Reliability: 0.66		
Facilitating Condition		
FC1:I have the resources necessary for using internet for learning	0.75	
FC2:I have knowledge and skills that are necessary for using internet for learning	0.7	
FC3In my university, my lecturer have been helpful in the use of internet for learning	0.68	AVE: 0.6
FC4:In general, my university has supported the use of internet for learning	0.66	
FC5: In my university, there is wireless internet service for the student	0.64	
Total Reliability: 0.72		

Result of the Structural Model of the study

A look at the fit indices of the model of this study in comparison to the common measure shows a not too fitted structural model. However, the purpose of the study was achieved. The purpose of the study was not to have a perfect fit model but to assess the effect size of the independent variable on the dependent variable. Also, to understand the relationship that existed among the construct as it influenced students' adoption of the internet for educational related activities. Fig 1 shows the graphical out-put of the SEM of the study which was used to answer the hypotheses generated for the study.

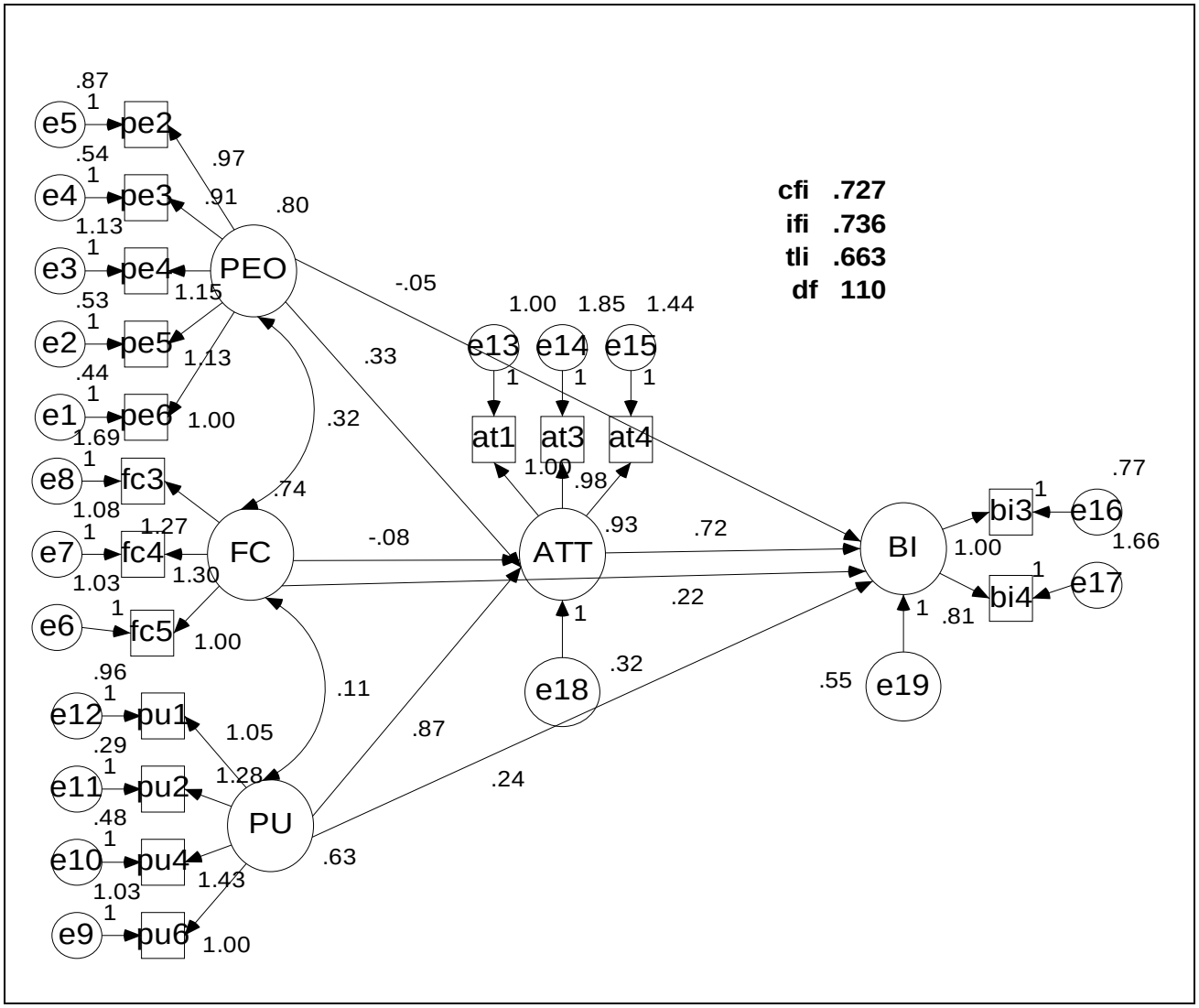

Fig2: Structural equation model output showing the "effect size" of independent variable on dependent variable

The structural out-put of the model in figure 1, revealed the following results. Perceived ease of use (PEO) shows a negative effect size of beta value of (-.05) on Behavioural intention. Perceived ease of use (PEO) shows a positive effect size of beta value of (.33) on attitude. Facilitating condition shows a negative effect size of beta value of (-.08) on attitude, and also shows a positive effect size of beta value of (.22) on attitude. Perceived usefulness shows a positive effect size of beta (.87) on attitude and a positive effect size of beta (.24) on behavioural intention.

Summary of the graphical out-put
PEO→BI= -.05
PEO→ATT= .33
FAC→ATT= -.08
FAC→BI= .22
ATT→BI= .72
PU→ATT= .87
PU→BI= .24

Analysis of the Hypotheses of the study

(Ho_1) Perceived ease of use will significantly influence students' attitude to adopt the internet for learning.

Based on the graphical result of the regression weight of the model above, perceived ease of use significantly influences the attitude of students on the adoption of Internet for learning, with direct effect size of β= 0.33, at (CR>1.96). This finding shows a good effect size (Kline, 2005). With this finding the hypothesis is supported.

(Ho_2) Perceived usefulness will significantly influence students attitude to adopt the internet for learning.

The regression weight of the path analysis between perceived usefulness and students attitude shows a large effect size of β= 0.87, (CR>1.96). With this finding, the hypothesis is supported and the effect size stand-out to be the highest compare to others, which implies that perceived usefulness statistically influences students attitude to adoption of internet for learning.

(Ho_3) Facilitating condition will significantly influence students attitude to adopt the internet for learning.

The regression weight of the path between facilitating condition and students' attitude was statistically insignificant. The regression weight show a β= -0.08, (CR>1.96). The result indicated that facilitating condition does not influence students' attitude, therefore the hypothesis is not supported.

(Ho_4) Students' attitude will significantly influence their intention to adopt the internet for learning.

The regression weight between students' attitude and their behavioural intention was statistically significant with weight of β= 0.72, (CR>1.96). The effect size is on the higher side based on Kline, (2005) suggestion. With this finding, the hypothesis is supported.

(Ho_5) Perceived ease of use will significantly influence students behavioural intention to adopt the internet for learning.

A look at the regression weight between perceived ease of use and students behavioral intention shows a weight of β= -0.05, (CR>1.96), which is statistically insignificant. Therefore, the hypothesis is not supported.

Discussion of the result

The major objective of this study was to find out students' attitude and their behavioural intention to adopt the internet for learning. The findings from this study have shed light to issues relating to the use of internet by the students. Majority of the respondents of the study 96 (58.2%) indicated to employ the campus wireless internet for educational related activities. Similarly, some of them indicated to use it for research. However, few students indicated that they use the internet for social interaction and entertainment.

Likewise, the findings of the study revealed that the students perceived the internet to be useful for learning. Because the construct (PU) appeared to be the strongest factor that influences students attitude to internet adoption for learning. This implies that as long as the University provides the wireless internet, the students are ready to utilize it for learning.

Surprisingly, facilitating condition was statistically insignificant in influencing the students' attitude to adoption of internet for learning. In fact, the effect size shows a negative sign, That is, there is no encouragement what-so-ever to facilitate the adoption of the internet for learning.

Perceived ease of use was found to be insignificant in influencing students' behavioural intention to adopt the internet for learning.

Theoretically, the study has further brought to fore what really influences students' attitude and their behavioural intention to Internet adoption for learning. The result of the study has in one way supported the claim of Davis (1986), Ahmad, Basha, Marzuki, Hisham, and Sahari, (2010), Adam, Nelson, and Todd (1992), Burton-Jones, and Hubona (2005), Igbaria, Zinatelli, Cragg and Cavaje (1997), Shittu et al. (2011), which posited that perceived usefulness was a strong determinant of students' attitude as well as their intention to adopt the Internet for educational related activities. Conversely, the result shows that perceived ease of use was insignificant predictor of the students' attitude to use the Internet despite the report of some studies that supported the claim of Davis (1986), which reported that perceived ease of use is another determinant of acceptance of IT by users.

Also, the result of this study supported the finding of Sumak, Hericko, Pusnik and Polancic (2011) that reported that student attitude was a strong determinant of their behavioural intention to use internet software. On facilitating condition, the construct was statistically insignificant predictor of students' attitude to internet adoption, which implies that facilitating condition as a factor for adopting an innovation presupposes that the environment, support received from those who are important to users like the teacher to students, the university administration to faculty members in the case of school environment determined whether the factor will be meaningful or not.

Conclusion

In conclusion, the study has shown that the usefulness of the Internet was a major predictor of students' attitude and their behavioural intention to use it for learning. The result of the study shows that the students were fully aware of the inherent advantage of the internet for learning related activities. This explains why most of them indicated to use it for education and research. Also the study shows that faculty members and trainers need to assist the student by deploying the internet for education, in order for the university to get value for the investment in provision of the resources for leveraging teaching and learning activities in the university. With the findings of this study, it is apparent that provision of a facility does not sometime imply usage. Therefore, the study recommend that the lecturers and trainers in the university should be encouraged to use the internet for teaching and learning through training and retraining on how to effectively use the emerging resources for implementing the university curriculum. In doing this, will enable both the students and the faculty members in the university to make use of unlimited advantage inherent in the internet in the present information explosion age and by this equip the student with skills and competences to face the challenges of modern life.

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