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EDITORIAL PREFACE

There are sixteen articles published in this edition. The first article by Adewole, Akintola, Mabyoje and Ogbomon addressed the issue of knowledge discovery from large databases using association rule mining. Apriori algorithm was implemented to discover hidden knowledge from a library database. They reported that borrowing a particular book may leads to borrowing another book based on the association between Data structure in C (DS) textbook and Programming in C (C) textbook. These authors concluded that the discovered pattern can help librarians in restructuring their bookshelf arrangement, and for book recommendation system and that the system can also help students to have good knowledge of related books.

Aremu and Olabode developed an efficient cancer classification model by examinining the existing body of knowledge in the field of molecular biology relating to gene expression, Artificial Neural Network, Differential Evolution Algorithm and classification; design a learning mechanism for cancer classification using Differential Evolution algorithm for Artificial Neural Network; simulate the model designed ; and evaluate the efficiency of the designed model and compare the results with existing acclaimed result. They concluded that the result of the simulation gives classification accuracy of 99.85%, which was slightly higher than the result of the reviewed DE-LSSVM hybrid model. Bello, Jolayemi, Faruk, and Ayeni addressed the problem of using visualisation through the use of ICTs to provide a cheap solution built primarily for the University of Ilorin, a Geographic Information System, to help with the navigation process. An extreme programming software development model was employed in the development process to create adequate understanding of the project and also hasten it up, while ensuring smooth transitions in the development process. The application was designed and developed using HTML5, CSS3, and Google Polymer for the client-side of the application program, while the server-side of the application was developed using JavaScript, Google Maps API, as well as Google Map API for the routing scheme implemented in the application.

The next article by Udende and Oyewo looked at the political communication and voting Pattern of Nigerian Electorates in terms of a comparative analysis of the 2011 and 2015 presidential elections. They reported an insignificant difference in the voting pattern as the 2011 presidential election showed a relatively general geographical spread in favour of President Jonathan while the reverse is the case in the 2015 presidential election except that in the 2015 election, President Buhari fails to win any state in the South-South and South-East geo-political zones. The authors concluded that the voting pattern has changed insignificantly. Based on the findings, the study recommends the need for electorate to eschew voting based on ethnic and religious sentiments. Abikoye and Nwokolo in their article focused an object oriented paradigm for implementation of Elgamal algorithm. In the proposed system, Object oriented paradigm was designed to implement a particular public key cryptosystem called the Elgamal Cryptosystem considered with the help of JAVA Programming language for use over texts. Since the

Elgamal cryptosystem over a primitive root of a large prime is used in messages; the proposed system showed how secured messages were sent over the network, and how the generations of public key was done in an encapsulated way.

Kwanya, Kibe and Owiti looked at the image of academic librarians in Kenya, their report indicated that majority of academic library users in Kenya perceived an academic librarian positively as a person, male or female, employed by an academic institution to organise and manage a library which supports the programmes of the institution. They also perceived academic librarians to be performing routine clerical roles such as collecting, keeping, arranging and lending information materials (books) as well as maintaining order in the library. Jane, Esohe and Dawha focused on the application of computer technologies to serials services in research institute libraries in North Central Nigeria. These authors reported that the opinions of librarians on factors constraining the application of computer technologies to serial services and strategies for enhancement differed significantly. On this basis, they recommended that library managements should address irregular power supply; inadequate computer technology infrastructure and inadequate funding which serve as deterrent to the integration of computer technologies to serial services in the libraries.

Akakandelwa and Mwafulilwa based on their experience from Lusaka Zambia investigated the usage of internet health information resources by health professionals at the University Teaching Hospital, Lusaka. The authors reported that most of the respondents had access to Internet health information resources on a daily basis. Furthermore, most of the respondents used Internet health information resources mainly for research, teaching, communication, and preparation of seminar presentations. However, the findings showed that most respondents were not familiar with the specific Internet health information resources subscribed to by the University of Zambia, resulting into the low utilization of these resources. The authors recommended improved marketing strategies of the existing Internet health information resources, improved ICT infrastructure, and introduction of information literacy programmes. A related article by Okiki focused on the availability of electronic infrastructures and accessibility of information resources among faculty members in Nigeria Universities. Okiki reported significant interactive effect of accessibility of information, availability of electronic infrastructures and electronic information resources among faculty members in Nigeria federal universities.

The article by Olasinde and Oyewo examined the media and society health by analyzing the attitude and habit of Nigerian undergraduates towards Ebola Virus (EVD) information. The authors reported that Ebola is not a spiritual punishment from God but rather a universal threat which is not restricted to any social class of people. The outbreak of Ebola had led to a drastic change in health practices of some youths who are considered very mobile, and that the use of a number of media outlets could be quite effective and efficient in reaching a profoundly large audience with health campaign messages. The authors concluded that since known cure or vaccine been established or

discovered for the virus, individuals should play safe by not engaging in health compromising practices.

Bariku and Tsegyu article focused on the influence of negative political advertisements on voters' choices in the 2015 presidential election in Nigeria. The research report indicated that while negative political advertisements did not influence the voting choices of the electorate during the election, as attested to by a majority of the respondents, negative political advertisements did not also dissuade the voters from coming out to vote in the presidential election. The authors recommended that political parties and their campaign organisations should focus more on issues-based campaign than on attacking their political opponents.

From the education perspective, Odewumi and Falade's article focused on the impact of computer assisted instruction packages on junior secondary creative arts in Ogbomoso, Nigeria. They reported that there was a significant difference between the scores of students taught creative arts with the computer assisted instructional packages and those taught using conventional method; and also, there was no significant difference between the mean achievement scores of male and female students taught creative arts with the computer assisted instructional packages. Based on these findings, the article recommended that creative arts teachers should be encouraged to use the Computer Assisted Instructional Packages for teaching related concepts in Cultural and Creative arts. Another article from the education perspective by Oyelekan, Aderogba, and Arowolo looked at the science teachers' disposition to the Use of electronic books as resource for science teaching in Ilorin, Nigeria. The results of the study demonstrated that majority of the teachers indicated positive disposition towards the use of e-books. While there was no significant difference in the disposition of experienced and less experienced science teachers the use of electronic books, there was significant difference in the disposition of male and female science teachers on the use of electronic books, with males having a better disposition than females. These authors recommended that proprietors of schools should provide good Internet and computer facilities in their schools to facilitate easy download of e-books since teachers were positively disposed to their use.

Bashir, Adebayo, Abdulsalam, Sadiku and Mabayoje in their own article examined a survey of cloud computing awareness, security implication and adoption in Nigeria IT based enterprises.They reported that the trend of awareness and adoption were very minimal with many being sceptical although few businesses were aware of the cloud technology. The survey also revealed that the stakeholders were precarious of the security-level of the cloud-based computing. Babatunde in his own article designed a web based mathematical application for high school in Nigeria using the Javaserver Faces (JSF) technology framework, Glassfish server and Prime Faces technology to help students improve and develop their abilities in assignments solution, summations, mathematics projects and increase their reasoning. The author reported that the application designed make students grab the understanding of mathematics concepts,

help solve problems faster and easier, and increase their performance in mathematics. And lastly, Adeniran provided an analytical framework for use by the university to decide whether to deploy a RFID based (ID) cards to identify and/or store electronically the data of staff and student, describing the benefits of RFID technology and its effectiveness as a security mechanism and also studying its technological features, current applications, and future trends. The author recommended that the information from the study may be useful in identifying the kind of data needed to be stored on the RFID chip to reduce rogue access threat on staff and students' privacy while complementing the university's management.

No doubt, this edition has featured a numbered of interesting articles from authors locally and internationally. It is on this note that I invite our readers to come along and review these articles.

BORROWING PATTERNS MONITORING IN LIBRARY: APPLICATION OF APRIORI ALGORITHM

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Abstract

Data is a valuable tool for any institution, and with the world advancing in technology, data stored in database management systems are growing in different capacities in almost all organization. The opportunities of database management systems have been explored. However, many organizations have not been able to leverage these opportunities in gaining business intelligence from their repositories. This paper addresses the issue of knowledge discovery from large databases using association rule mining. Apriori algorithm is implemented to discover hidden knowledge from a library database. Data depicting nine (9) different books were used within forty-seven (47) unique transactions. Eighteen (18) unique transactions were generated from the database showing the borrowing pattern of library users. The frequencies of borrowing of books were obtained as well as the associations. The result shows that borrowing a particular book may leads to borrowing another book as revealed in the association between Data structure in C (DS) textbook and Programming in C (C) textbook. The discovered pattern can help librarians in restructuring their bookshelf arrangement, and for book recommendation system. This system can also help students to have good knowledge different related books.

Keywords: Data Mining, Association Rule, Market Basket, Apriori Algorithm, Mining Support, Confidence.

Introduction

Libraries form a major part of any academic institution or organization. They are the basis of every educational institution and as a result should be well organized so that it can be used efficiently. The library management systems available today are designed to manage books, journals, manuscripts etc. They keep track of the books issued or returned and tell about the availability of the books in the libraries. From the transactional database of such library management system, the behavior of readers in terms of the books they borrow can be examined. For example, a set of books, web design and web development that appear frequently as well as together in a database is a pattern set. This patterns may reveal that if a reader borrows a literature textbook, he might also borrow a dictionary. From the history of the database, these borrowings occur sequentially, and this is known as frequent pattern. Informed decision can be made easily about book placement, ordering, lending, and to find out if there are any successful books that have no significant related elements. Similar books can be found so that they can be placed on the shelf near to each other.

A librarian must know the needs of library users and adapt to them. In the same vain, pattern analysis is one possible way to finding out which books can be put together. According to Pillai and Vyas (2011), market basket analysis gives retailer good

information about related sales on group of goods basis. In other words, pattern analysis is a key feature to effective book arrangement in the libraries. Customers who buy bread often also buy several products related to bread such as milk, butter or egg. It makes sense that these items are placed side-by-side in a retail center so that customers can access them quickly. Such related group of goods also must be located side-by-side in order to remind customers of related items and to lead them through the center in a logical manner.

Market basket analysis is one of the data mining methods focusing on discovering purchasing patterns by extracting associations or co-occurrences from a store's transactional data. It determines the products, which are bought together and to reorganize the supermarket layout, and also to design promotional campaigns such that products purchase can be improved (Pillai and Vyas, 2011).

Furthermore, the market consumer behaviors need to be analyzed, which can be done through different data mining techniques. Data mining finds interesting patterns from databases such as association rules, correlations, sequences, classifiers, clusters and many more of which the mining of association rules is one of the most popular problems.

Association rule mining finds interesting association or correlation relationships among a large set of data items. Association rules are derived from the frequent itemsets using support and confidence as threshold levels. The sets of items, which have minimum support is known as frequent itemset. The support of an itemset is defined as the proportion of transactions in the data set, which contain the itemset. Confidence is defined as the measure of certainty or trustworthiness associated with each discovered pattern. Association rules derived depends on confidence. Frequent itemset generation is done using data mining algorithms like Apriori, K-Apriori, Eclat and FP-Growth algorithms (Nasreen, Azam, Shehzad, Naeem and Ghazanfar, 2014). Apriori algorithm is used in this paper due to it wide application in association rule mining. The remainder of this paper is organized as follow: Section 2 discusses the related work on association mining; Section 3 presents the methodology applied in this paper; Section 4 focuses on results and discussion; and Section 5 concludes the paper.

Related Works

Apriori algorithm is a level-wise, breadth-first algorithm, which counts transactions (Annie and Kumar, 2011). Apriori algorithm uses prior knowledge of frequent itemset properties. Apriori uses an iterative approach known as a level-wise search, in which *n-itemsets* are used to explore *(n+1)-itemsets*. To improve the efficiency of the level-wise generation of frequent itemsets, the Apriori property insists that all non-empty subsets of a frequent itemset must also be frequent. This is made possible because of the anti-monotone property of support measure - the support for an itemset never exceeds the support for its subsets. A two-step process consists of join and prune actions are done iteratively.

Agrawal and Srikant (1997) proposed the Apriori algorithm to solve the problem of mining frequent itemsets. According to them, Apriori uses a candidate generation method, such that the frequent, *k-itemset* in one iteration can be used to construct candidate *(k+ 1)-itemsets* for the next iteration. Apriori terminates its process when no new candidate itemsets can be generated. Apriori is an algorithm for mining frequent item sets for Boolean association rule. This name is based on the fact that the algorithm uses prior knowledge of frequent item set properties. Apriori search an iterative approached which is known as level-wise search, where k item set are used to explore (k+1) item sets. In this algorithm two steps is used for iteration. The first step generates a set of candidate item sets and the second step is to count the occurrence of each candidate set in database (all infrequent item sets). Apriori uses two pruning technique, first on the bases of support count (should be greater than user specified support threshold) and second for an item set to be frequent , all its subset should be in last frequent item set. The iterations begin with size 2 itemsets and the size is incremented after each iteration (Sujata, Priyanka, Sachin & Kuthe, 2015).

Direct Hashing and Pruning (DHP) algorithm, proposed by Park, Chen and Yu (1997), improves the performance of Apriori. It uses a hash table to filter the infrequent candidate *2-itemsets* and employs database trimming to lower the costs of database scanning. However, the aforementioned methods cannot avoid scanning the database many times to verify frequent itemsets. Jianying and Mojsilovic (2007) also presented an algorithm for frequent itemset mining that identifies high-utility item combinations. In contrast to the traditional association rule and frequent item mining techniques, the goal of the algorithm is to find segments of data, defined through combinations of few items (rules), which satisfy certain conditions as a group and maximize a predefined objective function. They formulated the task as an optimization problem, presented an efficient approximation to solve it through specialized partition trees, they called it High-Yield Partition Trees.

Unlike Apriori, the FP-growth method by Han, Pei, Yin, and Mao (2004) uses an FP-tree to store the frequency of information of the transaction database. Without candidate generation, FP-growth uses a recursive divide-and-conquer method and the database projection approach to find the frequent itemsets. However, the recursive mining process may decrease the mining performance and raise the memory requirement. Grahne and Zhu (2005) however introduces an FP-growth*, which uses an FP-array technique to reduce the need to traverse FP-trees. Nevertheless, it still has to generate conditional FP-trees for recursive mining. Their experimental results show that running time and memory consumption of FP-growth* is almost equal to that of FP-growth. Racz (2004) improves FP-growth algorithm and employed the tree structure to raise the mining performance. The FP-growth method of Han (2000) and Han et al. (2004) requires two database scans when mining all frequent itemsets. The first scan of the database derives the set of frequent 1-itemsets, denoted as F1, and then inserts F1into a header table in the decreasing order of items' supports, where this order list is denoted as *List*. The header table not only stores items and their supports, but also contains a

pointer to a list that links all corresponding nodes of frequent *1-itemset* in the FP-tree. In the second scan, the items of F1 in each transaction are inserted into an FP-tree in Loader as a path. Distinct paths that have the same prefix path are merged to construct the FP-tree for reducing memory space.

The FP-growth method is efficient, but it has a potential drawback. The major work of mining frequent itemsets in FP-growth is recursively constructing new conditional FP-trees and traversing paths on these trees. When the FP-tree becomes huge, the recursive mining on the tree may decrease the mining performance drastically. Thus, Park et al. (1997) proposed an implementation called nonordfp to improve the FP-growth algorithm. Nonordfp is based on a more compact structure called tree for constructing FP-tree. Each node in the tree contains a counter and a pointer to the parent. The nodes are stored in an array. Thus, the task of traversing paths becomes reading the array sequentially. Another major feature of Nonordfp is that the recursive mining processes can be replaced by building new tree structures, which avoids rebuilding each conditional pattern base. Experimental results performed demonstrated that nonordfp is very efficient. Ke-Chung, Liao and Chen (2011) revealed that nonordfp incurs a space problem, as it requires continuous memory space for the array structure.

Despite the comprehensibility and simplicity, Apriori algorithm suffers from some weaknesses. The main restraint is waste of time to hold a vast number of candidate sets with much frequent itemsets, low minimum support or large itemsets. For example, if there are 104 frequent 1- itemsets, it need to generate more than 107 candidates into 2-length which in turn will be tested and accumulate. Furthermore, to detect frequent pattern in size 100 v1, v2… v100, it have to generate 2100 candidate itemsets that yield on costly and wasting of time of candidate generation. So, it will check for many sets from candidate itemsets, also it will scan database many times repeatedly for finding candidate itemsets. Apriori will be very low and inefficiency when memory capacity is limited with large number of transactions (Rao & Gupta, 2012).

Xin-hua, Ya-qiong & Qing-ling(2010)in their paper took grades of computer cultural foundation course as example. The weighted association rules algorithm was used to analyze grades of college-wide examination course in the paper, giving the model and mining method of mixed weighted association rules on grade database. Compared to directly apply the Apriori algorithm, more valuable correlations were obtained between the chapters, chapters and scores, colleges and chapters at the same threshold values. Thus, it is more helpful to guide teachers for their teaching and for the improvement of teaching quality. Apriori algorithm is not based on hardware implementation. However, research in hardware implementations of related data mining algorithms has been done (Estlick, Leeser, Szymanski & Theiler, 2001). In (Estlick et. al., 2001) the k-means clustering algorithm in implemented as an example of a special fabric in the form of a cellular array connected to a host processor. K-means clustering is data mining and that groups together elements 2 based on a distance measure. This distance can be an actual measure of Euclidean distance. Item is a set is randomly assigned to a cluster, the centers of the clusters are computed, and then elements are added and removed from

clusters to more efficiently move them closer to the centers of the clusters. This is based on the Aprori algorithm both are dependent on efficient set additions and computations performed on all elements of those sets. In the overall structure of apriori algorithm, the structure of the computation is also significantly different, as the system requires the use of glob.

In market basket analysis, medical diagnosis/ research, website navigation analysis, homeland security association rule mining plays very important role. As compare to the conventional algorithm, frequent item will take less time. It is considered in data mining to have key ideas of reducing time. Jayshree and Leena (2013) proposed an Apriori algorithm based on Bottom up approach and Support matrix to identify frequent item set. The algorithm replaces arbitrary user defined minimum support with functional model based on Standard Deviation. In proposed algorithm, Minimum support value was calculated based upon Standard Deviation value of support counts of all transactions. This approach makes this algorithm more comfortable for non-expert in data mining. The algorithm uses Bottom up Approach to find the frequent item set from largest frequent Item set to smallest frequent item set which help in mining long pattern easily. This algorithm works in 2 phases, Support Matrix Generation and Bottom Up approach to mine frequent items set based upon calculated minimum support. The proposed algorithm replaces the user-defined minimum threshold with standard deviation based functional model and it may lead to either too many or too few rules which can negatively impact the performance of entire model.

An Apriori algorithm was also proposed through reducing the time consumed in transactions scanning for candidate itemsets by reducing the number of transactions to be scanned. Whenever the k of k-itemset increases, the gap between the improved Apriori and the original Apriori increases from view of time consumed, and whenever the value of minimum support increases, the gap between the improved Apriori and the original Apriori decreases from view of time consumed. The time consumed to generate candidate support count in the improved Apriori is less than the time consumed in the original Apriori. Time consuming in improved Apriori in each value of minimum support is less than it in the original Apriori, and the difference increases more and more as the value of minimum support decreases. It showed that the improved Apriori reduce the time consuming by 84.09% from the original Apriori where the minimum support is 0.02, and by 56.02% in 0.10. As the value of minimum support increase the rate is decreased also. The average of reducing time rate in the improved Apriori is 68.39% (Mohammed & Bassam, 2014).

Methodology

Association rule mining links one or more attributes of a dataset with another attributes, to discover hidden and significant relationship between the attributes, producing an if-then statement concerning attribute values in the form of rules. According to Abdusalam, Adewole, Akintola & Hambali (2014), an association rule states that if a user is pick at random and find out that he/she selected some item (that is, bought some products), it

can be assured by indicate the quantity by a percentage that he/she also bought some other products. Agrawal, Imielinki & Swanmi (1993), introduced association rules for discovering regularities between products in large-scale transaction data recorded by Point-of-Sale (POS) systems in supermarkets. For example, the rule {smartphone, memory card} = { sim card } found in the sales data of a supermarket would indicate that if a customer buys smartphone and memory card together, he or she is likely to also buy Sim card. Such information can be used as the basis for decisions about marketing activities such as promotional pricing or product placements. In addition to the above example from market basket analysis, association rules are employed today in many application areas including Web usage mining, intrusion detection and bio-informatics etc.

Association rule mining is one of the most popular data mining approaches. It is used to discover interesting relationships between variables in databases. According to Agrawal et al (1993), an association rule explains a close correlation between items in a database in the form of **x=>y** where x and y are sets of Itemset I (**x and y**⊂ I) and **x** ∩ **y** = Φ. $\boldsymbol{I} = \boldsymbol{I_1, I_2, \ldots, I_m}$ is an Itemset of m distinct attributes. The rule indicated x implies y whereby x is called antecedent and y is called consequent. There are two importance thresholds for the measurement of association rule mining, they are minimum support and minimum confidence (Kanyarat et al., 2014). The support of a rule **x=>y** is the probability of the Itemset {x, y} that means the relevance of the rule and the confidence of a rule x=>y is the conditional probability of y given x; that indicate the accuracy of the rule over the set of transactions: $D = \{d_1, d_2, \ldots, d_n\}$ *each* $d_i \subset I$ Therefore, confidence is an important measure of the association rules to indicate the strength rules. If the confidence of the association rule x=>y is 80%, it means that 80% of the transactions that contain x also contain y (Kanyarat et al., 2014).

Structure of tables

Table 1 consist of a list of the books in the database and with their respective BookID. This are samples to demonstrate the operation of frequent itemset mining. This book may in large collection depending on the dataset under consideration.

Table 1: A list of books and BookID

Book Title	BookID
Programming in C	C
Programming in c++	C++
SQL and PL/SQL	DB1
Database Systems	DB2
Data structures through C	DS
Software Engineering	SW
.NET Framework	.NET

Table 2 consist of books borrowed in different transaction according to transaction ID, which is auto incremented. This shows the different combinations recorded from borrowing pattern of library users. It is important to note that, these transactions are supplied to the apriori algorithm during the experimental stage. The results obtained are discussed in section 4.

Table 2 Transaction Table

TID	Item set
1.	DS,C,.NET,DB1,DB2
2.	.NET,DB1,C,DS,DB2
3.	SW,C++,C,.NET,DB1
4.	SW,C,DS,DsII
5.	.NET,SW,DB1,C,DS1
6.	C,.NET,DB1,SW,DS,DB2
7.	DB2,DS,C,C++,DB1
8.	DB2,DB1,SW II
9.	DB1,C,C++,DS,.NET
10.	.NET,DB1,DB2,SW

Table 3 is the BorrowedBooks table, this table selected the different books a user borrowed per transaction.

Table 3: Borrowed Books

TID	Item-set
1.	C,C++,DB1
2.	DS,C,SW,.NET
3.	.NET,DB1,C
4.	DB2,DB1,SW,DS
5.	DB1,DS,.NET,C,C++

Apriori algorithm

Agrawal et al (1997), proposed the well-known algorithm, Apriori, to mine large itemsets to find out the association rules among items. This algorithm employs a level-wise approach, which iteratively generates candidate *k–itemsets* from previously found frequent *(k − 1)-itemsets*, and then checks the supports of candidates to form frequent *k-itemsets*. The algorithm scans multiple passes over the database. The efficiency and correctness of the level-wise generation of frequent itemsets are based on an important property called the Apriori property.The algorithm in first pass counts item occurrences to find the set of frequent 1-itemsets, denoted as L_1. A subsequent pass, say pass k, consists of two steps: the join and prune steps. In the join step, a set of candidate *k-itemsets* (denoted as C_k) is generated by joining the frequent itemsets $L_k{-}1$ found in the $(k-1)_{th}$ pass with itself.

Apriori algorithm is an influential algorithm for mining frequent itemsets from large repository of data for Boolean association rules. It extracts the frequent item sets from the candidate itemsets. Support for the frequent itemsets must be greater than minimum support that defined by user. Generally, there are two main steps to implement a priori algorithm. Firstly, determine the frequent item sets. Secondly, generate the association rules from the frequent item sets that fulfil the requirement of minimum confidence. A priori algorithm contains a number of passes over the database. During pass k, the algorithm finds the set of frequent item sets L_k of length k that satisfies the minimum support requirement. The algorithm terminates when L_k is empty. A pruning step eliminates any candidate, which has a smaller subset. This algorithm is described as follows (Kanyarat et al., 2014):

1) $L_1 = \{\text{large 1-itemsets}\}$;
2) **for** ($k = 2$; $L_{k-1} \neq \emptyset$; k++) **do begin**
3) $C_k = \text{apriori-gen}(L_{k-1})$; // New candidates
4) **forall** transactions $t \in \mathcal{D}$ **do begin**
5) $C_t = \text{subset}(C_k, t)$; // Candidates contained in t
6) **forall** candidates $c \in C_t$ **do**
7) c.count++;
8) **end**
9) $L_k = \{c \in C_k \mid c.\text{count} \geq \text{minsup}\}$
10) **end**
11) Answer = $\bigcup_k L_k$;

Discussion of Findings

The data mining software was developed using Java programming language. Figure 1 shows the Main Menu to access the interface where different transactions can be made.

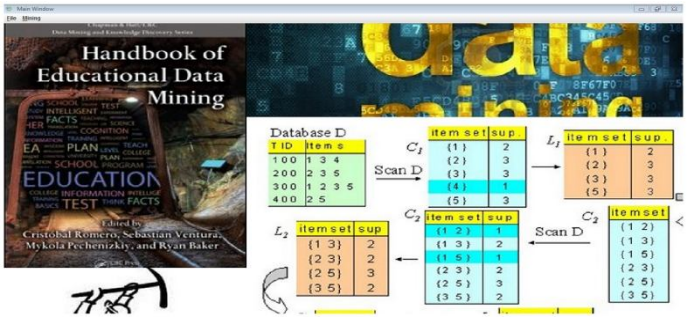

Figure 1: Main Menu

Figure 2 is an interface consisting of the "generate frequent item" and "generate association rule" buttons as well as a textfield; the textfied allow the input of the minimum support value, which is an integer. On supply of the minimum support value and clicking of the generate button, a list of frequent items that meet the minimum support value are displayed in the Item-set column and the serial number which is auto generated are displayed in the Serial column

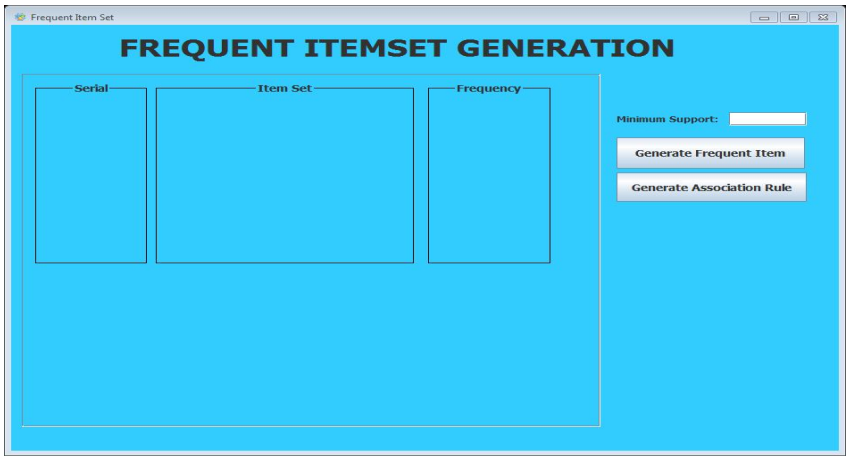

Figure 2 Interface Design

Figure 3 is a transaction interface showing frequent itemset generation after supplying the minimum support of value 4, as shown above and clicking on Generate Frequent Item button.

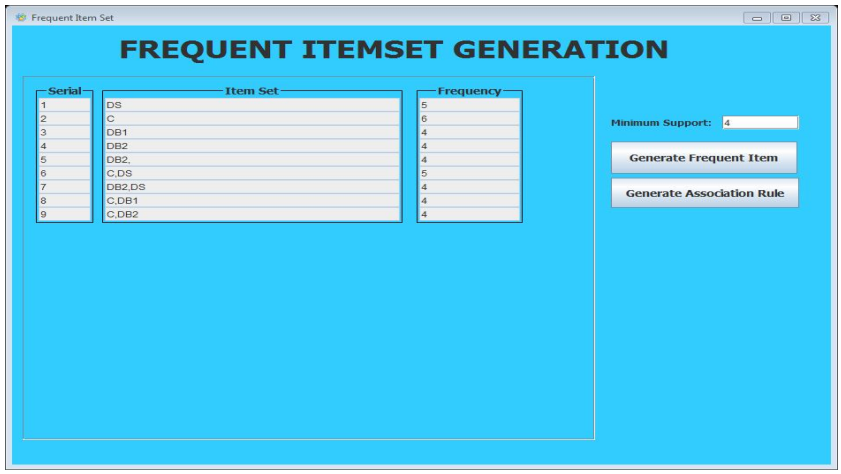

Figure 3: Transaction Interface

Figure 4 Output

Figure 4 shows the association according to the frequent itemset generated by the minimum support of 4 and the click of the generate association rule button. The result as shown above are the serial number of the items, association rules, rule support and rule confidence column. This interface also consists of minimum rule count 18, which is the total number of rules generated, and minimum confidence bar. To interpret this result, let us consider the item at serial number 1. This association rule generated indicates that, if a library user borrows the book with DC code, there is a possibility that the same user will borrow book with C code. Similar interpretation applies to other association rules. Association rules generated by Apriori algorithm can be pruned by defining a threshold on the rule confidence. For instance, if we are interested in rule with >=0.6 confidence, the implication of this is that rule with serial 11, 12, 14, 15, and 17 will be omitted. This association reveals the users strong interest, and it provides an insight into the reader borrowing patterns. This pattern can be used by librarian to re-organize the bookshelf, and to make an informed decision about users reading habit.

Generally, the issue of knowledge discovery from large databases using association rule mining was swotted. Apriori algorithm was implemented to discover hidden knowledge from a library database. Data depicting nine (9) different books were used within forty-seven (47) unique transactions. Eighteen (18) unique transactions were generated from the database showing the borrowing pattern of library users. The frequencies of borrowing of books were obtained as well as the associations. The result shows that borrowing a particular book may leads to borrowing another book as revealed in the association between Data structure in C (DS) textbook and Programming in C (C) textbook.

Conclusion

By means of pattern analysis of readers, the readers groups with different interests, hobbies and reading habits are acquired. Then, the lending information in different groups will help in performing association rules mining to acquire correlation information of various books, and to develop personalized books recommendation system. In addition, the implementation process of data mining technology is used to design a model for personalized information recommendation system. This paper highlights the processes involve in association mining by presenting a simple but important implementation of Apriori algorithm in studying readers borrowing patterns. This helps us to gain insight from the readers borrowing patterns, and to provide better way of organizing bookshelf. It is found that the correlation of borrowed books resources forms book recommendation pattern with different borrowing preferences, reading habits, and so on.

Recommendations

In this paper, traditional Apriori algorithm was used to discover interesting patterns in readers borrowing habits. This work can be extended by applying a more refined association mining algorithm to remove the need for candidate itemsets generation. This will improve the processing speed of the proposed approach in this paper. Therefore, algorithm such as AprioriDP and FP-growth are good candidates for this objective. In addition, there is a need to implement these algorithms on large datasets collection to provide us with better understanding of readers borrowing habit in a university library, and at the same time compare the performance of the various association mining algorithms in pattern recognitions.

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MODELING BREAST CANCER USING DE-ANN ALGORITHM

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Abstract

Recently, research interest has shifted to the issues of diagnosing, classifying and treatment of Breast Cancer (BC). Numerous works in the literature related to cancer disease diagnosis abound. For instance,Classification of Breast Cancer using hybrid of Differential Evolution (DE) and Least Squares Support Vector Machine (LS-SVM), in which DE was used as an optimization technique for LS-SVM parameters, while LS-SVM technique was used as classifier. The result of this effort was highly commendable with BC classification accuracy of 99.75%. However, this study investigated further into whether there could be a model to achieve better BC classification accuracy. The aim of this paper is to develop an efficient cancer classification model. The specific objectives of the study were to: (i) examine the existing body of knowledge in the field of molecular biology relating to gene expression, Artificial Neural Network, Differential Evolution Algorithm and classification; (ii) design a learning mechanism for cancer classification using Differential Evolution algorithm for Artificial Neural Network; (iii) simulate the model designed ; and (v) evaluate the efficiency of the designed model and compare the results with existing acclaimed result. The DE-ANN hybrid model so designed is simulated on MATLAB software, version 7, using the Wisconsin Breast Cancer Data set (WBCD) from UCI Repository of Machine Learning Database, made available on the internet. The result of this simulation gives classification accuracy of 99.85%, which is slightly higher than the result of the reviewed DE-LSSVM hybrid model.

Keyword: Artificial-Neural-Network, Differential-Evolution, Classification, Breast-Cancer, Least-Square, Support-Vector-Machine.

Introduction

In recent times, research interest has shifted to the issues of diagnonizing, classifying and treatment of Breast Cancer (BC). Numerous works in the literature related to cancer disease diagnosis abound. For example, Omar and AboElHamd (2014)presented Classification of Breast Cancer using hybrid of Differential Evolution (DE) and Least Squares Support Vector Machine (LS-SVM), in which DE was used as an optimization technique for LS-SVM parameters, while LS-SVM technique was used as classifier. The result of this effort was highly commendable with BC classification accuracy of 99.75%. However, this study probes into whether there could be a model to achieve better BC classification accuracy. Therefore the main aim of this study is to develop a more efficient cancer classification model. The specific objectives to achieve the aim of the study were to: (i) examine the existing body of knowledge in the field of molecular biology relating to gene expression, Artificial Neural Network, Differential Evolution Algorithm and classification; (ii) design a learning mechanism for cancer classification

using Differential Evolution algorithm for Artificial Neural Network; (iii) simulate the model designed using publicly available microarray dataset for breast cancer; and (v) evaluate the efficiency of the designed model and compare the results with existing acclaimed result. The study used cancer dataset from Wisconsin Breast Cancer Data Set (WBCD) from UCI Repository of Machine Learning Database and designs an hybrid model called Differential Evolution-Artificial Neural Network (DE-ANN). The remaining part of the paper is organized as follows: section 2 presented the related work; section 3 discussed the research methodology by presenting the detailed design of the models used for the analysis of microarray gene expression for classifying and diagnosing cancer disease; section 4 discussed the implementation of the hybrid model; while section 5 presented the simulation result of the designed hybrid model; and section 6 concluded the paper.

Related Work

The discussion in this section is in two parts: The first part focuses on Artificial Neural Network (ANN) and Evolutionary Computing while the second part reviews previous work on cancer classification.

Artificial Neural Network (ANN)

Artificial Neural Network (ANN) is the most popular supervised learning technique. In ANN, there are many elements to be considered such as number of input, hidden and output nodes, learning rate, momentum rate, bias, minimum error and activation/transfer function. These elements will affect the convergence of feed-forward learning. The learning consists of the following steps:

1. An input vector is presented at the input layer.
2. A set of desired output is presented at the output layer.
3. After a forward pass is done, the errors between the desired and actual output are compared.
4. The comparison results are used to determine weight changes according to the learning rules.

To guide ANN learning, DE is employed to optimize the initial weights. This is because ANN takes long time for training Cho, T-H., Conners, R.w. and Araman, P.A. (1991).

ANN consists of a parallel collection of simple processing units (neurons/nodes) arranged and interconnected in a network topology Yao, (1993). ANNs that are based on biological nervous system, are known as parallel distributed processing (PDP) systems since they are based on the idea that intelligent function is created through adaptation of the interconnections between simple interacting processing units in a network Luger, (2002). ANN consists of a set of interconnected processing units known as node, neurons or cells as shown in figure 1. Each node has its activation functions and the common activation function is the sigmoid function. The activation signal sent

(output) by each node to other nodes travel through weighted connection and each of these nodes accumulates the inputs it receives, producing an output according to an internal activation function. Zhang and Sun (2000) posited that the information processing capability of ANN is closely related to its architecture and weights. Figure 2 shows the interconnection between nodes which is usually referred to as a fully connected network or multilayer perception (MLP). Multilayer architecture means that the network has several layers or nodes usually referred to as input layer, hidden layer and output layer. MLP network can be used with great success to solve both classification and function approximation problems Van den Bergh, (1999).

There are two types of learning networks, which are supervised learning and unsupervised or self-organizing. Supervised learning is when the input and desired output are provided while for unsupervised learning, only input data is provided to the network. According to Ben Kröse, Patrick van der Smagt (1996) the nodes in an ANN with unsupervised learning are trained to respond to patterns within the inputs. Thus the system must discover features of the input population on its own, without a priori set of input output training pairs Ben Kröse et al, (1996).

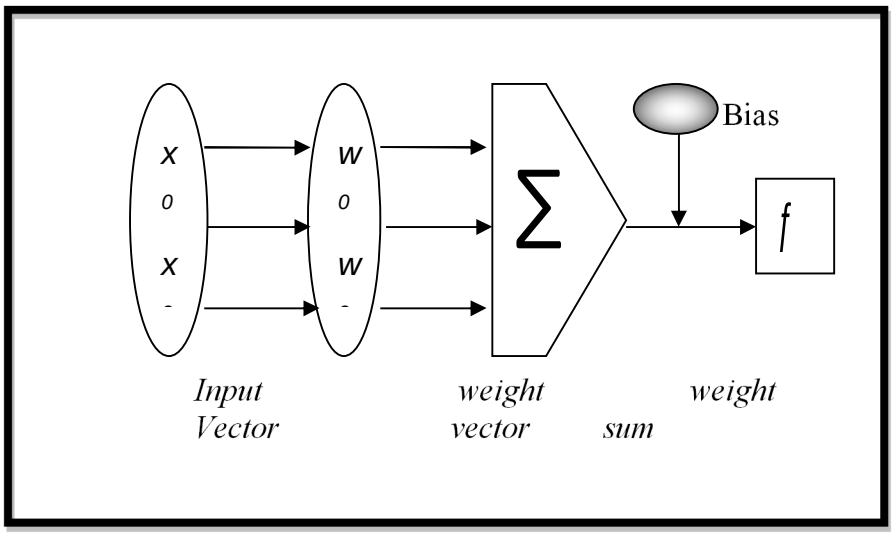

Figure 1: Artificial Neural Network Model

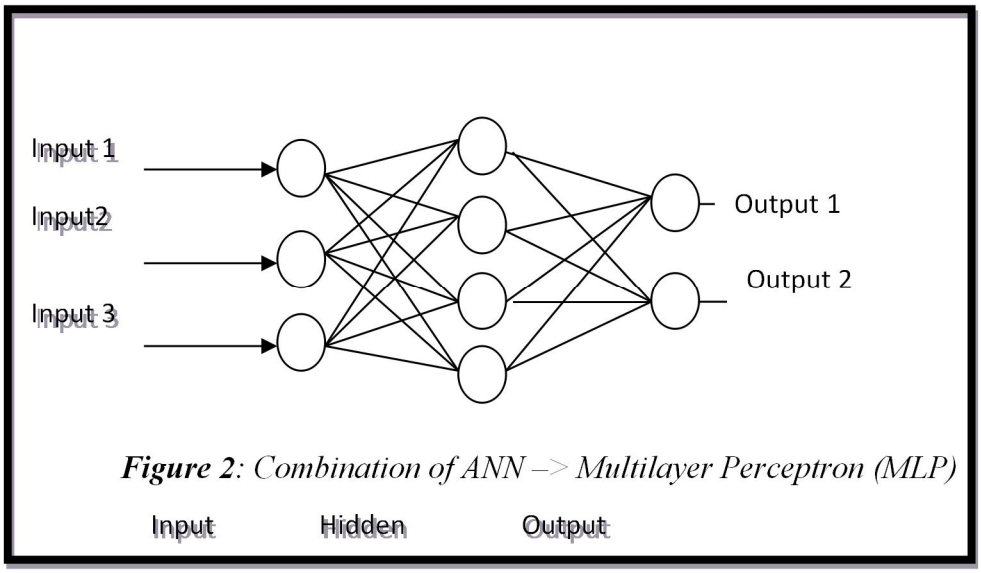

***Figure 2**: Combination of ANN –> Multilayer Perceptron (MLP)*

In order to get the desired output from ANN, the output from the network is compared to actual desired output. During training, the network tries to match the outputs with the desired target values. Network need to review the connection weight to get the best output. There are two phases in ANN learning algorithm which are feed forward phase and backward phase. In feed forward process, the dataset is presented to the input layer and the network propagates the input pattern from layer to layer until the output pattern is generated. The output is obtained from a summation of the weighted input of a node and maps to the network activation function. Equations 1 and 2 show the calculation formula from input layer (i) to hidden layer (j) and equation 3 and 4 show formula for hidden layer (j) to output layer (k). The network activation function as in equations 1 and 3 is Sigmoid Activation Function.

Between input (i) and hidden (j)

$$O_j = f(net_j) = \sum \frac{1}{1+e^{-netj}} \quad . \quad . \quad . \quad (1)$$

$$Net_j = \sum w_{ij} O_i + \theta_j \quad . \quad . \quad . \quad (2)$$

Where;

O_j is the output of node j
O_i is the output of node i
W_{ij} is the weight connected between node iand j
θ_j is the bias of node j

Between hidden (*j*) and output (*k*)

$$O_k = f(net_k) = \sum \frac{1}{1+e^{-netk}} \quad . \quad . \quad . \quad (3)$$

$$Net_k = \sum w_{jk} O_j + \theta_k \quad . \quad . \quad . \quad (4)$$

Where;

O_k is the output of node k

O_j is the output of node j
W_{jk} is the weight connected between node j and k
Θ_k is the bias of node k

Differential Evolution

DE belongs to the class of evolutionary algorithms which include Evolution Strategies (ES) and GA. It uses the steps of GA, namely, mutation, crossover and selection; see the flowchart in Figure 4. In the initialization, a population of NP vectors, each of dimension D (number of decision variable in the optimization problem), is randomly generated over the feasible region. Typical value of NP is about 5-10 times D to ensure DE has enough vectors to work with. The fitness of each individual is evaluated. Out of these NP vectors, one of them is randomly selected as the target vector. The DE algorithm is outlined below: Figure 3 shows the basic pseudo-code for the DE algorithm.

Procedure DE

Required: *D - problem dimension (optional)*
NP, F, Cr – control parameters
GEN – stopping condition
L, H – boundary constraints
Initialize population Pop_{ij} ← $rand_{ij}$ *[L,H] and Evaluate fitness* $Fit_j(Pop_j)$ ←
for *g = 1 to GEN* ***do***
for *j = 1 to N* ***do***
Choose randomly $r_{1,2,3}$ *[1,…,NP],* $r_1 \neq r_2 \neq r_3 \neq j$
Create trial individual ***X*** ← *S(r,F,Cr,Pop)*
Verify boundary constraints ***if*** (x_i *[L,H] xi* ← $rand_i$ *[L,H]*
Select better solution (X or Pop_j*), and update iBest if required*
end for

Figure 3 shows the basic pseudo-code for the DE algorithm.

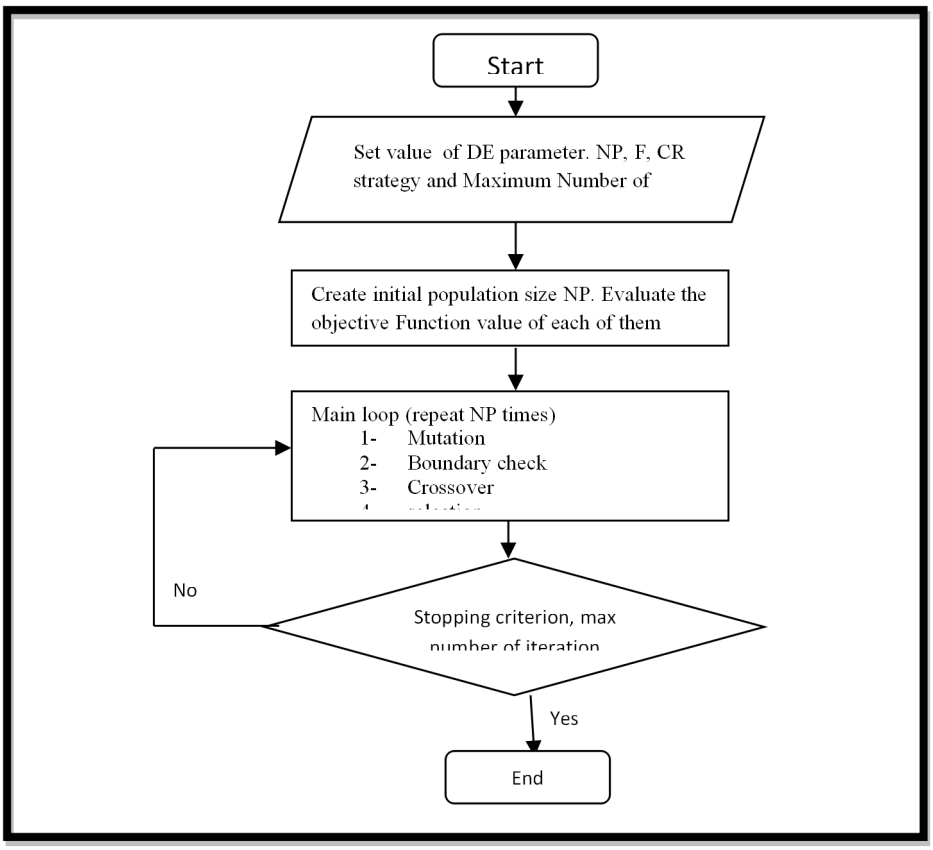

Figure 4: Flowchart of DE algorithm.

Differential evolution algorithm consists of only three real control parameters in the algorithm. These are: differentiation (or mutation) constant F, crossover constant Cr, and size of population NP. The rest of the parameters are:

1. Dimension of problem D that scales the difficulty of the optimization task.
2. Maximal number of generations (or iterations) GEN, which serves as a stopping condition in our case.
3. Low and high boundary constraints, L and H, respectively that limit the feasible area. These parameters can be varied at will.

Properties of Differential Evolution

A. Very simple to programme, the same for more dimensions.
B. Very reliable to find global extreme of cost function f(in contrast with geometrical optimization methods).
C. If function has more global extremes, differential evolution finds them.
D. can with number formats float, integer, with binary numbers and Combinations.

E. Solution of optimizations problem is one (or more) best solution

Proper DE Algorithm

1. Definition of parameters.
2. Creation of population.
3. Reproduction loop - grade between specimens from actual generation creation of new specimens
4. Testing cost function f for test specimen.
5. Determination of new population
6. Interpretation of results of evolution.

loop 3 – 5. is repeated until stop condition is satisfied. Best specimen is proclaimed as a result of optimization problem.

The Basics of Differential Evolution

DE has three operations: Mutation, Crossover and Selection.

1. Mutation.

From each target vector x^t_{ij}, a mutant vector v is generated according to

$V_i^{t+1} = x^t_{r1} + F*(x^t_{r1} + x^t r_2 - x^t r_3 - x^t_{r4})$ . . . (5)

The r1 , r2 and r3 are randomly chosen indexes and r1 ,r2,r3 { 1,2,…..,NP}.

F is a real number to control the amplification of the difference vector.

Range of F is in [0, 2] 0<F<=2)

2. Crossover.

The target vector is mixed with the mutated vector, using the following scheme, to yield

$$u_{ij}^{i+1} = \begin{cases} v_{ij}^{i*1}, & rand(j) \le CR \quad or \quad j = randn(i) \\ x_{ij}^{t}, & rand(j) > CR \quad and \quad j \ne randn(i) \end{cases} \qquad (6)$$

the trial vector u.

where j=1,2,…..,D, rand (j) ϵ [0,1] is the j^{th} evolution of a uniform random generator nu ϵ r. CR ϵ [0,1] is the crossover probability constant, which has to be determined previously by the user rand (i) v_i^{t+1} (1, 2,….D) is a randomly chosen index which ensures that at least one element from u_i^{t+1} gets at least one element from u_i^{t+1}. Otherwise, no new parent vector would be produced and the population would not alter.

3. Selection

DE adapts greedy selection strategy. If and only if, the trial vector u_i^{t+1} yields a better fitness function value than x_i^t then u_i^{t+1} is set to v_i^{t+1}. Otherwise , the old value v_i^{t+1} is retained.

Comparison DE and GA

Most evolutionary techniques (Including GA) use the following procedure:

1. Random generation of an initial population.
2. Reckoning of a fitness value for each subject. It will directly depend on the distance to the optimum.
3. Reproduction of the population based on fitness values.
4. If requirements are met, then stop. Otherwise go back to step b.

DE algorithm has many advantages, such as faster convergence, stronger Stability, easy to realize and so on, so it is recommended by many researchers. But the individuals of the basic DE algorithm is random during the period of evolutionary procedures and so it easily becomes unsteady. Basic DE algorithm is a kind of evolutionary algorithm, which is used to optimize the minima of functions, and its code is based on real number, the whole structure is similar to the GA, and the main difference between standard GA and DE is mutation operation. The mutation is a main operation of DE, and it revises each individual's value according to the difference vector of the population. Its basic idea lies in applying the difference of current population individual to reorganize to obtain the middle population, then, using the direct offspring and parents individual fitness value competition to get the new generation.

Some Previous Studies on Cancer Classification and Diagnosis

Diagnosis and treatment of Breast Cancer (BC) has become a challenging research problem for many researchers due to its severity. Numerous works in literature related to cancer disease diagnosis abound. In recent times, the data mining techniques are employed by numerous authors to propose diagnostic approaches for various kinds of cancer diseases. Soliman et al, (2014)presented Classification of Breast Cancer using hybrid of Differential Evolution (DE) and Least Squares Support Vector Machine (LS-SVM), in which DE was used as an optimization technique for LS-SVM parameters, while LS-SVM technique was used as classifier. The proposed algorithm was implemented and evaluated on Wisconsin Breast Cancer Data Set (WBCD) from UCI Repository of Machine Learning Database. The proposed algorithm was compared with different classifier which was applied on the same database, and the experimental results showed the superiority of the proposed algorithm that could achieve a classification accuracy of 99.75%. The study is still open to better results than what was obtained by changing the parameter settings or the schema. Hence other schemas for DE (like DE/best/2) could be used for future work.

Enrique Alba and Chicano, (2005) proposed a model for training Neural Network with GA hybrid algorithms, and tried to offer a set of results that could hopefully foster future comparisons by following a kind of standard evaluation of the results. Two gradient descent algorithms: Backpropagation and Levenberg-Marquart, one population based heuristic such as a Genetic Algorithm, and two hybrid algorithms combining the last with the former local search one were selected. As a future work, new algorithms are planned to be added to the analysis and to apply them to more instances, especially in the domain of bioinformatics.

Mohammed Hassan Abdel Majeed Alsheikhl, (2011) proposed classification of Breast Cancer using back-propagation neural network algorithms. Combination of weights which minimizes the error function is considered to be a solution of the learning problem. To solve a problem, the study considered neuroph program comparison by matlab7 software to achieve good result, using a kind of sigmoid function other than the step function used in perceptron. The scope of the study is to classify the data set of breast cancer in two groupings: cancerous (malignant) and other not cancerous (Benign). The results of experiment from the study, are still open to further improvement however in the area of accuracy and precision.

Hosseni Ghayoumi Zadeh, Javad Haddania, Maryam Hashemian and Kazem Hassanpour, (2012) presented Diagnostic of Breast Cancer using a Combination of Genetic Algorithm and Artificial Neural Network in Medical Infrared Thermal Imaging. The study is an effort to diagnose breast cancer by processing the qualitative and quantitative information obtained from medical infrared imaging. By analyzing this information, the best diagnostic parameters among the available parameters are selected and its sensitivity and precision in cancer diagnosis is improved by utilizing genetic algorithm and artificial neural network. In the study, the necessary information is obtained from thermal imaging of 200 people, and 8 diagnostic parameters are extracted from these images. The 8 parameters are used as input of the proposed combinatorial model which is formed using neural network and genetic algorithm. The result revealed that comparison of the breast areas: thermal pattern and kurtosis are the most important parameters in breast cancer diagnosis from the proposed infrared imaging. The proposed combinatorial model with a 50% sensitivity, 75% specificity, and, 70% accuracy shows good precision in cancer diagnosis. The method is beneficial to patients with and without symptoms.

Berrar, Bradbury and Dubitzky (2006), presented a probabilistic neural network (PNN) model to address issues pertaining to classification and diagnostic prediction of cancers using gene expression profiling by microarray technology. A novel technique, the PNN model provides sound statistical confidences for its decisions, and it is able to model asymmetrical misclassification costs. Furthermore, they demonstrate the performance of the PNN for multiclass gene expression data sets as they compare the performance of the PNN with two machine learning methods, a decision tree and a neural network. To assess and evaluate the performance of the classifiers, they use a *lift*-based scoring system that allows a fair comparison of different models. The PNN clearly

outperformed the other models. The results demonstrate the successful application of the PNN model for multiclass cancer classification.

A normalized Expectation-Maximization (EM) approach for the problem of gene-based clustering was proposed by (N.M. Phuong and H.D). Tuan. Clustering is one of the basic exploratory tools for microarray data analysis. A wide range of clustering methods have been proposed in gene expression community including hierarchical clustering, self-organizing maps (SOM), k-means and its variants, graph-based methods, and mixture model-based clustering. Here a normalized EM algorithm was proposed for clustering gene expression data, in which data points are already projected onto a hypersphere. The proposed approach also follows the mixture model-based clustering framework but data points are assumed to be generated by a mixture of exponential distributions in a fixed manifold, which is the surface of a hypersphere. The normalized EM is able to work stable with high dimensional microarray data sets. In short, the main contributions of this approach are the following:

(i) the normalized EM algorithm is introduced for the problem of clustering genes using microarray data;
(ii) the viability of the proposed normalized EM is demonstrated by comparing its clustering performance with that of spherical k-means and Gaussian parsimonious clustering.

The normalized EM clustering also follows the framework of generative clustering models but for the data in a fixed manifold. The effectiveness of the normalized EM was illustrated on two real microarray data sets by comparing its clustering results with the ones produced by other related clustering algorithms.

Bhattacharyya A1, Trotta CR& Peltz SW (2008),proposed gene expression mining for cohesive pattern discovery. The work focused on developing an appropriate mechanism for discovery of such genes that share common biological functions from microarray data. A conceptual property ‘cohesion’ among genes as representative of common biological function, under influence of which a geneset behave coherently was introduced. Such genesets are marked as ‘cohesive’. Depending on “100% cohesion” equivalence relation, the entire set of associated genes is decomposed into a number of disjoint equivalence classes, each with unique behavior. The equivalence classes form several disjoint affinity groups, members within a group having pair-wise direct interaction. Each group may be called a cohesive gene cluster. A data mining technique for cohesive geneset discovery is developed and applied on expression data to discover intra-cluster gene relationships for extracting natural coherent genesets. Experiments with some cancer datasets discovered thousands of long confident patterns within reasonable time. Results can provide important insight into molecular biology and biomedical research.

Martin and Nattkemper (2008**)** used simulated data as well as two public available cancer data sets to show a tree index to support clustering based exploratory microarray

data analysis. In order to support a selection of the to-be-applied algorithm and parameterizations, they proposed a novel cluster index, the *tree index (TI)*, to evaluate hierarchical cluster results regarding their visual appearance in accordance to available background information. Visually appealing cluster trees are characterized by splits that separate those homogeneous clusters from the rest of the data, which have low inner cluster variance and share a medical class label. To evaluate clustering trees regarding this property, the TI computes the likeliness of every single split in the cluster tree. Computing TIs for different algorithms and parameterizations allows identifying the most appealing cluster tree among many possible tree visualizations obtained.

One problem in clustering based exploratory data analysis is the variability of the cluster result dependent on the applied cluster algorithm and parameterizations (preprocessing of the data, (dis-)similarity measure). There is hardly any consensus about how to choose these; Handl, & Knowles J et al (2005). This results in an enormous number of potential visual displays for one data set leading to the confusion of the biomedical researcher.

In biomedical applications, microarray data is usually analyzed in combination with additional variables, like clinical data or tumor classifications. Thus they measure the usefulness of a tree visualization according to an external class label. For demonstration, the index is applied to cluster trees created by agglomerative clustering and normalized cuts on simulated data as well as on two public available cancer data sets. For illustration, the tree index is applied to cluster trees obtained from simulated data and two publicly available cancer data sets. The result shows that the number of high splitting scores decreases as noise increases. The fact that the TI decreases as noise increases makes the TI a reliable index to measure how well the label is reflecting the structure of the clustered data and how well a specific cluster tree is suited for visualization.

Research Methodology

This section presents a learning mechanism for Breast Cancer (BC) classification. The aim of the section is to design a learning mechanism for BC classification by using the following methodologies: (i) adopt cancer dataset from Wisconsin Breast Cancer Data Set (WBCD) from UCI Repository of Machine Learning Database; (ii) design an hybrid model called Differential Evolution-Artificial Neural Network (DE-ANN); and (iii) using MATLAB 7.10.0 (R2010a) to simulate the supervised learning of feed forward Artificial Neural Network (ANN), for the purpose of classifying BC.

Differential Evolution (DE) Model

DEs serve as intelligent search and optimization technique and adaptation of network weights. It is a stochastic, population based, real-valued algorithm. The essence of using DE in this study is to optimize the initial weights of ANN, the classifier. It starts with

the creation of an initial population (trial individual), normally at random. There are several schemes available to achieve this, some of which are shown in equations 7 – 11.

Scheme Name	**DE mutation définition**	
DE/Rand/1/*β*	$x_i^t = x^t_{r3} + F * (x^t_{r1} - x^t_{r2})$	(7)
DE/Best/1/*β*	$x_i^t = x^t_{best} + F * (x^t_{r1} - x^t_{r2})$	(8)
DE/Rand/2/*β*	$x_i^t = x^t_{r5} + F * (x^t_{r1} + x^t_{r2} - x^t_{r3} - x^t_{r4})$	(9)
DE/Best/2/*β*	$x_i^t = x^t_{best} + F * (x^t_{r1} + x^t_{r2} - x^t_{r3} - x^t_{r4})$	(10)
DE/Rand/2/*β*	$x_i^t = x^t_{r3} + F * (x^t_{best} + x^t_{r3}) + F(x^t_{r1} - x^t_{r2})$	(11)

The available schemes use the general notation DE/α/v/β where:

α - represents the way in which individuals necessary to obtain the new weighted differences vector, are selected from the current population. They can be selected randomly (*rand*) or as the best individual from the current population (*best*)

v - is the value of difference vector pairs used (which could either be 1 or 2)

β - is the crossover scheme that can either be binomial (bin) or exponential(exp). **β** is
binomial in this study.

r1≠ r2≠ r3≠ r4≠r5≠i are used as indices to index each parent vector

New individuals are connected by applying the mutation and the recombination operator in equation (10). At each generation, a new solution (x_i), selected randomly from the current population, for each individual of the population, is created, using a weighted vector difference between two individuals. This new individual is selected using DE/best/2/β in this study. The DE algorithm composed of 4 main phases: initialization phase, mutation phase, crossover phase, and selection phase.

Fitness Function

$$Fitness = \frac{1}{MSE} \qquad (12)$$

Where MSE is Mean Square Error

Initialization Phase

In this phase DE algorithm aims at evolving a population of size N with D dimension parameter vector, called (individuals).

$$\mathbf{X_{1,G} = \{X^1_{i,G}, \ldots\ldots X^D_{i,G}\}, i = 1, N;} \qquad (13)$$

Where; N is the population size D, dimension of DE and G, the generation

These individuals encode the candidate solution, (13) towards the global optimum, where i index denotes the population in the generation G.

The initial population should better cover the entire search space as much as possible by uniformly randomizing individuals within the range [0,1].

Mutation Operation Phase

There are lots of different mutation strategies that could be employed to produce a mutant vector $V_{i,G}$ for each individual $X_{i,G}$ in the current population. Some of these are shown in (7 – 11).

The proposed algorithm for this study uses DE/Best/2/β mutation strategy as in (14) below:

$$\mathbf{V_{i,G}} = x^t_{best,G} + F * (x^t_{r1} + x^t_{r2} - x^t_{r3} - x^t_{r4}) \quad (14)$$

where;
r1, r2,r3,r4 are mutually exclusive integers and normally generated within the range [1, N]. These indices are randomly generated once for each mutant vector and they are different from index i.
F is the scaling factor which is a positive control parameter for scaling the difference vector.
$X_{best,G}$ is the best individual vector with the best fitness value in the population at generation G.

The use of scheme (14) is informed by the need to verify whether a better classification accuracy could be obtained than the result got when scheme $x_i^t = x^t_{best} + F * (x^t_{r1} - x^t_{r2})$ was used with LS-SVM classifier as reviewed in the literature.

Crossover Operation Phase

This operation is a posterior step after the mutation phase. It is applied to each pair of the target vector $X_{i,G}$ and its corresponding mutation vector $V_{i,G}$ to generate a trial vector $U_{i,G} = (U^1_{i,G}, U^2_{i,G}, \ldots U^D_{i,G})$. Basically DE employs the binomial (uniform) Crossover defined in (14):

$$U^i_{iG} = \begin{cases} V^i_{iG} & if\,(rand(0,1) \le CR \quad or \quad (j = j_{rand}), j = 1,2, \ldots D \\ X^i_{iG} & otherwise \end{cases} \quad (15)$$

Where:
CR is a user defined constant within the range (0,1), which controls the function of parameter values copied from the mutant vector.
J_{rand} is a randomly chosen integer in the range [1,D]
$V_{i,G}$ is the mutant vector
$U_{i,G}$ is the trial vector

The binomial crossover operator copies the j^{th} parameter of the mutant vector $V_{i,G}$ to the corresponding element in the trial vector $U_{i,G}$. If $rand_j[0,1) \leq CR$ or $j=j_{rand}$, otherwise, it is copied from the corresponding target vector $X_{i,G}$.

The remaining parameters of the trial vector $U_{i,G}$ are copied from the corresponding target vector $X_{i,G}$. The condition $j=j_{rand}$ is introduced to ensure that the trial vector $U_{i,G}$ will differ from its corresponding target vector $X_{i.G}$ by at least one parameter.

Selection Operation Phase

If the values of some parameters of a newly generated trial vector exceed the corresponding upper and lower bounds, they are randomly and uniformly reinitialized within the pre-specified range. The objective function values of all trial vectors are evaluated; then, a selection operation is performed. The objective function value of each trial vector $f(U_{i,G})$ is compared to that of its corresponding target vector $f(X_i,G)$ in the current population. If the trial vector has less or equal objective function value than the corresponding target vector, the trial vector will replace the target vector and enter the vector and will remain in the population for the next generation. The selection operation can be expressed as in (15)

$$U^{i}_{iG+1} = \begin{cases} U_{iG} & if(U_{iG} \leq f(U_{iG}),\ (j = j_{rand}), j = 1,2,\ .\ .\ .D \\ X^{i}_{iG} & otherwise \end{cases} \quad (16)$$

The figure 5 below shows the algorithm for Differential Evolution

1. Randomly generate a population of N vectors, each of D dimensions.
2. Calculate the objective function value $f(X_i)$ for all target vector X_i.
3. Select 3 points from the population and generate mutant individual V_i using equation (14)
4. Apply Crossover operation on each target vector X_i with mutant individual (generated in 3) to generate a trial vector U_i using (15)
5. Calculate the objective function value for vector U_i
6. Choose better of the two (function value at target and trial point) using (16)
7. Check whether a convergence criterion is met, if yes then train the network; otherwise go to step 3.

The Pseudo Code of the DE Procedure is stated as follows:

***Required**: D - problem dimension (optional)*
NP, F, Cr – control parameters
GEN – stopping condition
L, H – boundary constraints
Initialize population Pop_{ij} $rand_{ij}$ *[L,H]* ←*and Evaluate fitness* $Fit_j f(Pop_j)$ ←
for *g = 1 to GEN* ***do***
for *j = 1 to N* ***do***
Choose randomly $r_{1,2,3}$ *[1,…,NP],* $r_1 \neq r_2 \neq r_3 \neq r4 \neq j$
Create trial individual ***X*** ←*S(r,F,Cr,Pop)*
Verify boundary constraints ***if*** *(*x_i *[L,H] xi* ←$rand_i$ *[L,H]*
Select better solution (X or Pop_j*), and update i Best if required*
end for
end for

Artificial Neural Network (ANN) Model

In this study we let $\mathbf{x_1}, \mathbf{x_2}, \ldots \mathbf{x_n}$ represent simple nodes of an artificial neural network (ANN) linked to certain neighbor with varying coefficient of connectivity w_i (called weights) that represents the strength of these connections. The basic unit of ANN, called artificial neurons simulates the basic functions of natural neurons. It receives cancer cells as inputs, processes them by simple combination and threshold operations and outputs a final result by aggregating the objectives into scalar function U: X → R.

This method combines the objectives into a higher scalar function that is used for output calculation.

ANN Activation Function

In a feed-forward network, the input units send signals x_j (representing breast cancer data) across weighted connections to intermediate or hidden units.
Any hidden node j sees the sum of all weighted inputs

$$w_{ji} = \sum_{i=0}^{p} w_{ji}\, x_i = w_{j0} + w_{j1}x_1 + \ldots\ldots\ldots + w_{jp}x_p \quad (17)$$

$$= w_{j0} + \sum_{i=1}^{p} w_{ji}\, x_i \quad (18)$$

Where:
- The first term w_{jo} is a bias term
- The weights w_{ji} are the weights to the j^{th} hidden unit
- *j*, a hidden unit, output a signal

$$h_j = \mathbf{G}(w_{j0} + \sum_{i=1}^{p} w_{ji}\, x_i) \quad (19)$$

The activation function is given as;

$$G(X) = \frac{1}{1+e^{-\alpha x}} \quad (20)$$

Where;

$$x = w_{j0} + \sum_{i=1}^{p} w_{ji} x_i \quad (21)$$

The Network Output

Given the hidden-output weights as $\beta_0 \ . \ . \ . \ \beta_d$ the output unit sees the sum of the weighted hidden units

$$\sum_{j=0}^{d} \beta_j h_j = \beta_0 + \sum_{j=1}^{d} \beta_j h_j \quad (22)$$

$$= \beta_0 + \sum_{j=1}^{d} \beta_j \mathbf{G}(w_{j0} + \sum_{i=1}^{p} w_{ji} x_i) \quad (23)$$

$$f(x,w) = \emptyset(\beta_0 + \sum_{j=1}^{d} \beta_j \mathbf{G}(w_{j0} + \sum_{i=1}^{p} w_{ji} x_i)) \quad (24)$$

f(*x*,*w*), the network output, is a function of inputs and weights.

The Network Output Function

The signals from the hidden units j = 1, . . .d are set to the output unit across weighted connections in a manner similar to what happens between the input and hidden layers. The output unit sees the sum of the weighted hidden units,

$\beta_0 + \sum_{j=1}^{d} \beta_j h_j$;

the hidden to output weights are

$\beta_0, \ . \ . \ . \ \beta_d$.

The output unit then produces a signal

$\beta_0 + \sum_{j=1}^{d} \beta_j h_j$.

If the expression for h_j is substituted into the expression $\beta_0 + \sum_{j=1}^{d} \beta_j h_j$; it yields the output of a single layer feed-forward network

$$\mathbf{f(x,O)} = \emptyset(\beta_0 + \sum_{j=1}^{d} \beta_j \mathbf{G}(w_{j0} + \sum_{i=1}^{p} w_{ji} x_i)) \quad (25)$$

as a function of inputs and weights. The expression f(x,0) is shorthand for network output since this depends only on inputs and weights. f is called the network output function.

Input Layer: Size depends on Problem Dimensionality.
Hidden Layer: A design parameter; must decide on number of layers and size for each layer. Creates a non-linear generalized decision boundary.
Output Layer: Size depends on number of classification categories.
Bias: Further generalizes the decision boundary
Net Activation: Weighted sum of the input values at respective hidden nodes.
Activation Function: Decides how to categorize the input to a node into a possible node output incorporating the most suitable non-linearity.
Network Learning: Training an untrained network. Several training methods are available.
Stopping Criterion: Indicates when to stop the training process; e.g., when a threshold MSE is reached or maximum number of epochs used.
Figure 6: The components of ANN**.**

Figure 6: showing the components of ANN

Table 1: ANN Structure

- number of input layer	1
- number of hidden layer	1
- number of output layer	1
- number of input nodes	9
- number of nodes in the output layer	19
- function for getting output for each neuron	activation function

The Hybrid Model

A hybrid classification model that integrates DE Algorithm and ANN is hereby proposed. The proposed model for BC classification is composed of two main phases; weights optimization and classification. The block diagram for the proposed algorithm is as shown in figure 7 below.

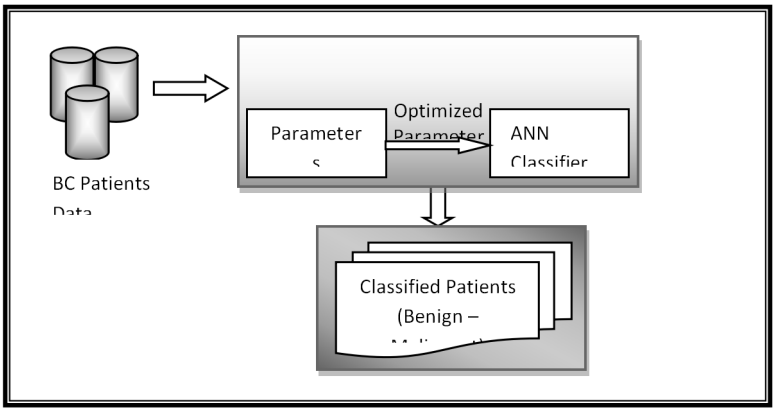

Figure 7: Block Diagram of the Proposed Algorithm

Weights Optimization Phase

The essence of weights optimization using DE is to find the optimal values for the weights of the classifier (ANN). To achieve this: first, a binary matrix vector with a length corresponding to the number of features is randomly created. Each element of this vector corresponds to specific diagnostic parameter in the neural network. For example, if the output equals 1, then the corresponding diagnostic parameter will be selected but, if the output equals 0, the corresponding diagnostic parameter will not be selected. The algorithm for weights evolution by DE in ANN is shown in figure 8. It is used basically to evolve optimal weights for ANN.

(a)	A population of μ parents, solution X_i, i=1,…. μ, is initialized over a region M ϵ R^n
(b)	Two parents selected randomly with uniform distribution from population of μ parents, and two offspring will be created by crossover operator
(c)	Mutation on newly generated offspring will be applied.
(d)	Process from step (b) will be repeated until population of offspring μ_o equal to μ, otherwise move to process (e)
(e)	Each parent solution X_i, i=1,…. μ and offspring X_o, o=1,…. μ, is scored in light of the objective function $f(X)$.
(f)	A mixture population X_m, m= 1……2μ contains both parent population and offspring population created. This mixture population randomly shuffled so that parents and offspring could mix up properly.
(g)	Each solution from X_m, m= 1……2μ is evaluated against 10% of μ other randomly chosen solutions from the mix population X_m,. For each comparison a 'win' is assigned if the solution's score is less than or equal to that of its opponent.
(h)	The μ solutions with the greatest number of wins are retained to be parents of the next generation.
(i)	If the difference in the best chromosome for N number of continuous generation are less than the defined threshold value k, terminate the process and the last generation best chromosome is the optimal weights, otherwise proceed to step (b).

Classification Phase

The classification phase, using ANN technique, consists of two main phases: training phase followed by testing of the algorithm phase. Both of these phases are simulated using MATLAB 7.10.0 (R2010a) to classify the BC lumps into either benign or malignant using the optimized weights. Figure 9 below shows the neural network architecture for breast cancer classification.

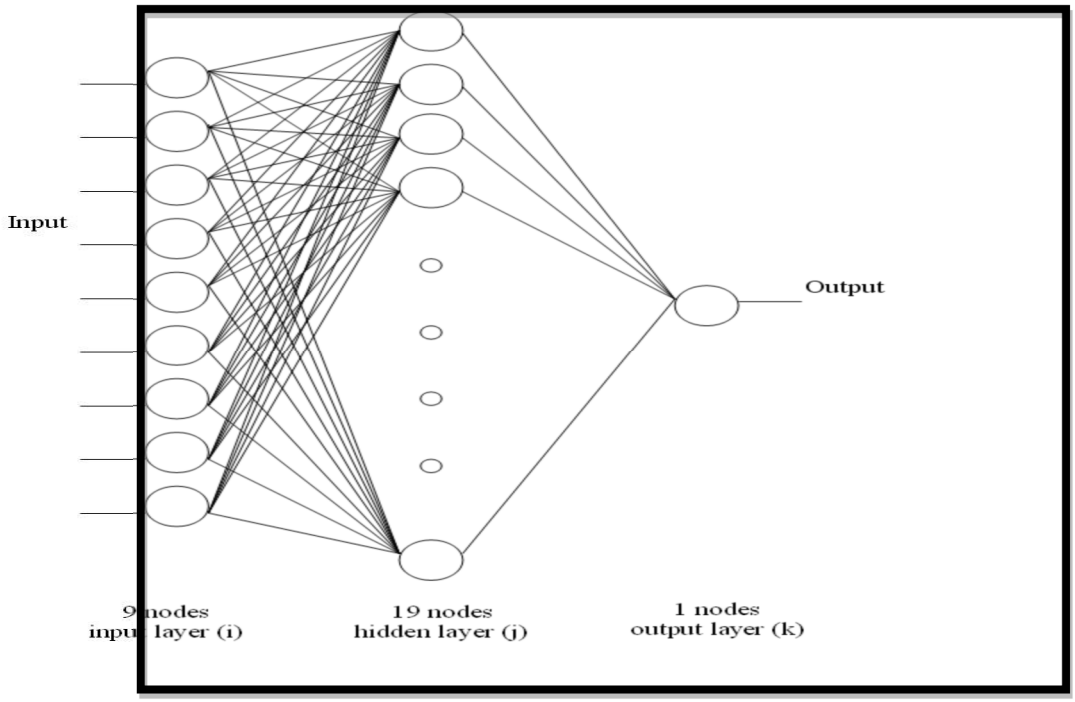

Figure 9: Neural Network Architecture for Cancer

The DE-ANN Algorithm

Below is the logical steps of the DE-ANN algorithm.

1. Design suitable neural network
2. Initialize the population (connection weights and thresholds)
3. Assign input and output values to ANN.
4. Compute hidden layer values
5. Compute output values
6. Compute fitness using:

$$Fitness = \frac{1}{MSE} \quad (12)$$

7 If error is acceptable, go to step 11
8 Select parents of the next generation and apply DE operator
9 Go to step 5
10 Train the neural network with selected connection weights

11 Study the performance with the test data.

Shown below in figure 10 is the flowchart of the DE-ANN model.

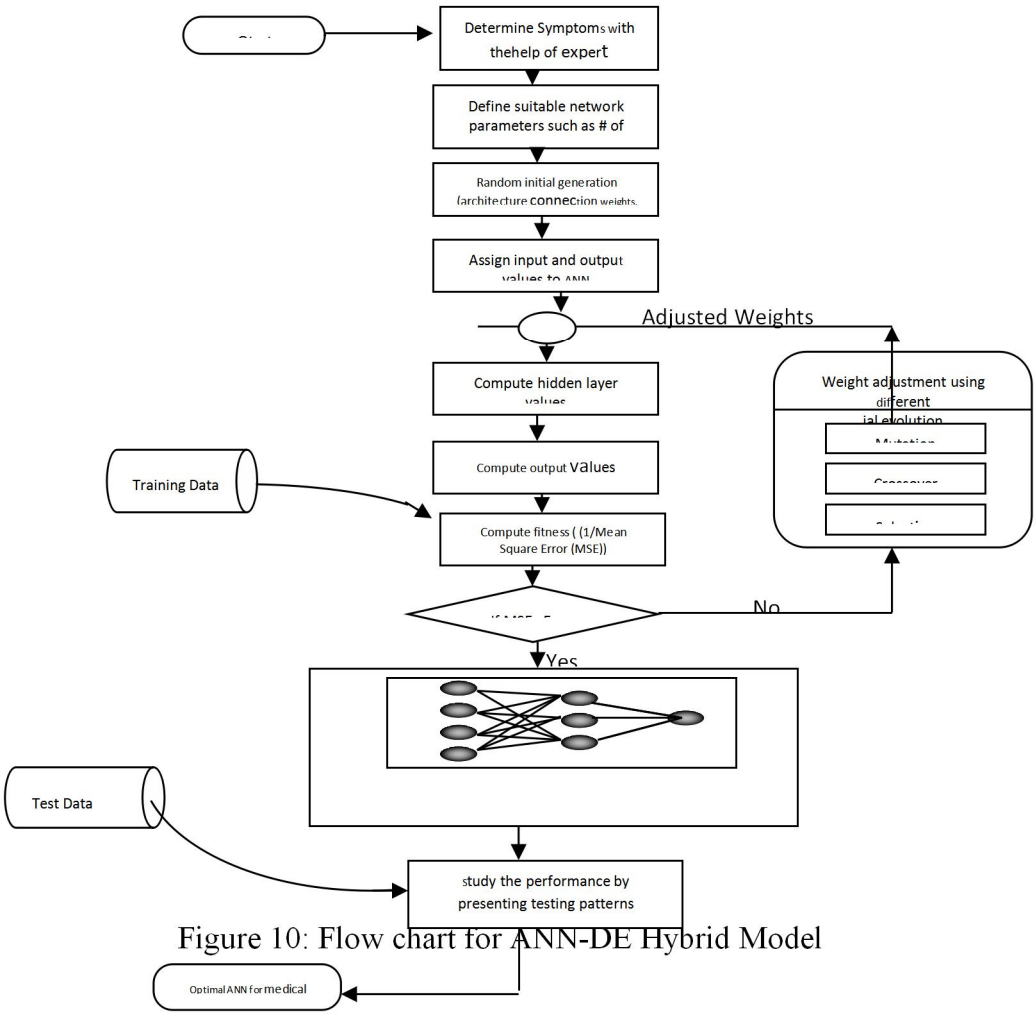

Figure 10: Flow chart for ANN-DE Hybrid Model

Implementation of the hybrid Model

This section presents the implementation of DE-ANN hybrid model used for classifying Breast Cancer (BC). The implementation was carried out using MATLAB 7.10.0 (R2010a) to simulate the supervised learning of feed forward Artificial Neural Network (ANN), for the purpose of classifying BC. An experiment was conducted using

Wisconsin Diagnostic Breast Cancer (WDBC) dataset, consisting of 699 instances of cancer tumor with two decision classes, which are, 457 (65%) benign cases and 242 (35%) malignant cases.

Experimental Design

The experiment in this study integrates two algorithms namely, Differential Evolution (DE) and Artificial Neural Network (ANN), to form a hybrid model called, Differential Evolution-Artificial Neural Network Model (DE-ANN). Supervised learning was applied on the WDBC dataset and implementation was done within MATLAB 7.10.0 (R2010a) software environment on an HP *Probook* laptop with Pentium 2.2GHZ processor and 4GB RAM. MATLAB software was adopted because it is an iterative software package for scientific and engineering numeric computations which produces faster prototype solutions than when a programming language is used. MATLAB is commercial software developed by Math Works *Inc*.

Evolution of initial Weights Using DE

The study uses DE algorithm to generate optimal real-valued parameters as initial weights for the ANN. The weights are randomly generated between -1.0 and +1.0, after which they are assigned to each link in the ANN. The study requires 2 sets of vector weights; first vector set consists of connection weights between input and hidden layer and second vector set for connection weights between hidden and output layers. Basically, the performance of weights evolution using DE depends on number of populations and generations. Consequently, setting these parameters requires great care, as, if they are set low, the evolution may converge to immature solution and if they are set too large, would require longer computation time for convergence. In this study, the number of individuals in the population was chosen to be 60 while the number of generations used to evolve the solution was set to 20. DE evaluates the fitness of the current population before creating an entire new population and then evaluates the fitness of the new population so created. The objective function is minimization of the Mean Squared Error (MSE). The fitness function considered in this study is the minimum MSE which was computed by recalling the network. The probability of crossover on average is chosen to be 0.7 and mutation rate is chosen to be 0.03. Roulette wheel selection method is used for doing the crossover operation.

To train the networks, the data are divided into three sets: (1) training (TR), (2) validation (VA) and (3) test (TE). The training set contained the data used to update the synaptic weights. The performance of the network is evaluated on the validation set, and the testing set is used to measure the performance of the network after the training. The training ratio is decided based on repeated iterations with different training-testing-validation ratio. This study decided on 70% for training, 15% for testing and 15% for validation.

Results

The classification accuracy was calculated as the ratio of the number of samples correctly classified to the total number of samples. Experimental results are shown in tables 2 and 3. The Testing results substantiated that the DE-ANN model is an effective model for classifying BC, because of its very low MSE (3.9276e-8). Small value of MSE indicates that the residuals were small, meaning that Multilayer Perceptron (MLP) fitted the data well.

Comparison of the results of the reviewed LS-SVM with the proposed DE-ANN shows that DE-ANN gives a slightly better model, judging by the values of their respective calculated accuracy. The accuracy figure for DE-ANN is 99.85% while that of LS-SVM is 99.75%. See Table 3

Table 2 showing a summarized result for MSE from MATLAB

Sets	Samples	Mean Square Error
Training	489	3.93245e-8
Validation	105	4.16325e-8
Testing	105	3.9276e-8

Table 3: Accuracies for DE-ANN and LS-SVM

	DE-ANN	LS-SVM
Sensitivity $= \frac{TP}{A} * 100\%$	$\frac{456}{457} * 100\% = 99.78\%$	Not Available
Specificity $= \frac{TN}{B} * 100\%$	$\frac{242}{242} * 100\% = 100\%$	Not Available
Accuracy $= \frac{TP+TN}{TP+FP+TN+FN} * 100\%$	$\frac{456+242}{A699} * 100\% = 99.85\%$	99.75%

Conclusion

This study uses differential evolution (DE) training algorithm to evolve the initial weights to train feed forward neural network. The result obtained shows clearly that DENN is slightly better than LS-SVM in term of convergence time and accuracy.

The study concluded that:

DENN algorithm converges faster with better and acceptable classification than LS-SVM, DE effectively improves ANN learning due to its simple calculation compared to LS-SVM, Differential evolution is a small and simple mathematical model of a big and

naturally complex process of evolution. So, it is easy and efficient. Also the success of differential evolution resides in the manner in which initial neuron weights were generated, Implementation of DE as parameter tuning to standard algorithm gives improvement to the convergence rate and The network architecture and selection of network parameters are critical to both algorithms.

Future Work

Based on the experiments, several suggestions can be implemented for future work and these include:

DE algorithm might obtain better results than what was mentioned in this paper either by changing the schema or changing the parameter setting. Hence, as a future work, other schemas for DE i.e. (DE/rand/2) might be used or DE parameters might optimize to choose the best value for F, CR and network structure. Also, for future work, more algorithms could be used to compare with the proposed algorithm. Time constraint did not permit comparison with more than the one LS-SVM used in this dissertation. Develop DENN to be more public with high speed through the usage of NN weights and passing these weights directly to MSE.

Due to time constraints, the programs are implemented for training purposes. Therefore, further experiments need to be executed for validating the network structure on testing dataset for generalization and verification purposes. The DE-ANN proposed algorithm can also be explored for classifying the GSM frequency allocation systems in order to enhanced service delivery.

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Authours' Biographies

Dr Aremu Dayo Reuben obtained a Ph.D. degree in Computer Science from the Department of Computer Science, University of Zululand, KwaDlangeZwa, South Africa in the year 2008. He received the National Research Foundation (NRF) award to pursue his Ph.D. research in Computer Science in 2005. He had earlier on obtained a Master of Science (MSc.) degree in Mathematics with Option in Computer Science and a Bachelor of Science (B.Sc. honours) degree in Mathematics

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DESIGN AND IMPLEMENTATION OF A NAVIGATIONAL SYSTEM FOR THE UNIVERSITY OF ILORIN

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Abstract

The 21st century is characterised by a myriad of developments, the availability and use of Information and Communication Technologies (ICTs) topping the chart, blazing the path for even greater developments in this field of study and providing for the simplification and automation of previously unimaginable tasks and activities. The University of Ilorin as an institution of higher learning, in which advanced development and awareness of ICTs is fostered is one which is facing a peculiar problem; the problem of population explosion and a simultaneous increase in number of structures on ground. This rapid increase in the number of buildings can sometimes prove rather confusing for the average student who has to move from one place to the other in quick succession. This research addressed the problem of using visualisation through the use of ICTs to provide a cheap solution built primarily for the University of Ilorin, a Geographic Information System, to help with the navigation process. An extreme programming software development model was employed in the development process to create adequate understanding of the project and also hasten it up, while ensuring smooth transitions in the development process. The application was designed and developed using HTML5, CSS3, and Google Polymer for the client-side of the application program, while the server-side of the application was developed using JavaScript, Google Maps API, as well as Google Map API for the routing scheme implemented in the application.

Keywords: Information and Communication Technologies, simplification and automation, Geographic Information System, navigation and visualisation

Introduction

The increasing demand for information at popular destinations has driven specialists to focus on finding better guiding solutions. The traditional guiding solutions are fixed interpretative signs, multi-media interpretation in an audio-visual room, and group guiding with a guide. Visualisation and graphic representation of guiding information using geographic information systems (GIS) techniques are useful approaches to improve such a guiding process (Tzu-How, Meng-Lung & Chia-Hao, 2011).

Information has always been the cornerstone of effective decisions, and thus the debate for the need of maps (more conveniently, digital/electronic maps) as a guide and a source of direction in various cases is no longer a bone of contention, as the usefulness cannot be overemphasised, however, the usefulness of these maps to the users might be the bone of contention here, and this has brought about the development of maps and information systems of various kinds and technology with increasing usability and affordability on the path of the end-users. The advent of technology has however necessitated the need for improvement in this technology as the task of carrying a map around and searching for directions is now considered a strenuous task in our appropriately labelled "lazy generation" when we consider other ways new technology can make these activities easier to carry out.

An information system as defined by Brovelli (2014) is an organised set of procedures, human resources, material resources, used to gather, store, process and communicate information needed by an organisation to manage its operational and government activities. In other words, it can be described as a system which helps its users in making informed decisions by providing them with the appropriate information. The concept of an information system leads us to that of a Geographic Information System (GIS) which can be defined as acomputer application capable of performing virtually any conceivable operation on geographic information, from acquisition and compilation through visualisation, query, and analysis to modelling, sharing, and archiving (Longley, Goodchild & Maguire, 2010). In turn, geographic information is defined as information linking locations on or near the Earth's surface to the properties, characteristics, and phenomena found at those locations.

The University of Ilorin, Ilorin, Nigeria is a foremost institution, one of the 128 Universities in the country (Adesulu, 2014) located in the central part of Nigeria, about 500 kilometres from Abuja, the Federal Capital Territory with a land mass of 15,500 hectares (AAU, 2011). Over the years, the University has been experiencing, and is still experiencing rapid growth and development both in numbers, i.e., in terms of the student and staff population, and structures. This growth and expansion of the school can be attributed to the increase in number of students, as the university has recently created new faculties and departments, increasing the number of faculties to 15, and the total number of departments to 99 (Oshin, 2013). This is to create room for more entrants into the various academic programmes being offered by the school annually.

The advent of ICTs has helped in creating a myriad of ways by which things can be done, a shift has been experienced from the use of conventional tools to new ICT tools and facilities through which problems of movement and navigation can be solved. This is to our benefit as we can take advantage of these and explore to our benefit. These systems exist to help ease the process of navigation by providing information that can be used to perform the intended activities. The need for a system that will ease the everyday process of navigation cannot therefore be overemphasised.

This work is therefore poised to the creation of a web as well as a mobile based application peculiar to the University of Ilorin that will enhance and ease the process of navigation from one location to the other within the school as well as structure identification to ease the movement process by the university population.

The rapid, continuous increase and development of structures and buildings within the University of Ilorin campus can be seen and described as a step in the right direction, as the problem of inadequate resources and facilities is being combated by making provisions for more facilities to serve her students and staff. With the simultaneous increase in the number of students due to creation of more departments and faculties, as it was recorded that in the 2014/2015 academic year, a total of 12,650 new intakes were matriculated into the school (Odunsi, 2014) as against the 8,587 that were admitted in the 2013/2014 academic session (Jimoh, 2014) and which cannot be compared to the 7,098 students admitted in the 2012/ 2013 session (Nwogu, 2013). With a 78 percent increase in number of students admitted into the school from 2012/2013 session to the 2014/2015 session, it can be said that the university population is growing in leaps and bounds. The task of moving from a location to another is increasingly becoming a challenge which needs to be addressed by the use of modern technology.

As regards navigation and easy movement, it can be said that technology has been adopted to come to our aid with hardware, software, and a combination of both hardware and software solutions such as Google Maps, Open Street Maps, GPS systems, etc., to ease our navigational activities. The GPS (Global Positioning System) in cars is an example which provides navigational aid for road users to get to their destinations, and it can be said that the same problems cars are facing, the University of Ilorin is currently facing also. The above mentioned solutions are to a level solving the problems, but still cannot be compared to the solution that will be provided by a bespoke application, well suited solely for the university environment.

Literature Review

Geographic Information Systems (GIS) was defined by Fadahunsi (2010) as one in which computer systems record, store, and analyse information about the features that make up the earth's surface. It is a computerised system for capturing, storing, checking, integrating, manipulating, analysing, and displaying data which are spatially referenced to the earth. Gottrell & Elliot (2009) also defined Geographic Information System (GIS) as a computer-based system for collecting, editing, integrating, visualising and analysing spatially-referenced data. Such data comprise two forms: the locational element and associated "attributes". GIS links geographic information (where things are) with descriptive information (what things are). GIS represents features on the earth – buildings, cities, roads, rivers, and states – on a computer (ESRI, 2014). Fadahunsi (2011) also adds that an ideal GIS defines spatial relationships among all data elements, in terms of how linear features are connected, how areas are bounded, which areas are contiguous, etc. This gives a premise into what the idea and usage of a typical GIS will be.

A map is defined as a representation, usually on a flat surface, of a whole or part of an area. The job of a map is to describe spatial relationships of specific features that the map aims to represent. There are many different types of maps that attempt to represent specific things. Maps can display political boundaries, population, physical features, natural resources, roads, climates, elevation (topography), and economic activities (Karpilo, 2014). Wolfgang (2004) however noted that a major disadvantage of maps is that they are restricted to a two-dimensional static representations, and are always displayed in a given scale. The evolution of GIS is, of late, very much tied to accessibility. In other words, the fact that these approaches to working with geospatial data are becoming increasingly available to people regardless of expertise is indicative of their evolution. By the same token, it is also accessibility and the lack of it that is an obstacle to progress (Deakin, 2009). The list of the types of GIS may be exhaustive, but on the basis of this literature, some of the types of GIS are: the four-dimensional GIS, Multimedia/Hypermedia GIS, Web GIS and the Mobile GIS.

Related Works

Development of a Location-Based Information System for Public Spaces

The basic idea behind the location-based information system is to connect information pieces to positions in outdoor or indoor space. Through position technologies such as GPS, GSM positioning, Wireless LAN positioning or Bluetooth positioning, the system keeps track of where a terminal and its user is located in space. Via his terminal, the user is allowed to enter information, to which the system automatically allocates a latitude-longitude coordinate. Later, the same user, or some other user, can access that information (again via their wirelessly connected terminals) when they enter the place. Although the digital information is stored on a remote server away from the actual location, the position technology and the mobile terminals give users the impression that information is actually “attached” to the place where the user is. In this way, location-based information systems create user experiences similar to those post-its, graffiti and public signs and posters (Persson, Espinoza & Fagerberg, 2002).

Development of Location Based Systems for Mobile Phones

Location aware services or systems are defined as context-aware services that utilise the location of the user to adapt the service accordingly (Kaasinen, 2003). Nulaz works with a small (J2ME) program on a mobile phone that connects to a GPS device. It receives its current location’s coordinates from the GPS, and transmits them (over GPRS or other data carriers and the Internet) together with a user ID to a central webserver, that stores them in a database. This process is repeated every few seconds. Nulaz can be used to show local relevant information. The software can also open a browser on the phone, in order to display relevant local information. The same webserver is then called with the ID and location of the user, and a mobile interface is shown. This mobile interface combines several data sources to show information about the area the user is in. the webserver also has a web interface for normal browsers, to enable interfacing with

the system from a PC, and certain data can also be viewed in Google Earth, a virtual globe application. When the user runs a small program on his phone, this program retrieves its current location, and transmits this to the webserver to store them, for the generating of tracks. The user can also start a mobile browser to show information relevant to his current location. This shows local pictures, a map or aerial picture of the surroundings, highlights from Wikipedia, restaurants in the surroundings, parking places in the area, movie theatres and their upcoming movies, cultural events, among others. All sources in Nulaz are sorted on distance from the current location of the user, to show only the most relevant items for that place (Pannevis, 2007).

AfriGIS Navigator

AfriGIS navigator is a complete personal navigation solution for mobile phones. The application is built on specific operating systems and enables its user to leverage the unique features of their handset. The client installed on the handset uses the AfriGIS navigation server via the mobile Internet to provide dynamic, 3D navigation views and voice commands. AfriGIS navigator also allows searching for addresses and points of interests (POI) with results returned from AfriGIS's comprehensive data sets. Once an address or point of interest is found, the most appropriate route from the current location can instantly be downloaded before activating the voice enabled, turn-by-turn navigation system. Voice navigation is accompanied by a high resolution, 3D view of your route on the handset screen. Users can also switch to a bird's eye view with satellite imagery if desired. A major benefit of the AfriGIS navigator application is the ability to share information (POI and addresses) with other uses via the inbox feature. This handy feature eliminates the hassle of sending written directions to your home or other locations to employees, friends or family members – simply send it to their inbox. The inbox feature can also be used to dynamically update route plans for travelling sales people or delivery personnel by updating their inbox with the next location on their route. Companies also have the option to customise the AfriGIS navigator according to their needs. Users can be tracked and an alert will be sent should the user deviate from a defined route or leave a specified geographic area.

Methodology

According to Faridani (2011), a software development methodology is a structure imposed on the development of a software product. It is a division of the software development work into distinct phases (or stages) containing activities with the intent of better planning and management. These stages are a collection of procedures, techniques, tools and documentation aids which will help the system developers in their efforts to implement a new information system (Avison & Fitzgerald, 2006). In other words, it refers to the framework that is used to structure, plan and control the process of developing an information system.

A wide variety of such frameworks have evolved over the years, each with its own recognised strengths and weaknesses (Roebuck, 2012). The success rate of software development projects can be increased by using a methodology that is adequate for the specific characteristics of those projects. Over time, a wide range of software development methodologies has been elaborated, therefore choosing one of them is not an easy task (Geambasu, Jlanu & Gavrila, 2011). One software development methodology is not necessarily suitable for use by all projects. Each of the available methodology frameworks are best suited to specific kinds of projects, based on various technical, organisational, project and team considerations (CMS, 2008). Adhering to a properly-defined methodology enables a project to provide better estimates, deliver stable systems, keep the customer informed, create a clear understanding of the task ahead, and identify pitfalls earlier allowing for ample time to make adjustments. The intent of a methodology is to formalise what is being done, making it more repeatable (Faridani, 2011).

Taking the project's framework and the given organisational structure into account, this study considered an extreme programming approach most appropriate for the development of a location based geographic information system. In this methodological framework, the progress of work will regularly be presented to future users and the institutions involved, and in this case, the developers of the work will run a constant review. It is a method of software development focused on providing the highest value for the customer in the fastest way possible. Extreme programming turns the traditional software development process sideways. Rather than planning, analysing, and designing in a linear fashion, extreme programming ensures that all activities are carried out a little at a time throughout the development phase. The software life cycle of extreme programming consists of six phases (Beck, 2000): exploration, planning, iterations to release, production, maintenance and death.

Phases of Extreme Programming

Exploration Phase

The exploration phase is the very first phase of the program development and for the purpose of this project, it was characterised by the familiarisation with the technologies and tools intended for the development of the application program. It also involved the installation of the desired tools and technologies that were not available prior to the initiation of the program. Storyboarding was also used to coin the user stories which present the intended functionalities for the application program, paving the path for clearly defined goals and objectives. The exploration phase is also known as the Analysis Phase.

Planning Phase

For any project, the planning phase stands as the most important phase, and for this project, the standard remained. This phase was characterised by the estimation of costs, i.e., time, monetary, personnel, and resources cost of the project so as to present an idea of what was needed to execute the project. Also included in this phase was the development of a schedule as well as a proposed completion time. A rough plan, which comprised what is known as The Planning Game in extreme programming lingua was developed, this was developed with the intention of further refinement as the project proceeded. A work breakdown was also developed to appropriately plan the execution of the project.

Iterations to Release

This phase of development included incremental developments of the application program, further design of application features and then the testing of the program, which then led to further development and testing until the final product was satisfactory enough to meet and surpass the functionalities included in the user stories.

Production

In this phase of the application development, the performance was analysed at the present stage of production, together with the released product in the previous phase. Revision of the release led to suggestions of modifications. Persons outside of the development team were also given the prototype to carry out tests so that further modifications can be pointed out, and they are then evaluated to go to the maintenance phase or being included in a next iteration if the cost and objectives suggest it.

Maintenance

In this phase, the modifications suggested by the team as well as other testers are implemented and an extra caution to integration is required. All user cases are re-run after the modifications are done and an update of the previous release is presented and then considered for final development and presentation.

Death

This phase of the project is the very final phase of the development process, and it occurred when all work regarding the development of the program had been concluded. Documentations were finalised and executed in a detailed fashion so as to provide a guide for future users, and descriptions of all functionalities was made and then presentation was carried out.

Analysis of the Various Modules Involved

Modularisation is the process of breaking a software system into a set of collaborating components. Each of these components should ideally have high cohesion and low coupling. Modularisation is inherently a recursive process. High cohesion means that each of a components are closely related to each other. Low coupling means that each component should be independent of the other components. A module in software is a part of a program. Programs are composed of one or more independently developed modules that are not combined until the program is linked. A single module can contain one or several routines.

The following are the various modules that the proposed software application will be composed of:

The Map Module

The base map which is the background of the application was originally developed making use of the Google Maps API, which provides the basic information based on the information available on the public map and the satellite images captured. The images captured however, were not the most recent, as it was dated January 2014, and since then a lot of buildings and infrastructures have sprung up in the school which are not reflected in this edition of the map. The map module is responsible for fetching the map using the Google Maps API provided. It provides the user of the application an interactive map upon which all other features of the proposed application will be built.

The Direction Module

This is a sub of the map module, but rather than just displaying the map to us, it is responsible for calculating the distance between any two points selected on the map. It helps in the practical navigation and provides navigational guide based on two recognised modes of transportation, i.e., the walking mode of transportation, and the vehicular mode of transportation. Based on either of this, the module suggests the most suitable path to your destination. This will be done via colour coding of the start location to the final destination, as well as provision of worded instructions on the left section of the page. This part of the application is a continuation of the map module and is an extension of the traditional features of the map module. It provides the user of the map with map functions such as the estimated distance and time between two or more points on the map, it also presents the user of the map with direction specification based on the map and locations selected on the map.

The Geolocation Module

The geolocation module includes the representation of all locations on the map in longitude and latitude, this helps to ensure that the location selected is indeed in

existence. This module also include a renaming component in which all buildings and locations were renamed to the popularly recognised and referred to names, this is to help with the localisation of the application to one that can easily be interacted with. This module of the application consists of the longitude and latitude direction that make up the directional element for the application. It is with this that the individual is able to get the precise locations of the place wherewith he/she seeks direction.

Design Tools

Balsamiq Mockups

Balsamiq Mockups is a graphical user interface (GUI) mock-up builder application. It allows the designer to arrange pre-built widgets using a drag-and-drop WYSIWYG (What You See is What You Get) editor. The application is offered in a desktop version as well as a plug-in for Google Drive, Confluence and Jira.

Sublime Text

Sublime text is a sophisticated text editor for code, mark-up and prose. It is a great general purpose text editor that offers plenty of power to anyone working on websites. It is especially well suited to anyone wedded to the keyboard, providing powerful shortcut and tools to move about a document, make selections, filter the file, and make quick edits. Switching between different projects is also very fast which makes it perfect for anyone juggling multiple clients. Sublime text may be downloaded and evaluated for free, but a licence must be purchased for continued use.

Application Development Technologies

HTML5

HTML5 is a core technology mark-up language of the Internet used for structuring and presenting content for the World Wide Web. HTML5 is the fifth revision of the HTML standard of the World Wide Web Consortium (W3C). Its core aims have been to improve the language with support for the latest multimedia while keeping it easily readable by humans and consistently understood by computers and devices.

Google Maps API

An API (Application Programming Interface) is a set of programming instructions and standards for accessing a web-based software application or web tool. An API is a

software-to-software interface, not a user interface. Google offers an extensive API to include its maps in webpages, this API allows you to display maps on your website and also allows you to customise maps, and the information on maps. This API consists of JavaScript, which can be included in the page that generates the code for showing and modifying the maps. The maps consist of many images, slicing the world in pieces of 256*256 pixels. The API offers two kinds of maps: one with a map view, and one with aerial view. The coverage of each tile depends on the zoom level, and varies from whole continents to sub-street level. In the lowest zoom, the whole world fits in one tile, and each consequent zoom doubles the number of tiles in both directions. The amount of zoom available varies for different parts of the world (Pannevis, 2007).

CSS3

CSS3 is the latest standard for CSS (Cascading Style Sheet), it is completely backwards-compatible with earlier versions of CSS. Cascading Style Sheet is a style sheet language used for describing the look and formatting of a document written in a mark-up language. CSS can be applied to any kind of XML document, including plain XML, SVG and XUL. Along with HTML and JavaScript, CSS is a cornerstone technology used by most websites to create visually engaging webpages, user interfaces for web applications, and user interfaces for many mobile applications.

CSS is designed to enable the separation of document content from document presentation, including elements such as layout, colours and fonts. This separation can improve accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple HTML pages to share formatting by specifying the relevant CSS in a separate .css file and reduce complexity and repetition in the structural content.

JavaScript

JavaScript is the most popular programming language in the world designed by Brendan Eich and developed by Netscape Communications Corporation, Mozilla Foundation, and Ecma International. JavaScript is a dynamic computer programming language, it is the programming language of HTML and the web. It is most commonly used as part of web browsers, whose implementation allow client-side scripts to interact with the user, control the browser, communicate asynchronously, and alter the document content that is displayed. It is also used in server-side network programming with runtime environments such as node.js, game development and the creation of desktop and mobile applications. JavaScript is classified as a prototype-based scripting language with dynamic typing and first class functions. This mix of features makes it a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles.

Google Polymer

Google Polymer, also known as material design, was launched by Google in May, 2013. Google Polymer allows you to craft your own HTML elements and compose them into complete, complex web applications that are scalable and maintainable. It is essentially about creating new (i.e., custom) elements that can then be reused in your HTML pages in a declarative way, without needing to know or understand their internals.

Results

Essentially, the application is started as soon as a Wi-Fi network can be connected to in the school environment, as the application will be housed on the school campus area network to help reduce the hassles of internet connectivity. Once a network is located and the application is launched, it proceeds to a web page, which can be displayed conveniently either on your laptop, tablet or smart phone screen, this shows the landing page, consisting of a map of the University of Ilorin showing the various buildings and structures within. To start navigating, you are provided with an option to select from the various modes of transportation available (i.e. walking and driving), after a decision has been made, you will have to input the start address, as well as the end address, i.e., your location as well as your intended destination. After these have been inputted, visual directions in form of a line from your location to your destination is provided, as well as worded directions which provides you with information on how to get to where you intend to from where you currently are.

Start Page of the Web Application

The application is a single page application with components that interact with one another to provide the overall functionality for the application. The start page provides a map overview of the University of Ilorin as shown in figure 1. It also serves as the launching point for all activities on the page. The blank column on the right is reserved for worded directions.

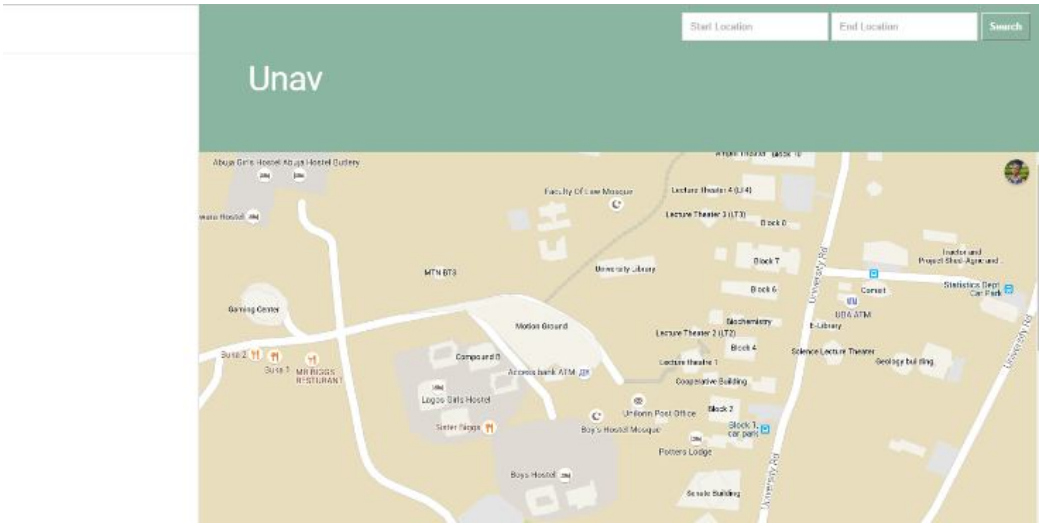

Figure 1. Start page of the application

Querying the application

Input to the application is done by typing into the boxes on the upper left section of the page. This facilitates ease of use and provides for convenience in a situation where you want to know in advance the directions to an intended location. Since the application has been localised for the University of Ilorin, an entry into either of the search boxes provide suggestions of locations within the school environment as shown in figure 2 using their commonly referred to names, this was done by creating a database containing all possible locations within the school environment, and this simplifies the process of searching.

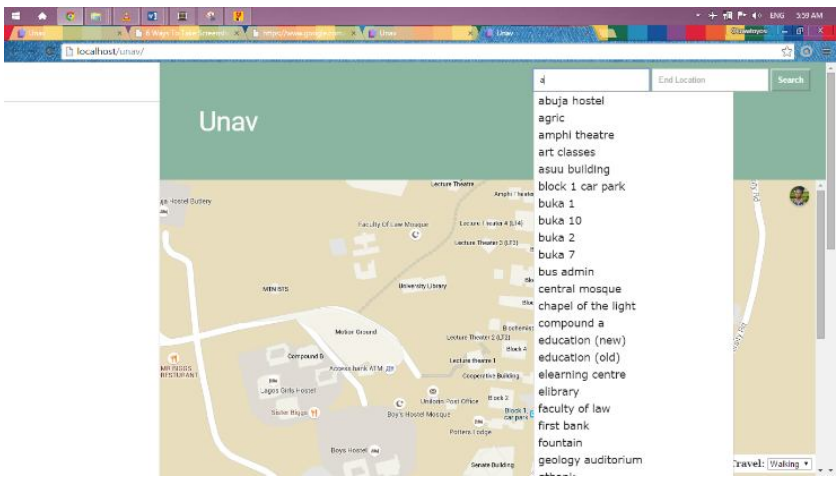

Figure 2. Suggestions based on input into the query box.

Walking Mode of Travel

For the purpose of this documentation, selecting the walking mode of travel, we have specified our start location as Lagos Hostel, and our end location as BSS Lecture Theatre, popularly known as BLT. Clicking on the search button will display navigational instructions on the left section of the page, as well as a visual specification of the path leading to the destination as shown in figure 3.

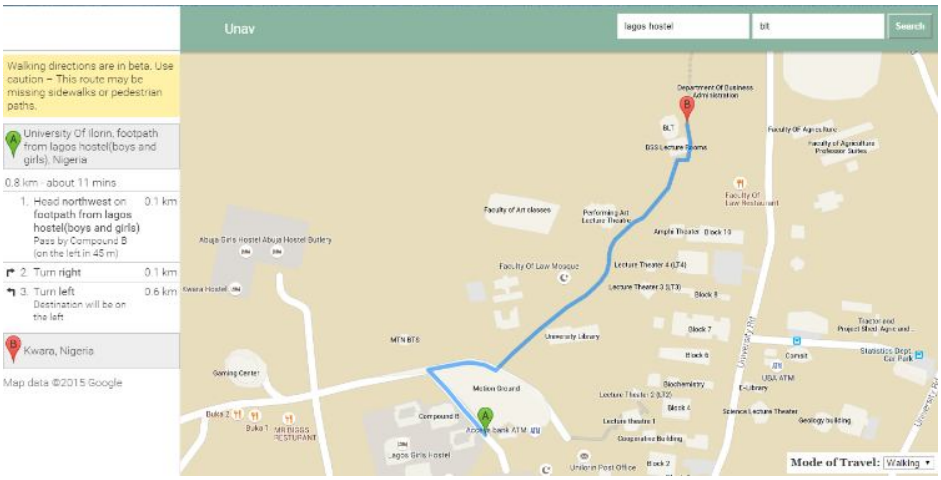

Figure 3. The specified path from location to destination

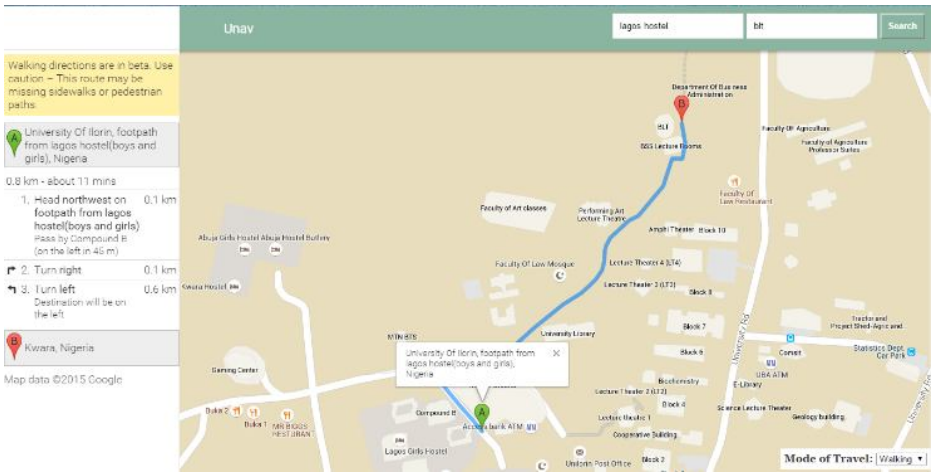

Figure 4. The start location as inputted, i.e. Lagos Hostel

The Figure 4 below specifies the start location as University of Ilorin footpath from Lagos hostel, Nigeria, and proceeding along the path will provide further directions as shown in subsequent images.

The next direction (route) towards the intended destination as provided by the application is to make a pass by the hostel, taking a turn around compound B on the left as shown in figure 5.

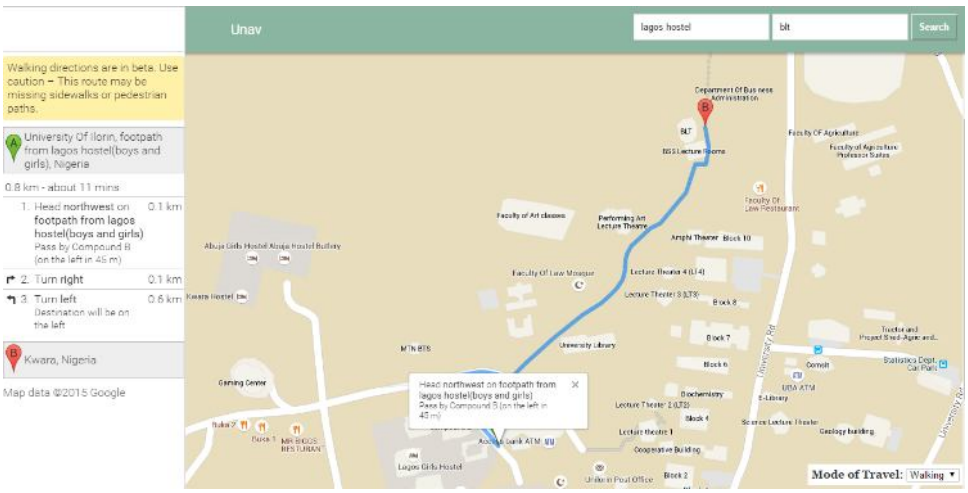

Figure 5. The next direction to the destination from Lagos hostel

The routing algorithm proceeds to provide instructions along the specified path at multi-faceted corners until the intended destination is reached.

The final destination which is BSS Lecture Theatre is reached and specified by the application, as shown in figure 6.

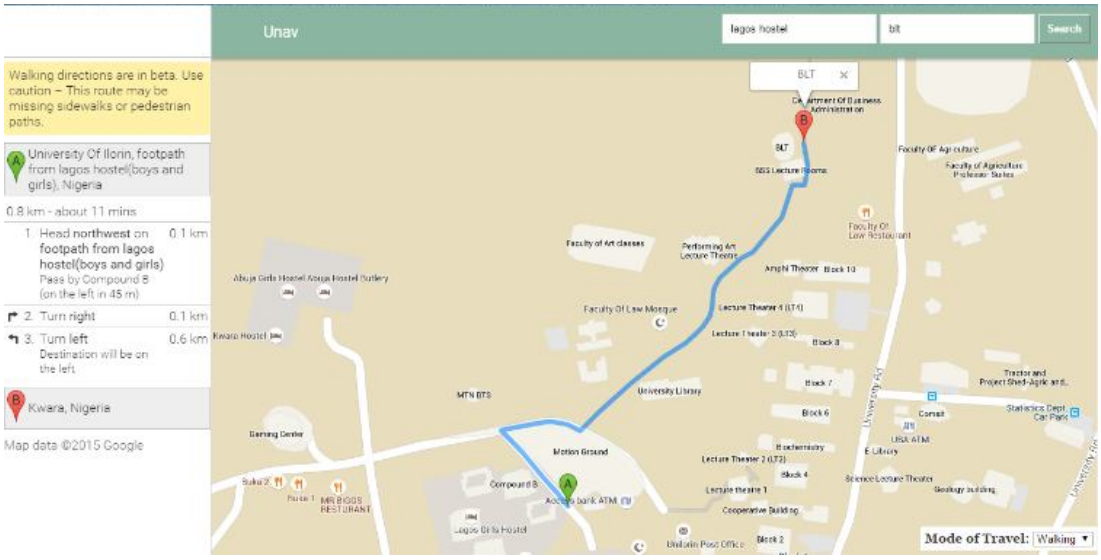

Figure 6. The final destination, i.e. BLT

Conclusion

In this work, a considerable effort has been made to develop an interactive navigational system for the University of Ilorin, which can be employed in carrying out various navigational and informational tasks within the school environment. The idea of an automated navigational system might sound ludicrous in the face of the university's current effort to ensure that readable signs are placed in front every structure in the school, but when you think about the world and how automation (ICTs) is making the process of carrying out activities easier, the cause behind the project is strongly justified. This supports the needs for innovation on the grounds in which it is being fostered.

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POLITICAL COMMUNICATION AND VOTING PATTERN OF NIGERIAN ELECTORATES: A COMPARATIVE ANALYSIS OF THE 2011 AND 2015 PRESIDENTIAL ELECTIONS

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Abstract

The political history of Nigeria shows that voting pattern at presidential elections reflects ethno-religious inclination. This is evident in almost all the elections starting from the first republic to subsequent ones. Against this background, the study makes a comparative analysis of the 2011 and 2015 presidential elections. The purpose is to determine if there exists significant difference in the voting pattern between the two elections. Population of the study is the 2011 and 2015 presidential elections from which the study purposively selects sample of results of two outstanding contenders. Method of study is quantitative content analysis of results of the two elections as announced by the Independent National Electoral Commission, INEC. Findings, which were descriptively presented, show an insignificant difference in the voting pattern as the 2011 presidential election shows a relatively general geographical spread in favour of President Jonathan while the reverse is the case in the 2015 presidential election except that in the 2015 election, President Buhari fails to win any state in the South-South and South-East geo-political zones. The study concludes that the voting pattern has changed insignificantly. Based on findings, the study recommends among other things, the need for electorate to eschew voting based on ethnic and religious sentiments.

Keywords: Political communication, presidential election, mass media, electioneering campaign, political party, electorate.

Introduction

On March 28, 2015, Nigerian electorate went to the polls to elect the next president who would assume leadership on May 29, 2015. The election, which was initially scheduled to take place on February 14, 2015, was postponed due largely to the spate of Boko Haram insurgency that was ravaging particularly the North-East part of the country for the past six years. This was amid doubts about efficiency of the card reader, poor distribution of Permanent Voter Card, PVC and other logistic problems that have become a perennial problem confronting the Independent National Electoral Commission, INEC, charged with the responsibility to midwife elections. This inclined Olujide, Adeyemi and Gbadeyan (2011, p.179) to express similar concern about elections in Nigeria thus: The present democratic dispensations have shown that the Independent National Electoral Commission (INEC), the electoral body responsible for

the conduct of elections in Nigeria has not lived up to expectations in terms of poor planning, excluding electorates from voting, inadequate supply of voting materials and late arrival of electoral officers to polling station (Abdullahi 008; Omodia 2009).

Therefore, it is not surprising that the postponement of the 2015 election was also interpreted variously as part of "an elaborate attempt to rig them, a broad move to block such attempts, sheer incompetence, or a mixture of all three" (BBC News Africa, April 4, 2011). Even though, the election was postponed, uncharacteristic of Nigerians, who would have developed a sense of political apathy, rather demonstrated a sustained uncanny enthusiasm.

Going by INEC pronouncement, out of the about 50 political parties that registered in 2011, only 19 featured presidential candidates. Similarly, not all registered political parties featured presidential candidates in the 2015 election as only 14 political parties did as against the existing 28 political parties (http://www.inecnigeria.org/?page_id=18).As if it was an enactment of the 2011 presidential election, of the 14 presidential candidates, two incontrovertibly took the centre stage in the public sphere; incumbent Dr. Goodluck Ebele Jonathan of the Peoples Democratic Party, PDP and General Muhammadu Buhari (rtd) of the Congress for Progressive Change, CPC, who previously contested on the platform of the All Nigerian Peoples Party, ANPP. Mohammadu Buhari had in the previous three successive elections unsuccessfully contested under different platforms for the coveted presidential seat. Top on the agenda of the PDP was "transformation" which the party leveraged on certain projects and policies while the APC had "change" as her nameplate mounted on the tripod of fight against corruption, economic empowerment and national security.

Similar to what transpired prior to the April 16, 2011 presidential election, both the traditional mass media and social media platforms ceaselessly featured debates, commentaries, opinions and advertorials and documentaries of various kinds during the electioneering campaign preparatory for the 2015 election. This finds expression in the words of Adibe, Odoemelam and Chibuwe (2011) cited in Okoro and Nwanfor (2013, p.30), who posited that besides the use of traditional mass media "almost every institution involved in Nigeria's elections conducted an aggressive social networking outreach, including the Independent National Electoral Commission (INEC), political parties, candidates, media houses, civil society groups and even the police". The aggressive media use was premised on what Olabamiji (2014, p.44) observed that "media have been in the vanguard of political communication, mediating even the interpersonal model". The traditional mass media was alive to conscientise the Nigerian electorate on the processes and electioneering etiquette during the election seasons. This feat was complemented with the amazing use of the social media platforms to achieve similar objectives. Unfortunately, most of the media messages centred not really on fundamental issues or ideologies and manifestoes of the political parties. Rather, discussions were ostensibly on individual credentials and personality. Even where

attempts were made, there was apparent lack of significant difference in their respective ideologies and manifestoes.

With the deployment of available media platforms, the overwhelming influence of media messages on the electorate became manifest in their resilience not only to register for the election but to also obtain their Permanent Voter Card, PVC, which according to INEC was a basic requirement to vote at the 2015 election. By implication, through political communication, it was incontestable that Nigerians had become politically conscious of the need to exercise their franchise.

Considering the level of poverty in Nigeria, this is why the World Bank (2009) reported that majority of the citizens lack adequate knowledge to make informed decisions about political issues, some Nigerians were indisposed to actively participate in the elections. However, most Nigerians, who were dissatisfied with the way the economy was ill-managed thus exacerbating the level of poverty did not only show eagerness to actively participate in the elections but also advocated for a change of government prior to the elections. This was in spite of some measure of developmental strides of the current administration. However, the incumbent was re-elected in the 2011 presidential election. In the 2015 election, despite the apparent opinion impasse between the pro-incumbency and anti-incumbency, the hitherto apathetical Nigerian electorate, who are presumably better informed and continued to crave for change of government, took it upon themselves to determine their socio-economic and political destiny through active participation at the polls. This marked the dethronement of incumbent president Goodluck Ebele Jonathan following the victorious emergence of General Muhamadu Buhari (rtd) at the poll as president in his fourth presidential contest.

Statement of the Problem

At every dispensation in the political history of Nigeria, the character of electorate appears interesting. While at given instances, the electorate develops a sense of political apathy due to injustice, deprivation and oppression, at other instances like in the recent times, particularly during the 2015 presidential election, the Nigerian electorate exhibited great enthusiasm to actively participate at elections. This is in spite of the sustained injustice, deprivation and oppression they are subjected to. Reasons could not be detached from the heightened awareness occasioned by vigorous political communication. Through political communication the electorate has come to the realization that it is by exercising their franchise that they could hold those in office of trust accountable. Historically, the voting pattern at elections in Nigeria in most cases reflects religious and ethnic colouration. Against this backdrop, this study seeks to make a comparative analysis of the voting pattern of Nigerian electorate, who actively participated in the 2011 and 2015 presidential elections with a view to determining if there is significant difference in the voting pattern between the two key elections.

Objectives of the Study

The objectives of the study are to:

i. Explain the voting pattern of the electorates at presidential elections.
ii. Determine if significant difference exists in the voting pattern between the 2011 and 2015 presidential elections.

Research Questions

Arising from these two objectives are the following research questions:

i. What is the voting pattern of the electorates at presidential elections?
ii. What is the significant difference in the voting pattern of the 2011 and 2015 presidential elections?

Theoretical Framework

The study makes use of the voting behaviour theory which attempts to explain the influences that define a person's political views, ideology, and levels of political participation. Key proponents of this theory are Karl Deutsch and Theodor (Adorno, 2012, p.30). The principle underlying the theory is that there are agents of socialization which shape voters' political orientation. Deys (1997) construed socialization as the process through which individuals acquire knowledge, habits, and value orientations that will be useful in the future. On the basis of this, voting behaviour theory identifies the family as one of the sources of influence that shape political orientation which creates long-term effects. As a basic unit of society, the family influences children to adopt their parents' ideological values. In the same way, teachers, who serve as foster parents to pupils and students, and other educational authority figures have a significant influence on voters' political orientation. The theorists recognize the influence of peers who also affect political orientation of voters.

Other factors that affect voting behaviour are the mass media which today comprise print, broadcasting and online channels. According to McNair (2011, pp.10 &11), the media are devoted to reporting, aggregating or commenting on political issues; and social networking sites such as Facebook, and Twitter, allow internet users to share information rapidly. The mass media modify political orientation by entertaining, informing and educating as they correlate and interpret the political process as well as feature campaign issues, debates and commercials. By so doing, the mass media shift certain political behaviours based on the candidates involved, which have different degrees of effectiveness in influencing voters (Wikipedia, 2015). Proponents of the voting behaviour theory further argue that demographic variables like age, gender, and ethnic groups also play a fundamental role in shaping the voting behaviour of electorate.

This theory is relevant to this study because the agents of socialization exert considerable influence on the voting behaviour of voters. Families and teachers influence children right from birth to their formative stage of political development. In the case of the mass media, they serve as the nucleus through which political communication takes place. The mass media play a great role of carrying out various activities such as coverage of election campaigns and news coverage. Consequently, the mass media influence the behaviour of voters before, during and after the elections. They achieve this through repeated election campaigns, news coverage and so on, thereby enlightening voters on the process of voting, who to vote for, and who not to vote for.

Conceptual Clarification

Political Communication: Denton and Woodward (1990, p.14) provided one definition of political communication as pure discussion about the allocation of public resources (revenues), official authority (who is given the power to make legal, legislative and executive decision), and official sanctions (what the state rewards or punishes). This definition simply implies the use of verbal and written political rhetoric. Intrinsically, visual means of communication is also involved. Building on this one could view political communication as an interactive process concerning the transmission of information among politicians, the news media and the public (Franklin, 1995). The process operates down-wards from governing institutions towards citizens, horizontally in linkages among political actors, and also upwards from public opinion towards authorities. Broadly speaking, Franklin (1995) argued that political communication focuses on the analysis of the:

a) Political content of the media.
b) Actors and agencies involved in the production of that content.
c) Impact of political media content on the audience and/or on policy development.
d) Impact of the political system on the media system.
e) Impact of the media system on the political system.

The deliberate use of political communication is to serve political objective which is to enable the electorates become knowledgeable about the political process, existing political parties, and party ideologies and manifestoes as well qualities of candidates political parties feature at elections. This informs Denton and Woodward (1990) to characterize political communication in terms of the *intentions* of its senders to influence the political environment, as they put it: The crucial factor that makes communication 'political' is not the source of a message [or, we might add, referring to their earlier emphasis on 'public discussion', its *form*], but its content and purpose (p.11).

Electorate: The American Heritage Dictionary of the English (2000) defined electorate as a body of all qualified voters. In a similar way, Word Net 2.0 English Dictionary (2003) described it as the body of enfranchised citizens, that is, those qualified to vote.

The implication of two definitions suggests that electorate is eligible voters or people who are qualified to vote for a political party or candidate of their choice. The electorate is expected to vote at elections because voting is the commonest measure of political participation in a democratic nation to choose its leaders. Onah (1997, p.289) elaborated that of all the various forms of participation in the political process in a country, 'voting is perhaps the simplest, cheapest and the most obvious form of participating in politics'.

Review of Related Literature

Election is a process of selecting, voting and mandating the people who will hold either legislative or executive positions as well as steer the affairs of a state for a period of time. Election contests are regularly scheduled events between peoples or groups, and they are governed by a set of rules. In Nigeria, the rules are set out in the 1999 constitution as amended and Electoral Act passed by the National Assembly. The Independent National Electoral Commission (INEC) is the umpire while Electoral tribunals and the law courts are the interpreters of the rules in cases of dispute. Election contests are full of drama much of which stem from the spontaneity of the action and uncertainty of the outcome (Nimmo & Combs, 1990).

According to Ejiofor (2007, p.75), voting is the one exercise that demonstrates the extent of people's involvement and participation in politics. When free and secret ballot voting takes place, the direction and quantum of individual's participation come out in their true form. In an attempt to analyse voting patterns one does not lose sight of the determinants of why people vote as they do and how they arrive at the decisions they make. Giving perspective on voting behaviour of people, Olaniyi (2004, p.16) observed that:

Sociologists tend to look to the socio-economic determinants of support or political parties, observing the correlations between class, occupation, ethnicity, sex, age and vote; political scientists have concentrated on the influence of political factors such as issues, political programmes, electoral campaigns, and the popularity of party leaders on voting behaviour.

Ejiofor (2007) further listed the factors that are related to voting behaviour in elections to include:

1. Religious Difference
2. Regional Loyalties
3. Men or Women Inclinators
4. Ideological Alignment
5. Rural-Urban Base
6. Issues of Modernity.

In affirmation of this, Oluwatula and Arogundade (2010) explicitly put it that since gaining independence in 1960, Nigerians have participated in several national elections:

Critical examination of these elections will reveal that Nigerians have had to consider some factors in the course of choosing political leaders to represent their views. Some of these factors appear to be ethnicity, geographical location and other desired benefits. This occurrence may be related to the foundations of the parties which were based on the discretion of the regional leaders in the 1960s… Recent division has resulted in six geo-political zones. This trend however appears to have raised a fundamental question of national identity as against regional and ethnic loyalty which seems not to facilitate good leadership and even development of the Nigerian nation (Oluwatula &Arogundade, 2010, pp.232 & 233).

Consequently, voters cast their votes for political leaders who share their geographical traits. In its findings, International Crisis Group Africa Briefing N°81 (2011, p.9) corroborated that President Jonathan was credited with over 85 per cent of valid votes cast in all eleven states in the South-East and South-South regions with ten of them at 95 per cent and above and four above 99 per cent (one, his home state of Bayelsa, at 99.6 per cent). On the contrary, in a research by Olujide., Adeyemi and Gbadeyan (2011, p.183), findings show that personality scored the highest proportion (36%), this is followed by those respondents that would want to vote on the basis of party affiliation.

Scholars have also investigated and reported certain factors that predict the pattern of voting. For example, Grafstein (2005) examined the impact of employment status on voting among Americans by formally modeling the effect of partisan government on workers economic interests. It was reported that, relative to the employed, the higher the education level, the income, and the unemployment benefits of the unemployed, the less likely they are to vote for the party associated with higher growth. The unemployment rate has the same impact. Also, Booth (2005) cited in Oluwatula and Arogundade (2010) assesses the effects of non-traditional media on contemporary voting. The preliminary findings support the hypothesis that voters who utilize these sources rely less on party identification than other factors.

An irresistible dimension to what influences pattern of voting is religious factor. Johnstone (2001, p.134) attests to this when he opined that, “A widely recognized point of religious influence over politics is that of peoples’ voting preference and behavior”. Such interest gives very explicit recognition to the correlation that exists between religious affiliation and commitment, on the one hand and voting behaviour, on the other. Similarly, other scholars dwell on election as it relates to religion with particular reference to Christianity, Islam and African indigenous Religion. According to Familusi (2012, p.22) the inseparability of politics from religion suggests that election, which is a form of political behaviour has a link with religion. Establishing the connection between religion and voting pattern in Nigeria, Onapajo (2012) pointed out that Muhammadu Buhari, who had earlier openly supported the *Sharia* cause, had been tagged a Muslim fanatic by many especially the Christians. The political party he successfully floated for his presidential ambition after leaving the ANPP over unsettled ideological conflict – the Congress for Progressive Change (CPC) – was also categorized as an Islamic

northern party. Onapajo (2012) further noted that CPC enjoyed the patronage of the Muslim masses, *Almajari* students and Muslim clerics in the north who gave Buhari the epithet, Mai Gaskiya (the truthful one) as a mark of their high trust in him. Consequently, the outcome of the 2011 presidential election reflected a voting pattern significantly determined by religion. Citing The News of May 2, 2011, Onapajo (2012) reiterated that Jonathan had a landslide victory in the Christian dominated areas of the South and also the Christian areas of the North otherwise known as the Middle-Belt region. "This guaranteed him a landslide victory after winning 23 states in the country and polling 22, 495, 187 votes. He was rejected outright in the Muslim's 'Core North' where Buhari swept all the votes in its 12 states including Sokoto, Zamfara, Niger, Kano, Kebbi, Katsina, Bauchi, Kaduna, Jigawa, Borno, Gombe and Yobe (Onapajo, 2012, p.56).

Irrespective of varying opinions, what is central in taking voting decision is the message the electorate receives otherwise known as the knowledge people have about the election process, existing political parties and their respective programmes as well as party flag bearers. Alluding to this, Aduradola and Chris (2013, p.106) posited that what seems to be very important in any political campaign is the 'message' that is sent to the electorates. A campaign message is an important and potent tool that politicians use to express views and feelings to the public with the intention of reshaping and redirecting the electorates' opinions to align with theirs. It is not surprising therefore, that the campaign messages are simple and are repeated several times throughout the campaign period to persuade the target audience or influence voters' to act in the candidates' favour.

A key vehicle that fosters the aspiration of contestants is the mass media. These includethe traditional media, new media and all other forms of media that serve the essence of political communication. These media perform several functions which according to Olabamiji (2014, p.45) include but not limited to "servicing the political system by providing information, discussion and debate, enlightening the public so as to make it capable of self-government, and safeguarding the rights of the individual by serving as watchdog against government". In essence, communication is in the centre of all political activity. Furthering discourse in political communication, Costas Panagopoulos cited in Olabamiji (2014, p.45, insists that the Internet in particular has become "a formidable medium that has inspired tremendous and influential innovations in campaign communication." Increasing use of the new or social media has extended interaction in time and space. Users of internet comment freely and directly on politicians and issues of debate during electioneering on website, cross-post to other websites, on their blogs and other social media interfaces to broaden the knowledge of politics and even enlarge a candidate beyond live.

Certainly, the media are used strategically to present political ideology, foster achievements of individual candidates and canvass for votes; they are sometimes used to disparage opposition. Handy examples were the serial documentaries on Nigerian Television Authority, (NTA) and African Independent Television, (AIT) as well as

other sponsored messages specifically the negative political advertisement that appeared on the front page of January 19, 2015 of the Punch newspaper against the APC flag bearer, General Muhammadu Buhari (rtd). According to Opeibi (2004), the use of negative adverts of this nature is due to several reasons amongst which include: fear of losing election, paucity of ideas and probably to settle old scores between perceived political "enemies". This is why conventional media critics believe that when allowed to be abused, voters are left with paid political propaganda containing only meaningless slogans, making them disinterested and cynical about politics (Abubakar, 2011 cited in Okoro & Nwanfor 2013, p.30). They argue that there is the absence of serious debate in the conventional media that could make people to learn the substance of issues and policies proposals as well as related arguments, and that this disallows citizens from participating actively in political discourse.

Method

The study adopted quantitative content analysis of data made available by Independent National Electoral Commission, INEC. Content analysis is a research method that uses a set of procedures to make valid inferences from the text (Weber, 1990, p. 9 cited in Macnamara, 2005, p.2). Quantitative content analysis focuses on numbers and figures. According to Edmonds and Kennedy (2012, p.9), "the emphasis of the researcher is on collecting scores that measures distinct attributes of the population". As a technique for objective description of manifest media texts, it is useful for certain purposes of classifying output, looking for effects and making comparisons between content and reality. The justification for the use of content analysis is premised on what Riffe, Lacy and Fico (1998) posited that quantitative content analysis enables the researcher to "… describe the communication, draw inferences about its meaning, or infer from the communication to its context, both of production and consumption" (p.20). Out of the numerous presidential candidates that contested in the two elections, the researchers purposively selected results of two: That of President Goodluck Ebele Jonathan and General Muhammadu Buhari (rtd). The choice of these candidates was informed by the fact that, they were top contenders at the two elections. The manifest content of the two presidential results was, therefore, analysed descriptively.

Data Presentation and Analysis

RQ1: What is the voting pattern of the electorate during the 2011 and 2015 presidential elections?

Data on Table 1 below is unambiguous on the outcome of the 2011 election as they show that President Goodluck Ebele Jonathan of the Peoples' Democratic Party secured votes almost in all the six geo-political regions. However, the highest number of his votes came from the southern part of the country just as Buhari won in most of the core north states. Specifically Goodluck Ebele Jonathan won all the South East States namely Abia, Anambra, Cross River, Enugu, Ebonyi, Anambra, and Imo States with 1,175,954 (98.7%), 1,145,169 (99.6%), 709,382 (99.4%), 882,144 (99.6%), 480,592

(99.8%), 508,314 (59.6%), 1,381,337 (99.5%) respectively. Similarly, he defeated Buhari in all the South-South States namely Bayelsa, Akwa Ibom, Delta, Rivers and Edo States with 504,811 (99.9%), 1,165,629 (99.5%), 1,378,851 (99.4%), 1,817,762 (99.3%) and 542,173 (96.8%) votes respectively. Similar feat was replicated in the South-West part where Jonathan won in Lagos, Ogun, Ondo, Ekiti and Oyo States with 1,281,688 (87.1%), 309,177 (94.6%), 387,376 (97.0%), 176,466 (59.5%) and 484,758 (84.0%) votes respectively with the exception of Osun State where he got 188,409 votes representing 38.6% as against Buhari's 299,711 votes representing 61.4% votes. In the North-Central geo-political zone, apart from Niger State, Jonathan won in FCT, Benue, Kwara, Nasarawa, Plateau, Kogi and Taraba States with 253,444 (65.8%), 694,776 (86.4%), 268,243 (76.2%), 408,997 (59.5%), 1,029,865 (74.3%), 399,816 (75.2%), 451,354 (63.6%) votes respectively. He was unable to win any state in the North-West and North-East geo-political zones with the exception of Adamawa State where he got 508,314 (59.6%) votes.

Results of the 2015 election shows that apart from all the states that comprise the South-South and South-East geo-political zones, Jonathan was only able to win in Ekiti State (176,466 [59.5%]) among the six states that make-up the South-West geo-political zone. For example, in Bayelsa, Akwa Ibom, Delta, Rivers and Edo States he got 361,209 (98.6%), 953,304 (94.2%), 1,211,405 (94.3%), 1,487,075 (95.6%) and 286,869 (57.9%) votes respectively. He also won in FCT, Nasarawa, Plateau and Taraba States with 157,195 (51.8%), 273,460 (53.6%), 549,615 (56.2%) and 549,615 (56.2%) votes respectively. Jonathan did not win any state in the North-Central geo-political zone, and none in the North-West and North-East zones.

For more clarity, the emboldened figures on Table 1 below represent votes and their corresponding States won by President Goodluck Ebele Jonathan of the PDP while the reverse is the case with General Mihammadu Buhari (rtd). Information on Figures I and II below reinforces the data as presented above.

Table 1: Voting pattern for the 2011 and 2015 presidential elections

S/N	State	2011 – Party		2015 – Party	
		PDP	CPC	PDP	APC
1	**Abia**	**1,175,954 (98.7%)**	3,608 (0.2%)	**368,403 (96.5%)**	13,394 (2.5%)
2	**Adamawa**	**508,314 (59.6%)**	344,526 (40.4%)	251,664 (40.2%)	374,701 (59.8%)
3	**A/Ibom**	**1,165,629 (99.5%)**	5,348 (0.5%)	**953,304 (94.2%)**	58,411 (5.8%)
4	**Anambra**	**1,145,169 (99.6%)**	4,223 (0.4%)	**660,762 (97.4%)**	17,926 (2.6%)
5	Bauchi	258,404 (16.4%)	1,315,209(83.6%)	31,589 (8.5%)	86,085 (91.5%)
6	**Bayelsa**	**504,811 (99.9%)**	691 (0.1%)	**361,209 (98.6%)**	5,194 (1.4%)
7	**Benue**	**694,776 (86.4%)**	109,680 (13.6%)	303,737 (44.8%)	373,961 (55.2%)
8	Borno	207,071 (18.5%)	909,763 (81.5%)	25,640 (5.1%)	473,543 (94.9%)
9	**C/ River**	**709,382 (99.4%)**	4,002 (0.6%)	**414,863 (93.6%)**	28,368 (3.9%)
10	**Delta**	**1,378,851 (99.4%)**	8,960 (0.6%)	**1,211,405 (94.3%)**	48,910 (5.7%)
11	**Ebonyi**	**480,592 (99.8%)**	1,025 (0.2%)	**232,653 (94.3%)**	19,518 (5.7%)
12	**Edo**	**542,173 (96.8%)**	17,795 (3.2%)	**286,869 (57.9%)**	208,469 (42.1%)

113	**Ekiti**	**135,009 (53.6%)**	116,981 (46.4%)	**176,466 (59.5%)**	120,331 (40.5%)
14	**Enugu**	**882,144 (99.6%)**	3,753 (0.4%)	**533,003 (97.5%)**	14,157 (2.5%)
15	**FCT**	**253,444 (65.8%)**	131,576 (34.2%)	**157,195 (51.8%)**	146,399 (48.2%)
16	Gombe	290,347 (38.7%)	459,898 (61.3%)	96,873 (21.1%)	361,245 (78.9%)
17	**Imo**	**1,381,337 (99.5%)**	7,591 (0.5%)	**559,185 (80.8%)**	133,253 (19.2%)
18	Jigawa	414,000 (38.4%)	663,063 (61.6%)	142,904 (21.1%)	885,988 (78.9%)
19	Kaduna	1,190,179 (47.1%)	1,334,244(52.9%)	484,085 (30.0%)	1,127,760(70.0%)
20	Kano	440,666 (21.3%)	1,624,543(78.7%)	215,779 (10.2%)	1,903,999(89.8%)
21	Katsina	428,392 (26.9%)	1,163,919(73.1%)	98,937 (6.8%)	1,345,441(93.2%)
22	Kebbi	369,198 (42.4%)	501,453 (57.8%)	100,972 (15.1%)	567,883 (84.9%)
23	**Kogi**	**399,816 (75.2%)**	132,201 (24.8%)	149,987 (36.2%)	264,851 (63.8%)
24	**Kwara**	**268,243 (76.2%)**	83,603 (23.8%)	132,602 (30.5%)	302,146 (69.5%)
25	**Lagos**	**1,281,688 (87.1%)**	189,983 (12.9%)	632,327 (44.4%)	792,460 (55.6%)
26	**Nasarawa**	**408,997 (59.5%)**	278,390 (40.5%)	**273,460 (53.6%)**	236,838 (46.4%)
27	Niger	321,429 (33.0%)	652,574 (67.0%)	149,222 (18.5%)	657,678 (81.5%)
28	**Ogun**	**309,177 (94.6%)**	17,654 (5.4%)	207,950 (40.3%)	308,290 (59.7%)
29	**Ondo**	**387,376 (97.0%)**	11,890 (3.0%)	251,368 (45.6%)	299,889 (54.4%)
30	Osun	188,409 (38.6%)	299,711 (61.4%)	149,929 (39.5%)	383,603 (60.5%)
31	**Oyo**	**484,758 (84.0%)**	92,396 (16.0%)	303,376 (36.5%)	528,620 (63.5%)
32	**Plateau**	**1,029,865 (74.3%)**	356,551 (25.2%)	**549,615 (56.2%)**	429,140 (43.8%)
33	**Rivers**	**1,817,762 (99.3%)**	13,182 (0.7%)	**1,487,075 (95.6%)**	69,238 (4.4%)
34	Sokoto	309,057 (36.4%)	540,769 (61.6%)	152,199 (18.5%)	671,926 (81.5%)
35	**Taraba**	**451,354 (63.6%)**	257,986 (36.4%)	**310,800 (54.3%)**	261,326 (45.7%)
36	Yobe	117,128 (25.8%)	337,537 (74.2%)	25,526 (5.4%)	446,265 (94.6%)

37	Zamfara	238,980 (27.7%)	624,515 (72.3%)	144,833 (19.1%)	612,202 (80.0%)
38	**Total**	**22,495,187(58.89 %)**	**12,214,853(31.9 8)**	**12,853,162(43.67 %)**	**15,424,921(52.41 %)**

As shown on Figure I below, the voting pattern in the 2011 presidential election depicts that apart from getting votes from most of the Southern part of the country, Jonathan was able to have advantage of some States in the northern part of the country especially in the North-Central geo-political zone. This means Buhari was able to win only in the core north States in addition to Osun State in the South-West and Niger State in the North-Central geo-political zone.

Figure I: GMB vs GEJ: State-by-state voting pattern in the 2011 presidential election.

Information on Figure II below affirms data on Table I above. Based on the information, Jonathan secured votes in all the South-South and South-East geo-political zones, one in the South-West (Ekiti State), two states (Plateau and Taraba as well as FCT) in North-Central geo-political zone and none in the North-West and North-East zones.

Figure II: GMB vs GEJ: State-by-state voting pattern in the 2015 presidential election.

Source: http://www.naij.com/415347-gmb-vs-gej-which-state-preferred-which-in-2011-2015.html

RQ2: Is there any significant difference in the voting pattern of the 2011 and 2012 presidential elections?

Data in Table 1 above clearly show that, there is a change in the voting pattern of the 2011 and 2015 presidential elections. Despite the fact that Jonathan was able to maintain all the South-South States and the South-East States in the 2015 elections which he won in 2011, he could not win most of the North-Central States apart from FCT, Nasarawa and Taraba States, and absolutely, none in the core north. This is unlike in the 2011 election when Jonathan was able to at least win in Adamawa State.

Similarly, unlike in the 2011 election when Jonathan won in all the South-West States except Osun, Jonathan lost in all the South-West States to Buhari in the 2015 election, except in Ekiti State.

Discussion of Findings

The study seeks to determine the voting patterns in the 2011 and 2015 presidential elections in Nigeria. Findings show that the voting patterns reflect ethno-religious colouration. For example, in the 2011 election, Jonathan, a Christian from Bayelsa State in South-South geo-political zone of the country was able to win in all the States that constitute the Christian dominated South-South, South-East, South-West and North-Central geo-political zones of the country. Out of the 58.89% votes he secured as against Buhari's 31.98%, Jonathan won in Abia (98.7%) as against Buhari's 0.2%, Anambra (99.6%) as against Buhari's 0.4%, Cross River (99.4%) as against Buhari's 0.6%, Enugu (99.6%) as against Buhari's (0.4%, Ebonyi (99.8%) as against Buhari's 0.2%, Anambra (59.6%) as against Buhari's, and Imo (99.5%) as against Buhari's 0.5%. Conversely, Buhari, a Muslim from Katsina State in North-West geo-political zone won in Kano (78.7%) as against Jonathan's 21.3%, Katsina (73.1%) as against Jonathan's 26.9%, Kebbi (57.8%) as against Jonathan's 42.4%, Sokoto (61.6%) as against Jonathan's 36.4% and Zamfara (72.3%) as against Jonathan's 27.7%. It is not surprising that for Buhari to win in Osun State where Muslims seem to dominate the State with (61.4%) as against Jonathan's 38.6% shows that religious consideration could have played a significant role in the voting behaviour of electorate in the State. In Kaduna State, where Buhari won in each of the elections (52.9% in 2011 and 70% in 2015), where there is admixture of Christians, Muslims and Traditionalists, it could be deduced that both religious and ethnic cleavages were instrumental in the voting pattern. This affirms Onapajo's (2012) assertion that the elections appear to be a political battle between the Muslims and the Christians as Jonathan and Buhari signify the major contenders of the presidential elections. Onapajo (2012) further notes that the voting pattern largely reflects religion and ethnicity. Implicit in Onapajo's observation is the fact that while Jonathan, the eventual winner of the 2011 election had a landslide victory in Christian dominated areas of the country as it is almost replicated in the 2015 election, Buhari sweeps in many northern states dominated by Muslims. Nevertheless, Olujide, Adeyemi and Gbadeyan (2011, p.183) contend that in the elections, some electorate voted based on personality of the contestants while some voted on the basis of party affiliation. This probably accounted for why the elections were keenly contested.

A broad picture of the voting pattern particularly during the 2015 reinforces the result of the 2011 election as Buhari was also able to win all the core north States including Kaduna (73.1% in 2011and 93.2% in 2015) and Adamawa where Buhari got 59.8% in 2015 but had lost to Jonathan who got 59.6% in the 2011 election.Interestingly, there is a significant change in the voting pattern as result shows. Based on data, Buhari, who in 2011 could not win in any of the South-West zones with the exception of Osun State, was able to win in all the States apart from Ekiti State (40.5%). For example, in Lagos State he got 55.6% votes, in Ogun (59.7%), Ondo (54.4%), and Oyo (63.5%). The same

shift in voting pattern manifests in the North-Central States where Buhari won in Kwara (69.5%), Benue (55.2%) and Kogi (63.8%) where he lost all the States to Jonathan in 2011. Therefore, it will not be out of place to conclude as Oji, Okeke and Agata (2014, p.17) retrospectively put it that:

In the Second Republic, the ethnic syndrome was minimized with the creation of states by the military who took over power from the drifting politicians. During the 1979 elections, Nigerians voted mainly for personalities either as one's old acquaintance or as a person whose name has remained in the political scene since independence. That is, they would vote according to their conscience. They would vote only for the party or person they could confide in or trust. They expected that the person or party for whom they would vote would be able to fulfill the promises and expectations as set out in their election manifestoes.

Perhaps, the remarkable change in the voting pattern evident in the 2015 presidential election could also be attributed to the personality factor occasioned by trust deficit among electorate towards incumbency and his party.

Summary and Conclusion

Since Nigeria attained independence in 1960, the country has witnessed series of presidential elections. In all cases, the elections have been competitive. Thus, the study was undertaken with a view to determining the voting pattern of Nigerian electorate and if there is significant difference in the voting pattern between the 2011 and 2015 presidential elections. The study takes insight into the factors that influence voting behaviour of the electorate. These include family ties, peer influence, schools, religion, and ethnicity, personality of candidate and general economic status of voters. Building on the results of the two presidential elections, the study makes a comparative analysis of the two elections and concludes that there has been a shift in the voting pattern in spite of the visible voting behaviour along ethnic and religious lines. It recommends among other things that the electorate should be guided by manifestoes of political candidates rather than ethnic and religious divide.

Recommendations

Against the backdrop that voting pattern of the Nigerian electorate exhibits ethno-religious tendencies in each of the elections, it is recommended that voters should eschew from this practice as it is retrogressive in every respect. Voters should vote along party manifestoes as well as disposition of candidates towards issues that affect them instead of holding unto ethnic and religious sentiments.Despite the fact that findings demonstrate a change in the voting pattern particularly in the 2015 election, the shift still reflect ethnic and religious colouration. That means much is desired to do away with religion and ethnicity which are instrumental to the voting patterns.
Apparently, Buhari won in almost all the South-West States besides all the North-West and North-East States as well as most of the North-Central States unlike in the 2011

election when he did not win the South-West zone. On the other hand, Jonathan won all the South-South and South-East States as opposed to result of the 2011 election.

It is gladdening that the change in voting pattern signifies some measure of impact of political communication on voters which should be sustained. Though Nigeria's experience in political communication through the new media that complement other media forms is commendable, the Nigerian situation requires caution. This is because most voters are not media literate to share meaningful and productive messages. There is, therefore, an urgent need to broaden the new media users baseline through improved computer literacy in Nigeria otherwise it remains the exclusive preserve of the elites. Besides, continual reliance on direct face-to-face campaign, door-to-door mobilization and traditional media should be prioritised. Conduct of the traditional mass media should be greatly guided by their professional ethics.

Further studies should be undertaken with a view to determining the effect or consequences of voting along ethnic and religious leaning. This is necessary as findings in this study are limited to voting pattern and whether or not there is significant difference in the voting pattern of the two elections. Conducting such studies will provide solutions to dire consequences associated with voting pattern that is skewed towards ethnic and religious divide

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OBJECT ORIENTED PARADIGM FOR IMPLEMENTATION ELGAMAL ALGORITHM

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Abstract

The need of exchanging messages secretly over unsecure networks promoted the creation of cryptography to enable in the security of the messages sent over an unsecure network and also to enable only the authorized receivers to interpret the exchanged message. The main goal of the paper is to enable people who do not have the full knowledge of programming language to understand how the proposed system will work and also to enable programmers to implement the Elgamal algorithm using Object oriented approach. It also helps to prevent unauthorized access from interpreting the exchange messages. In the proposed system, Object oriented paradigm is designed to implement a particular public key cryptosystem called the Elgamal Cryptosystem is considered with the help of JAVA Programming language to be used over texts. Since the Elgamal cryptosystem was used in messages over a primitive root of a large prime; the proposed system showed how secure messages were sent over the network, and how the generations of public key was done in an encapsulated way.

Keywords: Cryptography, Elgamal algorithm, Cryptosystem, Object Oriented, Security

Introduction

Message encryption (Security) is a very crucial aspect in today's World, where computers and electronic media are used for transferring sensitive information like electronic mail, bank accounts, electronic cash, username and password, personal document and so on. These computers and electronic media are vulnerable to security threat (which would be interruption, privacy-breach, integrity, and authentication) and security attacks (this attack are classified into passive and active attack) (Stallings, 2011). Today, the protection against misuse, manipulation and attackers of messages being sent on-line has been considered as the basic challenge of this new era. Cryptography is one of the steps taken in order to secure data and messages that are being sent through these computers and electronic media(s) via the internet.

Cryptography is the science and study of Secret (crypto-)-Writing (-graphy). A cipher is a secret method of writing, whereby plaintext (or cleartext) is transformed into ciphertext (sometimes called a cryptogram). The process of transforming plaintext into ciphertext is called encipherment or encryption; the reverse process of transforming ciphertext into plaintext is called decipherment or decryption (Denning, 1982). It can also be the study of mathematical techniques related to aspects of information security to encrypt and decrypt data (Mark Adler and Jean-Loup Gailly, 2004). For cryptography to be an effective way of securing data it must be able to provide the following services such as confidentiality, data integrity, availability, entity authentication, non-repudiation and access control (Stallings, 2011).

In most of information been sent on the Internet, hackers have found it easier to attack user's information on a network due to the limitation of encryption and decryption system. User's documents are being hijacked by attackers whose intention is to defraud the recipient's documents. According to Hamdan et.al., (2010), with the rapid development of various multimedia technologies, more and more multimedia data are generated and transmitted in the internet, also the Internet allows for wide distribution of digital media data, so this becomes much easier to edit, modify and duplicate digital information. In symmetric algorithm, the keys are not use for a more computationally intensive and therefore are mostly use for securing short text messages (Sudhir et.al, 2012). In order to conquer this problem an asymmetric algorithm is use to solve the problem of symmetric algorithm where two keys (public key and private key) are needed for the encrypting and decrypting of messages. Based on this problem stated above there is need of developing a message encryption and decryption system that would use a more advance algorithm called an asymmetric (Elgamal) algorithm.

Objectives of the Study

The objectives of this paper work are to:

i. review existing literature on cryptography;
ii. design a message security model using Elgamal algorithm; and
iii. design an object oriented paradigms for implementing the model.

Literature Review

Overview of Cryptography

Message security is mostly done by a means known as cryptography. Cryptography has been defined by many Authors. According to Denning (1982), cryptography is the science and study of secret writing. Santosh (2010), define cryptography as the study of mathematical techniques related to aspects of information security such as confidentiality, data integrity, entity authentication and data again authentication. Padmavathi and Ranjitha (2013), define cryptography is an effective way for protecting sensitive information, it is a method for storing and transmitting data in form that only those that it is intended for read and process.

Amoghand Rajballav (2007) also define cryptography as the science or art of encompassing the principles and methods of transforming an intelligible message into one that is intelligible and then transforming the message back to its original form. As the field of cryptography became advanced; cryptography today is assumed as the study of techniques and applications of securing the integrity and authenticity of transfer of information under difficult circumstances. The field of cryptography also deals with the techniques for conveying information securely. The goal of cryptography is to allow the intended recipients of a message to receive the message securely. Cryptography tries to

prevent the eavesdroppers from understanding the message. Cryptography is majorly of two forms, they are symmetric and asymmetric cryptography.

Symmetric Cryptography

In symmetric cryptography, the process of encryption and decryption is done using the same key. This form of cryptography is also called conventional encryption. Symmetric encryption transforms plaintext into ciphertext using a secret key and an encryption algorithm, in decrypting the ciphertext the same key is use and a decryption algorithm, after which the plaintext is then recovered from the ciphertext (Stallings, 2011).

A conventional encryption model can be illustrated as assigning Xp to represent the plaintext message to be transmitted by the sender. The parties involved select an encryption algorithm represented by E. The parties agree upon the secret key represented by K. The secret is distributed in a secure manner represented by SC. Conventional encryption's effectiveness rests on keeping the key secret. Keeping the key secret rests in a large on key distribution methods. When E processes Xp and K, Xc is derived. Xc represents the cipher text output, which will be decrypted by the recipient. Upon receipt of Xc, the recipient uses a decryption algorithm represented by D to process Xc and K
back to Xp.

Symmetric cryptography has some merit over the other form of cryptography. Some of which are:

- Symmetric cryptography is efficient; it takes less time to encrypt a message.
- The key use in symmetric cryptography is relatively small.
- Symmetric cryptography can be composed to produce stronger ciphers. Simple transformations which are easy to analyze, can be used to construct strong product ciphers.

While it demerits are:

- The key in use must be shared only between two users.
- The management of the key in a large network is as many as ((n(n-1))/2) making it tedious to manage the key pairing process.

Examples of symmetric cryptography algorithm are Data Encryption Scheme (DES), Advance Encryption Scheme (AES), Triple DES, etc.

Asymmetric Cryptography

Asymmetric cryptography is also known as Public-Key Algorithms. In this form of cryptography the key used in encrypting the message is different from the key used in decrypting the message. The encryption key, known as the Public key is used to encrypt a message, but the message can only be decoded by the person that has the decryption key, known as the private key. This type of encryption has a number of advantages over

traditional symmetric encryption. It means that the recipient can make their public key widely available- anyone wanting to send them a message uses the algorithm and the recipient's public key to do so. An eavesdropper may have both the algorithm and the public key, but will still not be able to decrypt the message. Only the recipient, with the private key can decrypt the message.

An advantage of public-key algorithm is that they are more computationally intensive than symmetric algorithms, and therefore encryption and decryption take longer. This may not be significant for a short text message, but certainly is for bulk data encryption. Beside, from the advantage mentioned above, asymmetric cryptography still has a lot of merits over symmetric. Some of which are:

- The primary advantage of public-key cryptography is increased in security and convenience. The Private keys are never transmitted or revealed to anyone, unlike the secret-key system, where the secret keys must be transmitted (either manually or through a communication channel), and there may be a chance that an enemy can discover the secret keys during their transmission.
- Another major advantage of public-key systems is that they can provide a method for digital signatures.

There is no method that has merit without demerit. Some of the disadvantages of using public-key cryptography are:

- Public-key cryptography for encryption has limited speed; there are popular secret-key encryption methods that are significantly faster than any currently available public-key encryption method. Nevertheless, public-key cryptography can be used with secret-key cryptography to get the best of both worlds.
- Public-key cryptography may be vulnerable to impersonation, however, even if users' private keys are not available. A successful attack on a certification authority will allow an adversary to impersonate whomever the adversary chooses to by using a public-key certificate from the compromised authority to bind a key of the adversary's choice to the name of another user.

However, public-key cryptography is not meant to replace secret-key cryptography, but rather to supplement it, to make it more secure. The first use of public-key techniques was for secure key exchange in an otherwise secret-key system; this is still one of its primary functions. Secret-key cryptography remains extremely important and it is still in use these days. Examples of asymmetric cryptography algorithm are Rivest Shamir Adleman (RSA), Diffie-Hellman Key Exchange Algorithm, Elgamal Public Key System, etc.

The RSA Algorithm

The RSA cryptosystem is one of the public-key cryptography, named after its inventors R. Rivest, A. Shamir, and L. Adleman, and it is the most widely used public key Cryptosystem in the world. It may be used to provide both secrecy and digital signatures and its security is based on the intractability of the integer factorization.

Diffie-Hellman Key Exchange Algorithm

Diffie and Hellman(1976), published the first public key based algorithm, which was designed to provide a means to exchange securely a key *K* over a public network. That key *K* can later be used as a session key. However this algorithm applies only to the exchange of keys.

Elliptic Curve Cryptography

Public key cryptography systems are usually based on the assumption that a particular mathematical operation is easy to do, but difficult to undo unless some particular secret is known. This particular secret serves as the secret key. A recent development in this field is the so-called Elliptic Curve Cryptography. Elliptic Curve Cryptography works with point on a curve. The security of this type of public key cryptography depends on the elliptic curve discrete logarithm problem. Elliptic curve cryptography was invented by Neil Koblitz in 1987 and by Victor Miller in 1986. The principles of elliptic curve cryptography can be used to adapt many cryptographic algorithms, such as Diffie-Hellman or EIGamal. Although no general patent on elliptic curve cryptography appears to exist, there are several patents that may be relevant depending on the implementation. The main advantage of elliptic curve cryptography is that the keys can be much smaller. Recommended key sizes are in the order of 160 bits rather than 1024 bits for RSA.

Elgamal Public Key System

The ElGamal cryptographic algorithm is a public key system like the Diffie-Hellman system. It is mainly used to establish common keys and to encrypt message. The EIGamal cryptographic algorithm is comparable to the Diffie-Hellman system. Although the inventor, TaherElgamal, did not apply for a patent on his invention, the owners of the Diffie-Hellman patent felt this system was covered by their patent. For no apparent reason everyone calls this the IElGamal" system although Mr. Elgamal's last name does• not have a capital letter 'G'.

Generating the ElGamal Public Key

As with Diffie-Hellman(1976), Amaka and Shalom have a (publicly known) prime number p and a generator g. Amaka chooses a random number a and computes $A = g^a \bmod p$. Shalom does the same and computes B = gb mod p. Amaka's public key is A and her private key is a. Similarly, Shalom's public key is B and his private key is b.

Encrypting and Decrypting Messages

If Shalom now wants to send a message m to Amaka, she randomly picks a number k, which is smaller than p. He then computes:

$C1 = m*k \bmod p$
And send C1 to Alice. Alice can use this to reconstruct the message m by Computing
$C2 = k^{-1}*C1 \bmod p$

Review of Related Studies

Ambalika and Sunil (2014) proposed an Object Oriented Modeling of DSA for Authentication of Student in E-Learning. In their paper they said that E-Learning is the interactive transfer of knowledge via an intranet or the internet. Due to use of internet as electronic communication media there are several types of risks & threats that may hamper security of E-learning environment. At the time of online submission of filling up form during any course registration by student, the authenticity and integrity of the information can be ensured using digital signature. To enhance the security level of the information the Digital Signature Algorithm (DSA) can be used to generate digital signature which will be an industry standard algorithm using public key cryptography for security of various electronic systems like E-Governance, E-Banking, E- Commerce etc. In their paper, authors have applied DSA algorithm to achieve optimal resource allocation, faster information and enhanced security for authentication of information in E-Learning during submission of ICT (Information and Communication Technology) based filled up course registration form in Object Oriented paradigm.

Hayder and Irtifaa (2014), develop a system which can encrypt and decrypt Image in a modify way using an ElGamal cryptosystem in MATLAB. The need of exchanging messages and images secretly over unsecure networks promoted the creation of cryptosystems to enable receivers to interpret the exchanged information. In their paper, they use a particular public key cryptosystem called the ElGamal Cryptosystem with MATLAB to implement the program to be used over the Images. Their work shows a modification of the cryptosystem by applying it over gray and color images by transforming an image into its corresponding matrix using MATLAB Program, then applying the encryption and decryption algorithms over it. Actually, this modification gives one of the best image encryptions that have been used since the encryption procedure over any image goes smoothly and transfers the original image to completely undefined image which makes this cryptosystem to really secure and successful encrypt the image. As well as, the decryption procedure of the encrypted image works very well since it transfers undefined image to its original.

Obaida (2013), proposed a new approach for complex encrypting and decryption data. In his research, he combined public key infrastructure and RC6 algorithm. RC6 is used to generate private key based on secret value from public key infrastructure. Plaint-text 1024-bit size divided to 2 blocks. One of this block used as key after performed

confusion and diffusion operation using R6C algorithm. The key is then inserted inside the cipher data based on the private position. The same process used for encryption is also used to decrypt data. The algorithm proposed by Obaida is very secure and possesses average key unlike the Advanced Encryption Scheme (AES). But this algorithm is majorly based on the symmetric key cryptography technique.

Anwar and Riyazuddin (2011), design a "Transparent Data Encryption- Solution for Security of Database Contents". The study deals with ways to create Master Key, creation of certificate protected by the master key, creation of database master key and protection by the certificate and ways to set the database to use encryption in Microsoft SQL Server 2008. The purpose of their study is aimed at dealing with the most critical threats to which database is vulnerable. The transparent data encryption shields database up to considerable extent against threats and prevent intruders to have access to confidential database, reduce the cost of managing user and facilitate privacy managements. This technology allows encryption of databases on hard disks and on any backup media.

They also made use of database encryption key (DEK), which is stored in the database boot record for availability during recovery. It is an asymmetric key secured by using a certificate stored in the master database and Microsoft SQL Server 2008 is use to implement and encrypt database content. The limitation of this research is that the transparent data protection does not provide encryption across communication channels. It also need regularly backing up of the certificate and the private key associated with the certificate.

Yonglin, Azzedine and Lynda (2011), presents the principle of selective encryption with a propose of probabilistically selective encryption algorithm. The algorithm was based on symmetric key by making use of probabilistic methodology and stochastic algorithm, in the process of message encryption, a sender includes proper uncertainty, so that the decryption of the ciphertext is done by only entrusted receiver and other unauthorized nodes have no information of the broadcasted messages on the whole.

Myungsun ,Jihye, and Jung(2010), designed a system that compress multiple ciphertexts using elgamal encryption schemes. In their work they deal with the problem of how to squeeze multiple ciphertexts without losing original message information. To do so, they formalize the notion of decomposability for public-key encryption and investigate why adding decomposability is challenging. They construct an ElGamal encryption scheme over extension fields, and show that it supports the efficient decomposition. They then analyze security of their scheme under the standard DDH assumption, and evaluate the performance of the construction.

Their limitation is that they have the problem of inefficient scheme in the compression of the image in not losing it quality.

Methodology

Elgamal Public Key System

The ElGamal cryptography algorithm is a public key system like the Diffie-Hellman system. It is mainly used to establish common keys and to encrypt message. The Elgamal algorithm which uses Diffe-Hellman theory was generated in 1976. The Elgamal algorithm works on discrete-logarithm. The Elgamal algorithm is composed of three sub phases:

a. key generation algorithm;
b. encryption algorithm; and
c. decryption algorithm.

The Elgamal algorithm makes use of the following variables:
a = generator key (a must be between 1 and p-1)
x^a = Amaka's private key ($1 < x < p-2$)
x^b = Shalom's private key ($1 < x < p-2$)
p = prime number (chose a larger prime number).
m = message to be encrypted [$0 < m < p-1$].
The public keys are calculated for both users as follows:
$pub_a = a^{xa} \bmod p$ (Amaka's public key)
$pub_b = a^{xb} \bmod p$ (Shalom's public key)
Let assume that the sender wants to encrypt a message m and send the encrypted message to the receiver. The following steps are to be taken;

1. both users agreed on the key generator a ($1 < a < p-1$) and also choses their private keys which is unique to them x^a and x^b($1 < x < p-2$);
2. both users also calculate their public key:
   i. $pub_a = a^{xa} \bmod p$
   ii. $pub_b = a^{xb} \bmod p$;
3. both user calculate the common key:
   i. $k_a = pub_b^{xa} \bmod p$
   ii. $k_b = pub_a^{xb} \bmod p$
4. the sender encrypt the message:

$C_1 = m * k \bmod p$ (C_1 = encrypted message(cipher))

5. the receiver decrypt the message:

$C_2 = k^{-1} * C_1 \bmod p$ (C_2 = decrypted message.) k^{-1} is calculated using the modular inverse. If $C_2 = m$ accept, otherwise reject.

The mathematical expression of the Elgamal public key system is shown below:
The proposed system is designed with Elgamal algorithm which uses Diffe-Hellman theory which was generated in 1976. The Elgamal algorithm works on discrete-logarithm.

Formula: $a^x \bmod p$

Key Generation:

Where a is a generator key (a must be between 1 and p-1)
x is the private key ($1 < x < p-2$)
p is a prime number (chose a larger prime number).
m is the message to be encrypted $[0 < m < p-1]$
Encrypting a message.i.e. sending a message from Alice to Bob.
Let $p = 139$, $x_a = 12$ (Alice private key), $x_b = 15$ (Bob private key), $a = 3$, $m = 100$.

To calculate the public key for Amaka

$pub_a = a^{xa} \bmod p$
$=3^{12} \bmod 139$
$=531441 / 139 = 3823$
$=531441 - (139*3823)$
$=44$

To calculate the public key for Shalom

$pub_b = a^{xb} \bmod p$
$=3^{15} \bmod 139$
$=14348907 / 139 =103229$
$=14348907 – (139*103229)$
$=14348907-14348831$
$=76$

To Get the Common Key Between Amaka and Shalom Use for Encryption and Decryption of their Messages.
For Amaka

$k_a = pub_b^{xa} \bmod p$
$=76^{12} \bmod 139$
$= 37133262473195501387776 / 139 = 267145773188456844516$
$=37133262473195501387776 – (139*267145773188456844516)$
$=37133262473195501387776 – 37133262473195501387724$
$=52.$

For Shalom

$k_b = pub_a^{xb} \bmod p$
$=44^{15} \bmod 139$
=448528606872902211888742 4 / 139 = 32268245098769943301348
=448528606872902211888742 4 – (139*32268245098769943301348)
=448528606872902211888742 4 – 448528606872902211888372
=52

To Encrypt a Message:

$C_1 = m * k \bmod p$
= 100*52 mod 139
=5200 / 139 = 37.41
=5200 – (37*139)
= 57

To Decrypt a Message:

$C_2 = k^{-1} * C_1 \bmod 139$ (k^{-1} is calculated using the modular inverse).
k^{-1}= mod 139
k.*=1 mod 139
x = (1/k) mod 139
prime number = k(multiple) + remainder
139 = 52(2) + 35
52 = 35(1) + 17
35 = 17(2) + 1
Re-arranging to get an equation
139 + 52(-2) = 35 …1
52 + 35(-1) = 17 …2
35 + 17(-2) = 1 …3
Start from equation 3
35 + 17(-2) = 1
35 + (52+35(-1)) (-2) = 1
35 + 52(-2) + 35(-2) = 1
35 + 35(-2) + 52(-2) = 1
35(1+2) + 52(-2) = 1
35(3) + 52(-2) = 1
(139 + 52(-2))(3) = 1
139(3) + 52(-6) + 52(-2) = 1
139(3) + 52(-6 + (-2)) = 1
139(3) + 52(-8) =1 mod 139
0 + 52(139-8) = 1 mod 139
0 + 52(131) = I mod 139
131 = (1/52) mod 139
The inverse modular for k^{-1} (52^{-1}) = 131

To Decrypt

$C2 = k^{-1}\ c1 \bmod 139$
$= 131 * 57 \bmod 139$
$= 7467 / 139 = 53.71\ldots$
$= 7467 – (139*53)$
$= 7467 – 7367$
$= 100$

Elgamal Encryption and Decryption Algorithm

Encryption Algorithm

- Obtain the public key from the receiver B in order to get the common key.
- Choose an integer xa such that : $1 < xa < p-2$
- Represent the plaintext as an integer m where $0 < m < p-1$
- Compute (k) as follows: $k= a^{xa} \bmod p$
- Compute (C1) as follows: $C1 = (k * m) \bmod p$
- Send C1 to receiver B.

Decryption Algorithm

- Obtain the ciphertext (C1) from sender A.
- Compute (C2) as follows: C2 = k-1*C1 mod p
- And recover the plaintext, m

RESULTS AND DISCUSSION

Object Oriented Paradigm

Unified Modeling Language (**UML**) approach is used as the object oriented paradigm for the design of the Elgamal algorithm. An object contains both data and methods that control the data. The data represents the state of the object. The **Unified Modeling Language** (**UML**) is made up of different types but this paper discusses on three major types.

1. Use case diagram.
2. Sequence diagram.
3. Class diagram.

Use case diagram

Use case represents a set of actions performed by a system for a specific goal. Use case diagrams are also a set of use cases, actors and their relationships. They represent the use case view of a system. A use case represents a particular functionality of a system.http://www.tutorialspoint.com/uml

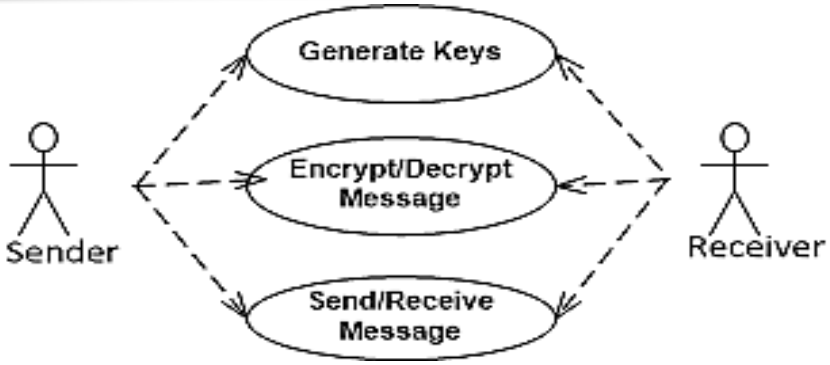

Figure 1: Use case diagram

Sequence diagram

A sequence diagram is an interaction diagram, it shows how sequence of messages flows from one object to another. Interaction among the components of a system is very important from implementation and execution perspective. So Sequence diagram is used to visualize the sequence of calls in a system to perform a specific functionality.

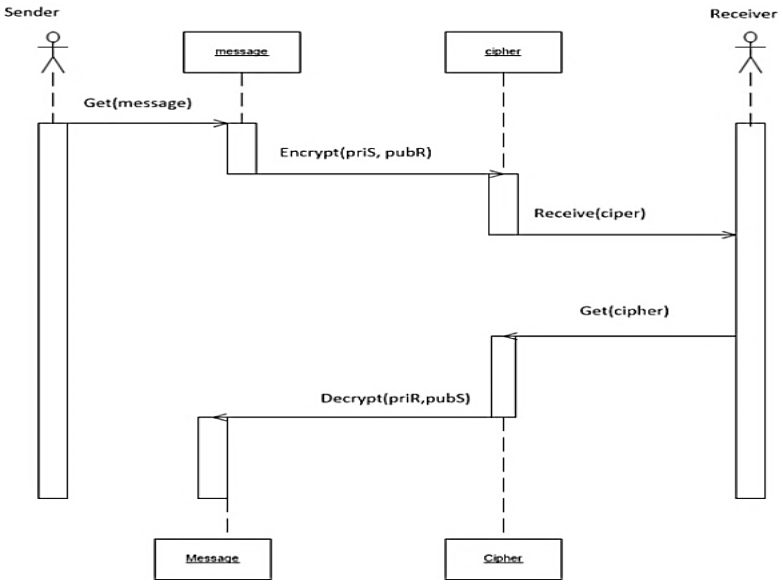

Figure 2: Sequence diagram

Class Diagram

Class diagrams are the most common diagrams used in UML. Class diagram consists of classes, interfaces, associations and collaboration. Class diagrams basically represent the object oriented view of a system which is static in nature.Class diagrams are made

up of attributes and methods. In this paper the attributes are those above the line in a section and the methods are those below the line in the section.

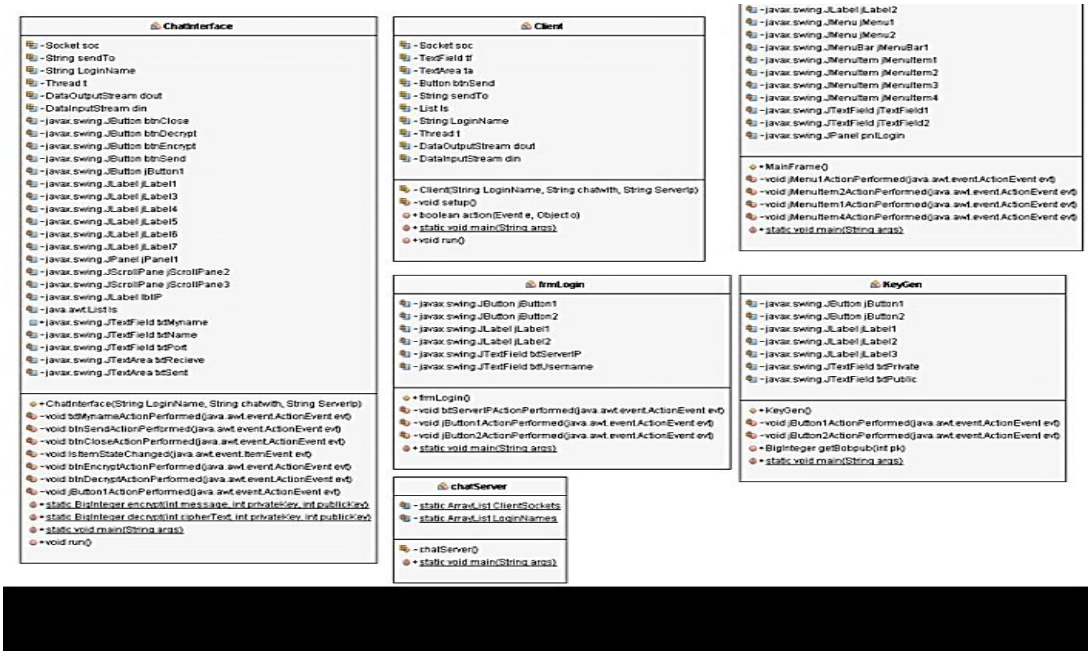

Figure 3: Class diagram

The use case diagram, the sequence diagram and the class diagram explain fully well how the Elgamal algorithm works. Using Elgamal algorithm an asymmetric type of cryptography to secure messages, the keys must be generated first after which the encryption processes is done. During the process of encryption the sender must supply its own private key which is only know to the him or her and the receiver public key which is mostly know to the public and the send the encrypted message to the intended receiver. The receiver receives the message and starts the decryption process. To decrypt the message the receiver will supply his or her private keys and the sender public keys, so has to understand the content of the message sent to him or her. Cryptography is very useful in message encryption, though not 100% efficient but it is efficient when it is being able to keep the confidentiality, integrity and provide the message in time (i.e. availability of the message). The purpose of the encryption and decryption process is to achieve the following:

i to secure message on the network and also the network itself, data, files etc.
ii to secure message communicated from one system to another on the network (internet).
iii to also enable the establishment of a secure channel for key sharing and encrypting & decrypting of messages.
iv to also prevent the eavesdroppers from understanding the message.
v. to allow the intended recipients of a message to receive the message securely.

Limitation

This paper works does not include the features for encrypting and decrypting scanned documents and images. The disadvantages of Elgamal algorithm include slow in speed, message expansion by a factor of two during encryption, semantically insecure and require randomness during operation (Adewole. et. al, 2014).

Conclusion

The need to develop a system that would assist the control of message security cannot be over emphasized. However, this study helps to solve some of the problem associated with current system by introducing the use of public and private key. Elgamal system is a public key cryptosystem that is based on discrete logarithm problem. In this paper, a message securitymodel was developed using Elgamal algorithm in the form of object oriented paradigm. Elgamal algorithm used both public and private key, hence, it is asymmetric encryption algorithm.

Recommendations

The symmetric cryptography system has been reviewed and new system software that will aid security control has been developed using object oriented paradigm for implementing Elgamal algorithm. The securing of vital information is essentially important. This paper works also show how to paper is recommended for exchange messages over the internet.Further research could be done in by combining both the symmetric and asymmetric cryptography in order to improve the efficiency and application of the system for securing data and information.

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THE IMAGE OF ACADEMIC LIBRARIANS IN KENYA

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Abstract

In the public psyche, a librarian is a woman of indeterminate age, who wears big spectacles hanging on a chain; a person with either a timorous or an austere disposition; someone who loves silence, likes books, and suffers people; someone who doesn't laugh and is covered with a thin film of dust; or someone who is crotchety, withdrawn and fearsomely protective of her domain. This low public image of librarians and how the profession is perceived is a significant hindrance to library development and a discouragement to aspiring library students. This study investigated how library users perceive academic librarians in Kenya as well as the impact of that perception on the effectiveness of librarians in helping their parent institutions to meet their corporate visions and missions. The findings of this study indicate that the majority of academic library users in Kenya perceive an academic librarian positively as a person, male or female, employed by an academic institution to organise and manage a library which supports the programmes of the institution. They also perceive academic librarians to be performing routine clerical roles such as collecting, keeping, arranging and lending information materials (books) as well as maintaining order in the library.

Keywords: Image analysis, perception, stereotypes, Kenya, academic librarians

Introduction

The image and perception of academic librarians is one of the major concerns in the librarianship fraternity in modern times (Aharony, 2006). Indeed many library users, librarians and scholars acknowledge that the perception of a librarian, especially by library users, influences whether and how they relate and ultimately impacts the effective provision and usage of library services (Asamoah-Hassan, 1997). Therefore, the prevailing low public image of librarians and their profession is a significant hindrance to library development and a discouragement to aspiring librarianship students. Myriad negative stereotypes of librarians exist. For instance, Bowes (1979) explains that a librarian in the public psyche is a woman of indeterminate age, who wears big spectacles hanging on a chain; a person with either a timorous or an austere disposition wearing a long sleeved blouse buttoned to the neck; someone who loves silence, likes books and suffers people; someone who does not laugh and is covered with a thin film of dust. Engle (1991) generally concurs with Bowes (1979) but adds that besides the stereotypes above, the public's collective image of librarians is that of an old but single woman who is crotchety, withdrawn and fearsomely protective of her domain. Although opinion is divided about the veracity of these perceptions, many librarians acknowledge the seriousness of the issue and the need to address it (Morrisey and Case, 1988; Carmichael, 1992). Marinelli and Baker (2000) argued that most of the perceptions and stereotypes used to describe librarians are based on users' experiences

with librarians in public libraries who, due to their stations of work and being constantly in the public eye, act as the image keepers of the profession. Consequently, the perceptions of librarians in public libraries are generally used to describe their counterparts in other library typologies even though the situations may be different.

An important perspective of the image of librarians is the view that institutions employing librarians sometimes perceive them as doing little for the organisation and earning more than they are really worth (Aharony 2006). Librarians are further perceived as feminine and powerless (Freeman, 1996; Harris and Wilkinson, 2001); serious and humourless (Rubin, 2000; Aharony 2006); introverted, lacking self-confidence and exhibiting poor interpersonal skills (Atkinson, 1994; Fourie, 2004; Aharony 2006); passive, conservative, introspective, orderly and meticulous (Spaulding, 1989; Aharony 2006); resistant to change and poor in decision making (Rubin, 2000; Aharony 2006); educated clerks (Fagan, 2002; Aharony 2006) who are responsible for the mere collection and dissemination of books; and eccentric persons not interested in material gain or prestige (Jackson, 1999; Aharony 2006).

From a study on the students' perception of academic librarians at the Morris Library, Southern Illinois University, Fagan (2002) found that students knew librarians are there to help them but often considered the librarians' knowledge as limited to familiarity with the physical library; students often described library school classes and librarian expertise in professional terms and correctly identified librarians but their descriptions of librarians' job duties included many clerical tasks; although some students thought librarians are faculty, they were not aware of the librarians' educational background and the professional character of a librarian's job; students were aware of the increase of technology in libraries and of librarians' positive role in assisting users with technology; and students had a generally positive impression of librarians' attitudes toward them but were not sure librarians were as willing to change services or to help during crunch time. The findings of this study reveal the fact that although academic library users are beginning to appreciate librarians as valuable partners in their academic pursuits, significant doubts about their capacity to meet dynamic user expectations still linger. It follows, therefore, that a lot more needs to be done to help academic librarians to build and project an image which the users perceive as positive and comfortable.

Wilson (1982) reported that although the perception and image of librarians have featured in librarianship literature since the 1920s, the same still persist as critical issues in the profession. Indeed, Lynch (1986) citing a random survey of the members of the American Library Association (ALA) conducted in 1985 argued that the majority of the respondents to the study listed librarians' image and perception as one of the top ten important librarianship issues of the time. Schuman (1990) while acknowledging the significance of the perception of librarians on the effective delivery of information service pointed out that the debate was skewed and suggested that the focus of the discourse ought to be less on the physical attributes of the librarians but more on their usefulness. Fagan (2002) explained that the significance attached to the librarians' image perhaps stems from the understanding that misconceptions about the librarians'

professional status, teaching roles, knowledge and expertise, and attitudes toward students are often proposed as causes of their dysfunctional interactions with library users.

An important step towards building a good image for academic librarians is an understanding of the root causes of the current situation. Literature on professional image indicates that most prestigious professions derive their strength from economic and governmental status (Aharony, 2006). In the case of librarianship, economic and governmental status is negligible. Thus, the main strength of the profession is found in its management of information and relationship with its beneficiaries. A partial explanation for the low perception of librarians may be found in Spaulding's (1989) suggestion that groups associated with high professional status, such as lawyers and doctors, are perceived as having a monopoly of a body of specialised knowledge and skills. The situation is different for information professionals as they cannot claim a monopoly on information because it is a public utility used by everyone. The situation is further exacerbated by the notion that working with information is not limited to librarians and the library and that the product which the library purports to supply is not unique to librarians (Aharony, 2006). Furthermore, the public does not fully understand the librarian's role or what it means to be a professional in this field. In fact, ordinary people often do not believe that librarians need a broad education (Fagan 2002; Aharony 2006). Librarians are not considered as the only professionals with specialised skills in information gathering, processing and retrieval (Aharony, 2006). Van House and Sutton (1996) further assert that the association between librarianship with women's further work contributes to the poor image of the profession. As information and communication technologies which enable users to search, identify, access, use, store and share information become more ubiquitous, some people fear that librarians will be needed less and less in the future (Aharony 2006).

It is evident from the foregoing that many actual and potential library users perceive the librarians as less capable of helping them to meet their information needs. They argue that librarians exhibit narrow perspectives and are unwilling to learn because of a know-it-all attitude. Undoubtedly, librarians perceived thus are incapable of providing the ideal information environment desired by the emerging breed of academic library users.

Whereas, stereotyping of librarians has been studied widely, there is no indication of any such study focusing on academic librarians in Kenya. This study analysed the image and branding of librarians in Kenya. The study also investigated the impact of the user perception of academic librarians in Kenya on the effectiveness of librarians in helping their parent institutions to meet their corporate visions and missions. The study also proposes some strategies which academic librarians can use to develop and project a positive image which is supportive of their work as information experts.

Theoretical framework

This study applied the impression management theory which states that any individual or organisation must establish and maintain impressions that are congruent with the perceptions they want to convey to their publics. This theory, originally proposed by Goffman (1959), encompasses the vital ways in which one establishes and communicates this congruence between personal or organisational goals and their intended actions which create public perception. This theory is based on the notion that perception is reality and the presumption that the others' perceptions of an individual or organisation become the reality from which they form ideas and the basis for intended behaviour. The theory argues that when an individual comes in contact with other people, that individual will attempt to control or guide the impression that others might make of him by changing or fixing his or her setting, appearance and manner. At the same time, the person the individual is interacting with will also try to form and obtain information about the individual. The theory posits that people consciously and unconsciously choose to generally relate with other people they perceive to have a good image and vice versa. Therefore, people attempt to manage their public impressions, for instance, through styles which conform to their contextual expectations. People may also enhance their impression management through personal or professional branding or self-packaging.

Methodology

This study was designed as a survey to assess the prevailing perceptions of academic librarians by their users. Primary data for the study was collected through interviews using self-administered structured questionnaires. The study targeted the users of eight academic libraries in Kenya selected through information-oriented purposive sampling from twenty-two chartered public and seventeen private universities. The selected public universities included The Technical University of Kenya, the University of Nairobi, Moi University, and Jomo Kenyatta University of Agriculture and Technology. The private universities, on the other hand, included Africa Nazarene University, United States International University, Catholic University of Eastern Africa, and Daystar University. All library users in the population were included in the survey. The researchers distributed the questionnaires to all users who visited the respective libraries within a period of two weeks in August 2014. The users were allowed to carry and fill the questionnaires and return the same to designated collection points within their library premises. Additional data about the perceptions and stereotypes of librarians was collected through documentary analysis.

Findings and discussions

The key findings of this study are presented and discussed hereunder.

Response rate

A total of 800 questionnaires were given out. From these 500 were filled completely and returned. Thus the response rate was 62.5 percent. The response was fairly low

because the respondents were allowed to carry the questionnaires with them and fill and return them at their convenience.

Description of who a librarian is

Most (15%) of the respondents perceive academic librarians in Kenya to be those who have a good knowledge about a library while 14 percent described an academic librarian as anybody who assists users in the academic library. Nine percent (9%) of the respondents just said that an academic librarian is an employee of the academic library as another nine percent (9%) said an academic librarian is in charge of an academic library; one who manages information materials (7%); one who keeps book records (5%); one who collects and stores books (5%); and one who organises a library (4%). Some respondents focused on the perceived personality attributes of the librarians such as someone who is smart (4%); a researcher (3%); organised (2.4%); social (1.5%); harsh (0.9%); humble (0.6%); polite (0.6%); patient (0.3%); and understanding (0.3%).

The findings above indicate that the majority of the respondents (68%) perceive an academic librarian as a person employed by an academic institution to assist the patrons to make the best use of an academic library by collecting, organising and providing access to relevant information materials. While these perceptions seem to describe the essential roles of an academic librarian, none of the respondents seemed to perceive librarians as professionals with specialised skills which enable them to offer expert services in academic libraries. Indeed, some of the roles mentioned above such as keeping a record of books or storing books are clerical in nature and point to the perception of librarians as paraprofessionals performing non-expert functions in an academic institution. Although some users stated that academic librarians manage information materials, the conspicuous reference to books (10%) also gives the impression that academic library users still hold the view that libraries are about books. This finding can either be interpreted to imply that academic library users still value books or that they perceive the libraries as being outdated and stuck in the book era.

It is important to note that most of the respondents who focused on the personality attributes of the librarians generally described them positively. Only a very small minority (0.9%) perceived academic librarians as harsh. Although expressed by a small minority, this perception is worth considering and will become clearer in the subsequent sections of this article.

How an academic librarian looks like

The respondents were asked to indicate how a typical academic librarian looks like. They responded that they perceived them as knowledgeable and educated (19%), smart (17%), neat with good grooming (16%), like any other person (10%), social (9%), calm (6%), presentable (5%), focused (5%), organised (4%), a poorly dressed woman with spectacles (2%), intelligent (2%), gloomy and bored (2%), old (1%), bald-headed (0.65%), and poorly dressed (0.3%).

The findings above indicate a very positive perception of academic librarians in Kenya. These expressed perceptions by the respondents of this study sharply contradict the traditional librarian stereotype explained earlier. The perception of the academic librarian as knowledgeable and educated, smart and presentable particularly contradicts the perception of librarians as less educated and poorly groomed. In fact, 38 percent of the respondents specifically stated that the academic librarian is smart (17%), neat (16%) and presentable (5%). Less than ten percent of the respondents perceived the librarians as poorly dressed (2%), gloomy and bored (2%), and old (1%). The findings also contradict the general perception of librarians as women. Only 2% specifically stated that they perceive an academic librarian as "a poorly dressed woman with spectacles". It is also noteworthy that 0.65 percent thought of the academic librarian as bald-headed which gives the impression of a man. It is also important to note that ten percent of the respondents viewed academic librarians "like any other person". This implies that academic librarians in Kenya fit culturally in their communities and are not easy to pick out on account of their social or physical attributes. Although just two percent of the respondents thought academic librarians are intelligent, this particular finding may be an important pointer to a changing attitude towards librarians. It is not possible at this point in time and with the available data to predict whether this opinion may spread over time. Nonetheless, it gives the academic librarians a window of hope which they can maximise to change their image in the public psyche positively, permanently as intelligent experts.

What academic librarians do

Asked what academic librarians do, the majority (18%) of the respondents said that they help library users. The other roles of academic librarians identified by the respondents include managing the library (12%); lending books (10%); keeping books and records (8%); arranging the library (7%); organising books (6%); managing academic information materials (5%); and ensuring there is order in the library (5%). The other roles such as providing access to information materials, advising users, research, stocking the library with information materials, taking care of information materials, cataloguing and classification of information resources, acting as the links between the users and the libraries, providing user orientation and maintaining library books were also mentioned albeit in magnitudes less than five percent.

The findings above generally indicate a positive perception of the roles of academic librarians. It is noteworthy, however, that the respondents did not mention any role relating to ICTs which are considered as some of the major tools for designing and delivering library services and products in this age. Other omissions include strategic planning, resource mobilisation, publishing support, reference management, strategic networking and alliance building, marketing of information services and products, and corporate social responsibility. The exclusion of these roles indicates that the respondents perceive academic librarians in Kenya as performing the traditional librarianship roles only. If that is the case, then it implies that the respondents do not understand the special roles academic librarians play. It may also imply that the

academic library users in Kenya do not interact closely with the librarians to get a good understanding of what they do.

It is also noteworthy that the respondents perceive the academic librarians as the bridges between them and the information services and products. This implies that the librarian plays a pivotal role in the information value chain by mediating between the users and the information services or resources they need. This mediation approach implies that the effectiveness of library usage is greatly influenced by how well the librarians play their bridging role. This perception underscores the significance of a good librarian image which influences the extent to which users can look up to them to meet their information needs. This role may change over time as more users embrace ICTs and adopt disintermediation and self service. It is probable that academic library users in Kenya rely more on librarians due to challenges posed by the effects of the digital divide in the developing countries making meaningful digitisation of library services and resources less effective.

Gender of academic librarians

The majority (65%) of the respondents were of the view that an academic librarian in Kenya can typically be of either gender while 25 percent said she would be female as the remaining ten percent said he would be male. Figure 1 below represents these opinions. Although an overwhelming majority of the respondents opined that an academic librarian can be of any gender, it is noteworthy that the number of those who were of the view that she would be female was more than double the number of those who felt he would be male.

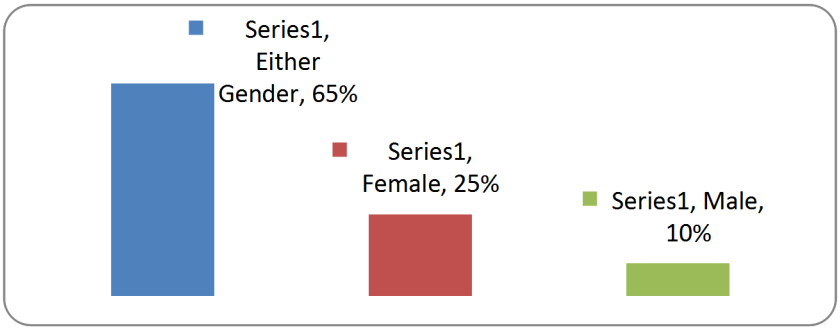

Fig. 1: Typical gender of academic librarians in Kenya

Therefore, the finding above subtly reinforces the common view that librarians are typically female and librarianship a “pink-collar” profession. Indeed Samuelson (2012) summarises this view by asserting that women of a fairly high average age undeniably predominate the library workplace. Although there are variations in the gender proportions of librarians in different library typologies, the female dominance of the profession is still strong across the board. The situation is the same in academic libraries as well. For instance, the American Library Association (ALA) in a 1999 survey found that more than half (57%) of the library academic library directors were female (ALA,

1999) while Bobinski (2007) reports that according to the 2000 census, 82 percent of the librarians in the United States of America were female. The United States Department of Labour (2013) estimated that the number of female librarians in the country was 82.8 percent last year. The situation was not different in the United Kingdom where the number of female librarians grew from 75.9 percent in 2001 to 83.3 percent in the 2010 (Easton, 2012) or South Africa where Hoskins (2013) reports 71.4 percent dominance by females.

A notable difference is in Nigeria where Nwezeh (2009) conducted a study which confirmed that male librarians in the country were about 60 percent. This view is supported by Haliso (2011) who also conducted a study which concluded that there are more (77.2%) male academic librarians in 25 universities in South-western Nigeria. This difference may be attributed to contextual differences which may be unique to Nigeria. Such differences may include social-economic factors like the prevailing relatively higher illiteracy and unemployment levels among women.

Attributes of academic librarians the users like

The majority (17%) of the respondents liked academic librarians for being friendly and sociable; 16 percent for being helpful; 13 percent for being knowledgeable; 9 percent for being polite; 7 percent for being generous and kind; another 7 percent for being smart and neat; and 6 percent for being organised. The other attributes of academic librarians which the users liked include effective communication (5.3%), understanding (5.3%), patience (5%), focus (4%), cooperation (3%), honesty (2.4%), and availability (1.5%).

The findings indicate that the majority (above 80%) of the academic library users in Kenya value social more than the technical attributes of librarians. These findings concur with other studies including Partridge, Lee and Munro (2010) that emphasised that some personal traits may be more important to academic librarians than technical skills. They explained that some of these personal traits include passion, enthusiasm, good grooming, "spark", resilience, curiosity, self-drive and open-mindedness. Myburgh (2003) also suggests other personal attributes such as independence, moral integrity, action-orientation, patience, diplomacy, sensitivity, personal commitment and customer-orientation. It is also important that academic librarians have a flexible attitude. Gutsche (2010) explains that in an earthquake, it is the rigid structure that is the most likely to fail while the flexible structures bend and sway and then settle when the quake is over. Academic librarians also need life skills such as problem solving, critical thinking, effective communication, teamwork and ethical thinking which complement their discipline-specific skills and professional knowledge (Partridge and Hallam 2004). Advocacy, lobbying, negotiation, diplomacy, conflict resolution, marketing, and promotion skills are also important (Partridge, Lee and Munro, 2010). Partridge and Hallam (2004) also emphasise that teaching, marketing and customer service skills are critical for all librarians of the 21st Century. Myburgh (2003) also suggests that in a

globalised world, librarians now need to understand at least one more language spoken by their core publics going beyond the common lingua-franca.

Attributes of academic librarians the users do not like

The attribute disliked by most (84%) academic library users in Kenya is arrogance. The other disliked attributes include harshness (28%), strictness (26%), lack of cooperation with the users (18%), ignorance (17%), being boring (16%), laziness (14%), seriousness (12%), insensitivity (10%), poor public relations (8%), poor communication skills (4%), and low self esteem (2%).

The users explained that some academic librarians are rude and do not give the users a fair chance to develop a mutually beneficial relation with them. Such arrogant academic librarians treat library users with contempt and show no respect for their points of view or suggestions. They exhibit a know-it-all attitude which makes it difficult for them to benefit from the unique experiences of the users. They behave as if the services they are paid to deliver to the users were a favour which they can offer and withdraw at will. Some academic librarians were also considered to be lazy people who prefer to issue instructions to the users from behind their desks than provide help to the users where it is needed. They whine and grumble when they have to attend to the users away from their desks. The users emphasised that academic librarians should be sensitive to the needs of the users and be willing to do their best for their users rather than seeking their own comfort and gratification first.

The library users also decried the poor public relations and communication skills some academic librarians in Kenya exhibit. They explained that such librarians could hardly express themselves making it difficult to get meaningful help from them. They emphasised that academic library users are not able to maximise the benefits of their libraries without a good relationship with the librarians based on effective communication. The users explained that the challenges associated with poor public relations amongst academic librarians emanates from their low self esteem.

Recommendations

The respondents recommended that academic librarians should develop competencies in public relations, communication and other interpersonal skills to enable them to relate better with the library users. These competencies may be developed through formal training, mentorship and other forms of capacity building. They further recommended that the academic institutions should explore ways of motivating the librarians they employ so as to inspire them to give their best to the library users. Motivation may be achieved through better remuneration, job satisfaction, recognition, and work environment.

Academic libraries should also develop clear policies on client-relations issues such as turnaround time, expectations management, essential etiquette, and standard operation procedures as a means of ensuring better customer care. Where appropriate, the libraries may consider installing CCTV cameras to enhance compliance with the policies. It is

also recommended that academic libraries should modernise their library physical spaces and collection which have over the years discouraged the users from making the library their first option for seeking credible information for their academic interests. The image of academic librarians has been associated with the sorry physical state of the library and collection. However good the academic librarians are, their image would still be dented if the physical library is untidy or dilapidated. Academic institutions would help the librarians to improve their image by improving the physical facilities in the library premises.

Given that the information seeking behaviour of typical academic library users of this generation has changed from being library-centric to peer networks, academic libraries should adjust their service models to correspond with the interests, tools and expectations of the modern users. This may be achieved through the provision of customised services; liberalisation of library services through infotainment; expanding the reach and convenience of library services and products through various forms of automation; building and facilitating peer networks and alliances; as well as inviting user participation in the design and delivery of library services and products. The librarians should also embrace and embody the spirit of academic freedom most of their institutions practise by making the library less rigid. This can be achieved, for instance, by allowing the users to bring snacks or drinks into the library; inviting the users to bring and use their own devices such as smart phones, i-pads and notepads in the library premises; noise zoning the library to allow loud discussions in designated areas; and including programmes such as plays, art galleries, drama or debates in designated areas in the library. Less rigidity in the library has the potential of loosening the tension that normally exists between the users and the librarians thereby increasing the chance of them working together to create the information environment necessary for the effective use of the library.

The respondents also recommended that academic libraries should consider introducing dress codes which fit their contexts. This would ensure tidiness and good grooming of librarians to make them more personable. Each academic library may choose whether to adopt uniforms or general guidelines on colours, styles and fits of librarians' clothing. Given that grooming plays a vital role in image development, a dress code has a high potential of addressing the image issues relating to the physical appearance of the academic librarians.

Academic librarians should also demonstrate their worth by engaging the other members of the institutions through active participation in research; innovative conceptualisation and delivery of library services and products; as well as participating effectively in institutional activities such as strategic planning. Since no one would like to associate with a gloomy person, academic librarians can enhance their social capital by shedding off the stern and shushing countenance and replacing it with a vibrant and cheerful spirit.

Conclusion

The findings of this research study indicate that the majority of academic library users in Kenya perceive an academic librarian positively as a person, male or female, employed by an academic institution to organise and manage a library which supports the programmes of the institution. They perceive such a person to perform routine clerical roles such as collecting, keeping, arranging and lending information materials (books) as well as maintaining order in the library. Although some of the perceptions were contradictory, the academic library users in Kenya's general mental picture of the academic librarian is that of a knowledgeable, smart, sociable, calm, organised and focused person. The academic library users in Kenya like sociable, knowledgeable, helpful, polite, kind, organised, understanding, patient, cooperative, honest and available person as a librarian. Conversely, they dislike arrogant, harsh, strict, ignorant, uncooperative, boring, lazy and insensitive librarians. They acknowledged that the image of the librarian influences their effectiveness in working together with the users to create an information environment which is conducive to teaching, learning and research. They recommended that academic librarians should strive to develop, project and sustain an image which is perceived as positive by the library users. They suggested that academic librarians may enhance their image by developing interpersonal skills, developing and enforcing customer-centric standard operation procedures, embracing liberalisation and academic freedom, adopting a dress code, participating actively in institutional activities and research as well as demonstrating their worth in the information value chain through creative and innovative library services and products.

Implications of the findings of the study

These findings can be used by academic institutions or academic librarianship associations to develop guidelines on important image issues such as dressing, code of conduct and etiquette. They can also be used to support the development of policies on the classification and remuneration of academic librarians; conduct job analysis and develop effective job descriptions for academic librarians; develop frameworks for networking and partnerships with the library users as well as the other academic library communities to enhance the effectiveness and impact of the academic library; and by library and information science schools to develop curricula capable of equipping student librarians with the skills and competencies which library users desire of academic librarians.

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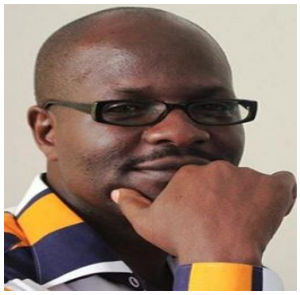
Authors' Brief Biography



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APPLICATION OF COMPUTER TECHNOLOGIES TO SERIALS SERVICES IN UNIVERSITY OF RESEARCH INSTITUTE LIBRARIES IN NORTH CENTRAL NIGERIA

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Abstract

The study focused on application of computer technologies to serials services in university and research institute libraries in North Central, Nigeria. Descriptive survey was used as design of the study. The study covered 13 university and 19 research institute libraries. The population of this study was 234 librarians which were adopted. Research instruments were Questionnaire and a checklist developed by the researcher titled "Questionnaire on Application of Computer Technologies to Serials Services in Libraries" (QACTSSIL). A response rate of 183(78.21%) was recorded. The null hypotheses were tested at 0.05 level of significance using t-test. The findings revealed that librarians in both university libraries and research institute libraries differ significantly in their opinions on the application of computer technologies to serials services($t = -4.26$, $p<0.05$). It was found that the opinions of librarians on factors constraining the application of computer technologies to serials services ($t = -2.79$, $p<0.05$) and strategies for enhancement ($t=-4.69$,$p<0.05$) differed significantly. It was recommended among others that library managements should address irregular power supply; inadequate computer technology infrastructure and inadequate funding that hindered effective application of computer technologies in serials services for effective and efficient services in university and research institute libraries.

Keyword: Computer Technologies, Serials Services, University, Research Libraries, Nigeria

Introduction

In recent times, university and research institutes no longer look at the library as the only arena for research and information-gathering. The introduction and rapid growth in use of computer technologies has actually increased the scope and importance of library as repository of information for research output. Besides, surfing Internet for information is now a common phenomenon among academics and researchers. Notwithstanding this over-reaching role of computer technology, library remains the main source of information in both soft and hard copies. This study tends to focus on application of computer technologies using computer, storage devices, computer

accessories and Internet to improve the quality of serials services in university and research institute libraries in North Central Nigeria.

Serials is a publication in any medium issued in successive parts usually at regular intervals, bearing numerical or chronological designations and intended to be continued indefinitely (Madu, 2010). Serials include periodicals, newspapers, annuals etc. Serials control constitutes major sources of information for library users. It holds records of various particulars about serials such as periodicity, frequency of arrivals, whether current issues have been received or not, whether subscription has been paid or not. Computer technologies can handle serials more easily, quickly and less expensively. According to Adio (2005) Serials contain current information that serve as the nerve centre of academic and research libraries and are very useful for studying, teaching, learning and research purpose. Thus, they are accorded prominence in libraries. Madu and Adeniran (2005) enumerated the characteristics of serials as:-

1. They are current and up-to-date,
2. The content of each issue is different
3. The publication interval varies : bi-annual, monthly, quarterly, forthrightly, weekly, daily and annually,
4. No planned end to the sequence,
5. They are more expensive than books, and
6. The publisher might change
7. They are subscribed to.

This is an on-going study to determine the application of computer technologies in serials services in university and research institute libraries. Currently, research institutes are at the vanguard of applying computer technologies to Information services delivery. For instance, Raw Material Research and Development Council have been pioneering the use of computer technologies. It will be useful to know whether universities are also applying computer technologies to improve the quality of serials services in North Central Nigeria.

Statement of the Problem

One of the greatest challenges facing libraries, especially university libraries in Nigeria, is users' increasing demand for information due to information explosion. Libraries over time have tried to meet this demand by developing information services. Serials services are activities aimed at enabling users make effective use of library resources. Among these diverse information materials, serials are most needed especially by faculty and research students. Serials by their nature could be very difficult to manage and control. Consequently, the application of computer technologies such as computer, Compact Disk Read Only Memory (CD-ROM) and the Internet will revolutionalize these services. These technologies have immense capacity to process, manipulate and retrieve information in a very short time (Oketunji, Okojie and Abdulsalam, 2002). They are also used to providing timely information to library users thus reducing the time lag

between generating and accessing such useful information. However, pre-research investigations and preliminary observations of some libraries in North Central Nigeria revealed that not many of the vital serials services were performed electronically.

The undesirable consequences of this trend are that these libraries would be unable to provide current and timely information to their users. This situation may also lead to the inability of these libraries to meet their users' information needs efficiently. Studies have shown that the application of computer technologies in Serials services can help libraries deal with these challenges (Babu 1999, Agbaje 2002; Anunobi and Nwakwuo 2008, Anunobi and Edoka 2010).

It has been found that studies relating to this area were very scanty and no similar study has been carried out in the North Central Nigeria to the knowledge of this researcher.

Objectives of the Study

The objectives of this study were to:

1. Determine the extent to which computer technologies are used for rendering serials services inuniversity and research institute libraries in North Central Nigeria.
2. identify constraints against effective application of computer technologies in serials services in university and research institute libraries in North Central Nigeria.
3. identify strategies for improving application of computer technologies in serials services in university and research libraries in North Central Nigeria.

Hypotheses

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

1. There is no significant difference between mean rating of university and research institute librarians on use of computer technologies for serials services.
2. There is no significant difference between mean rating of university and research institute librarians on constraints that affect application of computer technologies in serials services.
3. There is no significant difference between mean rating of university and research institute librarians on strategies employed to address constraints that affect application of computer technologies in serials services.

Literature Review

The concept of computer technologies encompasses computer and its accessories. Computer has been defined as a machine that can be programmed to manipulate

symbols, perform complex and repetitive procedures quickly, precisely, reliably and quickly store and retrieve large amounts of data (The American Heritage Science Dictionary, (2002). There are two major components of a computer, namely, software and hardware. Hardware is the physical component of a computer system which is categorized according to the basic operations they perform: input, processing, output, storage and communications. The software refers to instructions that make computer to function. Generally, software is divided into system software and application software (Onwudinjo, 2008). The system software program enables a computer to function and control its own operations.

Application software packages are programs and other operating internal control systems used by a computer to solve special problems and perform routine duties to users. There is generalized software which is produced by manufacturers to meet general needs of users, and there is user-defined software which is specially produced by the users to serve specific needs (Adesina and Fatuyi, 2001). According to Oketunji (2001), application software packages are sequences of instructions that tell computer what to do, how to manipulate data and how to relate to users. It normally addresses one aspect of computing or the other. Most of the off-the-shelf (i.e. readily available software) for micro-computers are referred to as application software packages. Traditionally, most computer manufacturers provide system software for use with computer unit, while the development of application software has been viewed as user's responsibility. In this study, application software control and coordinate activities of computer system.

Storage devices in this study can be used to store information for future use in the library. This includes Compact Disc Read Only Memory (CD-ROM). It can also be referred to as an external storage device. CD-ROM is common in modern computers and it has the capacity of holding 650 Megabyte (MB), that is, about 300,000 text pages (Aguolu & Aguolu, 2002). Data from CD-ROM are read by laser beam, which is used for recording them and while user can read the disc, information stored on them cannot be erased. They are portable, durable, cheap and not easily prone to virus attack and can conserve a lot of space (Sharma, 2000). A current version of the CDs is DVD.Generally, the use of electronic CD-ROM has positive effect on users in accessing resources easily (Ray and Day, 1998). This is clearly confirmed in the case of a survey undertaken at Oakland University by (Schulz & Salomon, 1990) that students are satisfied with the use of CD-ROMs.

Computer technologies in serials services can be used for the following functions and activities: subscription control, procurement process, order preparation, fund analysis and accounting (Oketunji (2001), Agbaje (2002); Oni (2004), Otolo and Anie (2009). They can also be used for bibliographic file control, cataloguing of new serials, preparation of serials record entries and transaction control. Effecting serials additions, changes and deletions or collection control can be performed with computer technologies. Services and preservation functions such as servicing request for serials

publication, binding control file, missing issues, holdings accession of want lists as well as union lists are amenable to computer technologies.

For serials operation, Agbaje (2002:27) stated that "computer technology can be an effective hand-maid to serials management at every stage of management process and irrespective of content, use, format and overall strategy adopted for serials management by organization in question". Application of computer in serials services facilitates ordinary receipt, accession and renewal of subscription. It can also be used in serials control to handle inventory, ordering and acquisition, accessions, cataloguing and circulation of serials (Khalid, 2007).

Commenting on the advantages of electronic resources, Dadzie (2007) writes that electronic resources are invaluable research tools that complement the print-based resources in a traditional library setting. Their advantages, according to her include: access to information that might be restricted to the user due to geographical location or finances, access to more current information, and provision of extensive links to additional resources related contents. This rapid emergence and development of electronic information technologies therefore makes it possible to envision radically different ways of organizing the collections and services the library has traditionally provided. While libraries approach a crisis point in financing collection development, these new technologies offer possible ways to mitigate costs and revolutionize ways to access information. Navjyoyi (2007) also finds that speedy publication and availability on the desktop are the key advantages that attract research scholars. The implication of applying computer technologies to serials services is that libraries worldwide can have access to numerous journal title online (Chukwuma, 2011). Research has shown that academic staff prefers electronic journals to print. Brown (2007) who worked on academic staff use of e-journal found that Serial control constitutes major sources of information for library users.

Furthermore, serials operations in developing countries are besieged with problems associated with cost (Millis (1992), de Marcas (2000); Aina (2003), inadequate acquisition and processing tools (Szilvassy 1996), competency and accessibility problems (Cohen (1989) and Mullis (1992). It was also suggested by these researchers that the use of computer technologies can be used to overcome some of these problems. Similarly, Ajayi (2003) asserted that any information industry that sidelines these technologies has simply signed a death warrant.

A cursory survey of library services especially serials in Nigeria by various scholars such as Tise (2001), Oketunji *et al (*2002), Obajemu, Ogunyade and Nwoye, (2004),revealed a catalogue of problems and gaps. These include a towering infrastructural inadequacy, seemingly insurmountable problems of human and financial resources, lack of access to necessary information and resources for learning, as well as poor communication among key players in Nigerian library scene. In the same vein, Tedd (1984) wrote on the inherent problems of serials which include: elusiveness, as most of them are not published by commercial organizations, the tendency of serials to

change name; divide into two or three separate publications, die or lay dormant for several years; the difficulties in being aware of which issues have not yet been received, possible changes of publisher, some serial, especially in research libraries, are not bought but are gifts or exchange, the physical problems of storing and circulating individual issues, and awareness of when all the issues of a volume have been received and so ready to be sent to the binders.

Due to harsh economic conditions and government apathy to library development in Nigeria, the state of computer technologies in research and university libraries is mediocre. Available literature affirms that quality of research institutes and university can be judged by content and quality of services offered by library. The economic conditions and government apathy has made content and quality of services in most Nigerian university libraries deteriorated and as such products of these universities has also been adversely affected. Ogunleye (1997) stated poor electricity supply, unfavorable government policy, lukewarm attitude towards alleviation of academic institutions, high cost of computer technology importation and insufficient fund allocation are some of the problems that hindered their use in libraries. This view is affirmed by Ajala (2000), Majid (2001); Adeyemi (2002), Oketunji, Daniel and Okojie (2002) who indicated lack of telecommunication/telephone facilities and Internet accessibility in their research and use of these technology in Nigerian libraries. Chisenga (2004) opined lack of budget provision for purchase and maintenance of computer technology by parent organizations and library managements has greatly hindered libraries. Even meager funds approved which could have been used for development of library including computer technologies according to Ayo (2001) are in some cases diverted to other areas. Similarly, Ochai (2000) confirmed that poor state of libraries and library services in Nigeria is no longer news. Empty library shelves or outdated books on shelves say it all. Dilapidated library buildings complete the story. These cases depict funding problems being experienced by Nigerian libraries. Dankwa (2004) reported that use of computer technology such as networking, trunking; cabling, networking cards; software administration and maintenance of file servers are capital intensive. Funds are usually not available for libraries.

Lack of skilled staff on use of computer technologies could be a problem (Omoloju, 1985). For Oketunji (2000) it is lack of technical support staff. Ojedokun (2000) confirmed that such staff is in abundance in other African countries like South Africa and Egypt. Adeyemi (2002) stated that mobility rate of system analysts employed in university libraries is very high due to poor remuneration. Dada (1994) equally asserted fear and anxiety hindered computer technology skill acquisition by some library staff.
Another problem militating against development of these technologies in university and research institute libraries is negative, laissez-faire attitude of library staff. They feel that government or their employers should train them in computer technologies. This is a wrong conception and belief. Popoola (2002) argued that there is widespread fear and negative attitudes that have slowed the progress of computer technology implementation.

The study of Ray and Day (1998) found out that 83% of students surveyed felt that using CD-ROM saved them time, and found it relatively easy to use. Two thirds of those surveyed stated that if the CD-ROM was busy, they would wait for it to become free rather than use the print tool. However, a study of online searching of scientific information in science and technology libraries of Delhi revealed that a sizeable number of users (almost 60%) are facing numerous problems while browsing electronic information, such as lack of knowledge about the resources, lack of trained staff and inadequate terminals (Ali, 2005).

Oduwole and Akpati (2003) investigated the accessibility and retrieval of electronic information at the University of Agriculture Library, Abeokuta, Nigeria. The 425 participants responded out of a survey population of 1,000, giving a response rate of 53.87%. The study revealed that electronic information cuts across all members of the University community, it was easy to use and was satisfied with their search outputs. The constraints identified included insufficient number of terminals available for use despite high demand and inadequate electricity supply.

Anunobi and Edoka (2010) conducted a study in southern Nigerian federal university libraries to identify extent of computer technologies used for serials functions. Questionnaire was distributed to staff of 11 federal university libraries in southern Nigeria. Results revealed that serials functions are still predominately manual with computer technologies being more prominent in serials public services and preservation functions; public services activities involved use of computer technologies to access, retrieve serials and article titles. It was recommended that university libraries should make a decision on whether to equip serials units with computer technologies or have a systems unit where these technologies and related operations will be carried out, including serials. University libraries should solicit aid from donor agencies for hardware and software for serials functions. Implication of the study is closely related to this research because computer technologies are fundamental to delivery of serials services in libraries under study. This also related to findings of Siddique (1997) whose work in Saudi Arabia, revealed only two of seven libraries studied applied computer technologies to serials control.

Ogunniyi, Akerele and Afolabi (2011) investigated the use of serial publications in Adeyemi College of Education Library, Ondo, by the academic staff of the School of Arts and Social Sciences. Questionnaire was the main instrument of collecting data from the respondents. Also, complete enumeration sampling method was used. Out of the 49 questionnaires administered, 30 (61.2%) were returned and found useful for analysis. The study found that 20(66.7%) used the serial section of the Library while 10 (33.3%) did not. Also, 12 (6.6. %), 6(20%) and 12 (40%) used the section very often, often and rarely, respectively. It was inferred from the result that those that were not using the section did so because of the notion that there is non-availability of new journals in their areas of interest. It was recommended that the serial section should send list of recent journals and photocopies of contents' table to relevant departments to improve the use of the section.

Adio (2005) studied the problems of managing serials at selected library and proposed solution. The study was exploratory, 7 library staff, 50 academic staff, 100 postgraduate and 50 undergraduate students were randomly selected from University of Ilorin. Data was collected by questionnaire administration, interviewing, examination of records and observation of activities in the library. Analysis of responses and observation was descriptive. The problems were those of funding, human resources, acquisition, users attitudes etc and mainly institutional oriented. Adequate funding, user's education, regular evaluation of stock, improved human resources e.t.c would alleviate the problems.

The literature focused on concept of computer technologies and serials services in libraries; application of computer technologies in serials services in libraries and constraints that hindered effective application of these technologies to serials services A number of studies reviewed threw light on Serials services as activities aimed at enabling users make effective use of library resources. The provision of access to the right information, to the right users; at the right time and in the right quantity will not only save the users' time. It will also go a long way in improving their efficiency in information search. It will assist users to avoid duplication of research and get new ideas. It will create a totally different environment for information provision.

Methodology

The study adopted descriptive research design. The population of this study was 234 librarians and was adopted entirely. Research instruments adopted included checklist and Questionnaire developed by researcher titled "Questionnaire on the Application of Computer Technologies to Serials Services in Libraries" (QACTSSIL). A response rate of 183(78.21%) was recorded. The null hypotheses were tested at 0.05 level of significance using t-test. In testing hypotheses, calculated t-test for equality of means was compared with critical i.e. 0.05.

Findings

Table 1: Mean, Standard Deviation on Significant Difference Between Mean Rating of University and Research Institute Librarians on Extent of Computer Technologies used for Serial Control Services

S/N	Librarians	N	Mean	SD	Df	t	Sig. (2-tailed)	Decision
1.	University librarians	120	1.90	1.02	181	- 4.26	0.000	Rejected
2.	Research institute librarians	63	2.58	1.04				

Table 1 show the result of Hypothesis 1. Result revealed that the test was highly significant (t = - 4.26, p < 0.05). This implied that the null hypothesis was rejected. Therefore, there was a significant difference between the mean ratings of university and research institute librarians on the extent of application of computer technologies in serials control services. Hence, the null hypothesis had been rejected.

Table 2: Mean and standard deviation on significant difference between mean rating of university and research institute librarians on constraints that affect application of computer technologies in Serials services.

S/N	Librarians	N	Mean	SD	Df	t	Sig. (2-tailed)	Decision
1.	University librarians	120	2.69	0.87	181	- 2.79	0.006	Rejected
2.	Research institute librarians	63	2.33	0.76				

Tables 2 show the result of Hypothesis 2. Result revealed that the test was significant (t = - 2.79, p < 0.05). This implied that null hypothesis was rejected. Therefore, there was significant difference between mean ratings of university and research institute librarians on constraints that affect application of computer technologies in Serials services in university and research institute libraries. Hence, null hypothesis had been rejected.

Table 3: Mean and standard deviation on significant difference between mean rating of university and research institute librarians on strategies used to address constraints that affect application of computer technologies in Serials services

S/N	Librarians	N	Mean	SD	df	t	Sig. (2-tailed)	Decision
1.	University librarians	120	3.36	0.66	181	- 4.69	0.000	Rejected
2.	Research institutelibrarians	63	2.72	1.16				

Table 3 shows the result of Hypothesis 3. Result revealed that the test was highly significant ($t = 4.69$, $p < 0.05$). This implied that null hypothesis was rejected. Therefore, there was a significant difference between mean ratings of university and research institute librarians on strategies used to address constraints that affect application of computer technologies in Serials services in university and research institute libraries. Hence, null hypothesis had been rejected.

Discussion of Findings

Application of computer technologies in serials services

Result revealed that the opinions of librarians in these libraries were found to differ significantly on application of computer technologies in serials services. These findings are surprising because computer technologies were readily available for serials services in university libraries but serials services were still performed manually. This is similar to the findings of Anunobi and Nwakwuo (2008) where majority of university libraries in Eastern Nigeria have not embraced computer technologies for the operation of serials. This finding, however, agreed with Anunobi and Edoka's (2010) findings which revealed that serials functions are still predominantly manual. These findings negate the role of university libraries as major information providing system that supports teaching, learning and research with various types of information materials. Among these diverse information materials, serials are most needed especially by faculty and research students. This also relates to the findings of Siddique (1997) whose work in Saudi Arabia, revealed only two of seven libraries studied applied computer technologies to serials control. Low usage of computer technologies for acquisition and processing of serials services in university libraries may be attributed to non-availability of serials software which will enable use of computer technologies for complex acquisition and processing activities involved in serials functions. An explanation for this could be found in the works of Anunobi and Benard (2007) where many libraries studied do not have library software and those with such were yet to activate their serials module. Findings in research institute libraries were expected as these technologies were highly used for serials services such as inventory, ordering and acquisition, accessions, cataloguing and circulation. This agrees with Babu (1999) and Agbaje's(2002) findings that computer technologies can be an effective hand-maid to serials management at every stage irrespective of content, use, format and overall strategy adopted.

C**onstraints to the application of computer technologies in information services**

University and research institute libraries were both constrained by irregular power supply, inadequate computer technology infrastructure and inadequate funding. However, these were cited as more serious constraints by university libraries. Furthermore, opinions of librarians in these libraries on factors hindering their efficient provision of serials services differed significantly. Result were expected because this could be the reason why some serials services were still being performed manually and

users cannot benefit fully from computer technologies application in research and developmental activities.

Despite existing constraints, prospect of computer technology application in serials services is very crucial. Besides, the meager funds approved which could have been used for the development of library including computer technologies according to Ayo (2001) are in some cases diverted to other areas. Sani and Tiamiyu (2005) pointed out that irregular power supply; librarians attitude towards use of these technologies and poor funding were militating towards computer availability and use in Nigerian libraries. Result also confirmed Onilude and Apampa (2010) findings that the bandwidth available could be inadequate compared to users and this account for very low speed of connectivity. Majority of staff required more training in the use of computer for research activities. Infrastructural challenges constitute a major barrier to accessibility of on-line resources which supports research and development.

Strategies for improving application of computer technologies in Serials services

The suggested solutions to constraints of serials services were training and retraining of library staff in the use of computer technologies, adequate funding for computer technology equipment and availability of computer technologies for information services. These strategies were given higher rating by those in university libraries, who saw their inadequacy as greater constraints. Generally, the strategies proposed here were found to be appropriate for enhancing application of computer technologies in serials services in research institute libraries. It was also found that opinions of librarians in these libraries differed significantly on the solutions to problems of Serials services in libraries in North Central Nigeria. These strategies were possible solutions to constraints that affect application of computer technologies in information services.

Implications of the Study

Findings of this study have implications for librarians, government and management of university and research institute libraries.

It was also found that computer technologies were not applied in serials services and as such this service was still performed manually. Application of these technologies were expected to have increased productivity, improved quality of tasks/services in university and research libraries in North Central Nigeria but this is not to be as the performance of serials services by librarians were still very low. This implies that librarians and relevant library authorities and managements should develop service charter that will clearly define the vision, mission, roles and computer technology policy and application in university and research libraries in North Central Nigeria.

Besides, application of computer technologies in Serials services in university and research institutes is still being constrained by inadequate computer technology infrastructure, irregular power supply and inadequate funding. These implied that

librarians were still performing serials services manually and users could not benefit fully from these technologies application in research and developmental activities. This also implied that library managements can request for fund from their parent organizations for the purchase of modern state-of-the-art equipment.

Suggested strategies to solve the problems discovered in this study include making computers available, providing adequate funding for computer technologies and training and retraining of library staff in the use of computer technologies in university and research institute libraries in North Central Nigeria.This implied that these strategies are possible solutions to constraints that affect application of these technologies in serials services. It also implied that these strategies will form a baseline for the formulation of computer technology policy that would be used for provision of serials services in university and research institute libraries in North Central Nigeria.

Recommendations

The following recommendations are made based on the findings of study: Serials services in university libraries should be equipped with computer technologies to provide information system that would support teaching, learning and research. Library managements should address the following constraints: irregular power supply, inadequate computer technology infrastructure and inadequate funding that hindered effective application of computer technologies in serials services in university and research institute libraries. Library managements should also consider the following strategies: training and re-training of library staff in the use of computer technologies, adequate funding for computer technology equipment and availability of computer technologies for serials services in university and research institute libraries in North Central Nigeria.

Conclusion

Application of computer technologies in Nigerian university and research institute libraries have become the most realistic way and means of providing timely, accurate and efficient information services. The importance of providing right information at an appropriate time for university and research institute libraries in North Central Nigeria goes a long way in enhancing academic research.

The study is about application of computer technologies to improve quality of serials services in university and research institute libraries in North Central Nigeria. Despite the roles these technologies are playing in the provision of serials services in libraries under study, results of this investigation revealed that not many of the vital serials services were performed electronically. For instances, it was found that research institute libraries applied computer technologies more in serials services than in university libraries. Findings suggested that these libraries should have computer technology policy framework aimed at encouraging application of computer technologies for innovative serials services.

Computer technologies were both constrained by a lot of factors. These factors were found to consist of irregular power supply, inadequate computer technology infrastructure and inadequate funding. Suggested solutions to constraints of computer application in Serials services were training and re-training of library staff in use of computer technologies, adequate funding for computer technology and availability of these technologies for information services. It was also found that the null hypotheses were all rejected, which revealed that there were significant differences between mean ratings of university and research institute librarians on application of computer technologies for information services. The application of computer technologies in serials services in university and research institute libraries globally has come to stay. In Nigeria with specific reference to North Central a lot needs to be done especially in the radical transformation of serials services.

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AN INVESTIGATION INTO THE USAGE OF INTERNET HEALTH INFORMATION RESOURCES BY HEALTH PROFESSIONALS AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA

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Abstract

This paper presents the findings of a study on the usage of Internet health information resources by health professionals at two institutions in in Zambia, the University Teaching Hospital and the School of Medicine of the University of Zambia. This study sought to establish: (1) the health professionals' awareness of Internet health information resources, (2) the extent to which health professionals use the Internet health information resources, and (3) the factors that motivate or hinder the utilization of Internet health information resources. A self-administered questionnaire was used to collect data from a sample of 90 health professionals. Sixty-eighty questionnaires were successfully completed and returned, giving a 75.6% response rate. The findings indicated that 87% of the respondents had access to Internet on their personal laptops, personal computers or mobile phones through private subscriptions to Internet service providers. Most of the respondents (50-57%) had access to Internet health information resources on a daily basis. Furthermore, most of the respondents used Internet health information resources mainly for research, teaching, communication, and preparation of seminar presentations. Internet health information resources were also used, to a less extent, for preparation of examinations, patient care, and administration. Most respondents reported that Internet health information resources had increased their productivity, improved their clinical work, enhanced their effectiveness in their performance, and had enabled them to have more control of their work. However, the findings showed that most respondents were not aware or familiar with the specific Internet health information resources subscribed to by the University of Zambia, resulting into the low utilization of these resources. The major barriers to usage of Internet health information resources included lack of awareness, poor Internet connectivity, inadequate computers, poor search skills, and lack of time. Furthermore, health professionals found it time consuming, frustrating, and difficult to use the Internet health information resources. The study recommends improved marketing strategies of the existing Internet health information resources, improved ICT infrastructure, and introduction of information literacy programmes.

Keywords: Internet health information resources; health professionals; information use; medical libraries; Zambia

Background to the study

The advance of the Internet and the World Wide Web (WWW) has resulted in unprecedented increased provision of access to huge amounts of information resources and services. The Internet is a global network of computers that enables people of all professions and backgrounds to easily communicate and engage in various activities such as research, study and teaching. In the field of medicine, the Internet is being used

for research, teaching, and diagnosis of diseases, treatment, and patient care (Jones, 1991; Odusanya & Bamgbala, 2002; Hong, 2002). Furthermore, the Internet is increasingly being used as a source of health information by the general public as well as the private and public health care practitioners (Eysenbach, Sa and Diepen, 1999; Riegelman and Persily, 2001; Skinner, Biscope and Poland, 2003). Godlee et al. (2004) argue that among currently available technologies only the Internet has the potential to deliver universal access to current health care information. The Internet has also made it much easier for health professionals to base their practice and training on evidence-based medical resources. Evidence-based medicine (EBM) involves the explicit, conscientious and judicious consideration of the best available evidence in making health care decisions (Sackett, 2005). This approach relies on identifying and reviewing the best and most relevant scientific literature to determine the appropriate diagnosis, test or treatment. Evidence-based medicine is about making informed decision, answering clinical questions and solving patient's problems using available evidence in the medical literature. Several EBM resources are now available online for health professionals to improve and perfect their decisions and practice.

Many researchers have observed that, despite the availability of IHIRs, access to the Internet is a challenge for many health professionals and researchers in many countries in Sub-Saharan Africa, mainly due to limited telecommunication infrastructure (Godlee et al, 2004; Royall et al., 2005; Watts and Ibegbulam, 2005; Akpan-Obong, 2007). Internet penetration is very low in Africa (at an estimated rate of 15.6%); consequently, only 7.0% of Africa's population uses Internet (Internet Word Stats, 2012). Only a few people in Sub-Saharan Africa can afford to pay Internet subscription fees to an Internet Service Provider (Bukachi and Pakenham-Walsh, 2007). Furthermore, with the exception of South Africa, only a very small percentage of health professionals in Sub-Saharan Africa have routine access to broadband connections (Jensen, 2007). Most have slow and unreliable connectivity which makes Web browsing expensive and frustrating.

Access to required literature has been a challenge to researchers, academics, health care providers, scientists, students and policy makers in Zambia. Of the over 14,638,505people living in Zambia, only 2,313,013 (15.8%) were Internet users in 2015 June (Internet World Stats, 2014). Most of these users reside in urban areas even though the majority of the population lives in rural areas where access is either very limited or unavailable. For many years, Zambian health professionals especially those working in rural communities have been confronted with the challenge of lack of current, relevant and reliable information from published literature due to lack of access to ICTs. The concept of lack of equal access to ICTs is termed 'digital divide'. Norris (2001) describes the digital divide as the inequity that exists in access to ICTs between countries, within regions and among different social groupings within a country or between citizens of a country. Dimaggio et al. (2001) defined it as "inequalities in access to the Internet, extent of use, knowledge of search strategies, quality of technical connections and social support, ability to evaluate the quality of information and diversity of uses".

Initiatives to increase access to IHIR

The need to have access to essential heath information for health care has prompted recent efforts by international organizations, academic institutions, governmental as well as non-governmental agencies (Godlee et al., 2004; McConnell, Hail-Mariam and Rangarajan, 2004) to develop health systems and for the care of patients in areas with limited resources. These efforts have been enhanced by recognition of the strategic role health information plays in the achievement of the Millennium Development Goals (MDGs) targeted at 2015. Among the most successful initiatives is the Health Internet Network Access to Research Initiative (HINARI) launched in 2002 by the World Health Organization (WHO) (Katikireddi, 2004; Aronson, 2004). HINARI (www.who.int/hinari) is an initiative between the WHO and many of the world's biomedical publishers aimed at making published research information accessible to researchers in developing countries. HINARI provides access to over 5500 peer-reviewed journals covering medicine, nursing and related health and social sciences. It also includes many databases, indexes and reference books, as well as journals in several languages. The journals can be searched through a special version of PubMed (Medline). Brundtland (2002) observes that HINARI is "perhaps the first step ever taken to bridge the health information gap between rich and poor countries". Brundtland (2002) concluded that the launch of HINARI will help to bridge the digital divide in health, and has resulted into an important move by publishers to facilitate the flow of health information using the Internet. The availability of these resources free-of-charge on the Internet, have brought huge benefits to medial schools, health care institutions and medical libraries in developing countries including those in Zambia and other countries in Sub-Saharan Africa. Medical libraries now provide useful links to relevant, reliable and up-to-date health information resources on their Websites for easy access by their clients.

The second initiative is the Programme for the Enhancement of Research Information (PERI) (*www.inasp.info/peri/*), of the International Network for Availability of Scientific Publications, or INASP (*www.inasp.info*). INASP is a network of more than 4000 partners and organizations that share the goal of enabling worldwide access to information and knowledge. INASP was established in 1992 by the International Council for Science as a program of the Committee for the Dissemination of Scientific Information. PERI supports capacity building in the research sector in developing and transitional countries by strengthening the production, access and dissemination of information and knowledge. INASP also supports Zambian libraries to have access to various electronic databases at highly subsidized prices. This includes journals in science, medicine, social science and the humanities. Through collaboration with PERI, online journals from various publishers across all subject areas are available at a reduced rate to academic institutions in select developing countries.

It is hoped that all these initiatives will result into improved delivery and access to accurate, current and reliable information resources to students, researchers, policy makers, and managers of various health institutions in developing countries, including

Zambia. Furthermore, it is hoped that these initiatives are effectively helping to narrow the digital divide. The University of Zambia Library provides online access to several electronic journals through the Zambia Library Consortium (ZALICO), with support from International Network for the Availability of Scientific Publications (INASP), Programme for the Enhancement of Research Information (PERI), and eIFL. Some of the databases available include HINARI, Cochrane Library, Credo Reference Services, Oxford Journals (OUP) and EBSCO Host which provides access to Medline.

Statement of the problem

Health professionals play important roles in providing secondary and tertiary health care services, and in the training of health professionals. Health professionals therefore need access to health information resources to improve their capacity with regard to diagnosis, treatment, prevention, and management of diseases. They also need health information resources for research and publication of findings in their areas of specialization. Equally, lecturers in schools of medicine need current information to competently conduct their core business of teaching and research. Many studies have shown that there are challenges in accessing this vast valuable information resource due to infrastructural problems such as power outages, low bandwidth, and inadequate computers. Furthermore, studies have shown that, in many developing countries, poor perception of the benefits of Internet use, low information literacy skills as well as inadequate motivational factors militate against its optimal use. In addition, personal characteristics of the users have been found to play a significant role in the use of Internet health information resources among medical practitioners. Few empirical studies have been conducted in Zambia to establish the extent to which health professionals use IHIRs, the purposes for which they use them and factors that motivate or hinder them to use these resources. This study was therefore designed to fill this knowledge gap.

Objectives of the study

The main objective of this study was to determine the extent to which health professionals and lecturers use IHIR at the University Teaching Hospital and the School of Medicine. The specific objectives of the study were to determine the:

1. proportion of lecturers and medical doctors who have access to the Internet
2. frequency use of IHIRs among lecturers and medical doctors
3. purposes for using IHIRs by lecturers and medical doctors
4. perceived usefulness of the IHIRs
5. perceived ease of use of IHIRs
6. factors that affect lecturers and medical doctors' use of IHIRs

Literature Review

The Internet has grown from a small network that allows exchange of information between military, academic and government officials to a global infrastructure that has

radically changed the way information is obtained (Prutkin, 2001). Chin (2003) asserts that accessibility and rapid transmission of health care information and acquisition and storage of electronic medical records are two areas of medical practice that have been revolutionized by computer technology. The Internet has become the world's biggest library, where retrieval of scientific resources can be done within minutes. Of particular interest to the medical community is the large and increasing number of technical, scientific, and biomedical information resources that can be accessed through the Internet. Some institutions, organizations and libraries have developed extensive databases and services that are being used by medical researchers, clinicians, and educators to access health information. Furthermore, the Internet offers novel tools for providing continuing medical education (CME) to health professionals. Continuing medical education of health professionals is a key element of the quality and efficiency of a health system. Internet is providing more opportunities for formal physician CME on-line.

A lot of studies have been conducted to establish information seeking behavior of health professionals (Cogdill, 2003; Bryant, 2004; Gorman, Yao and Seshadri, 2004; Andrew et al., 2005; Bennett et al., 2005; Renwick, 2005; Dee and Stanley, 2005; Nwagwu and Oshiname, 2009; Haines et al., 2010). Information needs of medical doctors have been found to vary by specialty. The needs of general practitioners vary from those of the specialists (Haug, 1997). Bryant (2004) reported that a need for problem-orientated information relating to the care of individual patients' was the predominant factor that prompted family physicians and general practitioners to seek information. Furthermore, it was observed that general practitioners were more likely to search for evidence to keep up-to-date with new information and modern clinical opinion (McConaghy, 2006).

A study by Naidoo, Jinabhai and Taylor (2010) revealed that health professionals need a wide variety of health information resources to meet their clinical and educational needs. These resources include print media, colleagues, meetings, lectures, workshops, the Internet and others. However, due to time constraints, many prefer to obtain information from resources that are convenient, easy to use, and reliable (Dee and Blazek, 1993). The sources of clinical information used by doctors to keep abreast of developments in their specialties have been extensively investigated (Verhoeven, 1995; Thompson, 1997; Haug, 1997; Dawes and Sampson, 2003). According to Thompson (1997), physicians frequently rely on their personal knowledge, accumulated over years of clinical practice for patient care; but need to update this knowledge base periodically. Studies have revealed that clinicians usually consult interpersonal sources of information as a source of clinical information (Chimoskey and Norris, 1999; Gorman, Yao and Seshadri, 2004) as well as local print sources to answer questions that arise in their daily practice.

The way a physician obtains and evaluates information is influenced by a number of environmental factors, among which are: specialty, age, gender and location of practice (Agency for Healthcare Research and Quality, 1996). A common finding by researchers is that primary care practitioners have preference for print, ready reference and interpersonal sources such as colleagues (Haug, 1997; Dorsch, 2000; Cullen, 2002;

Andrews et al., 2005). This preference may be due to the fact that the main goal of the clinician is to improve the patient's health rather than seek more information.

The introduction of computer and the Internet has brought about increased access to the medical literature. Overall, use of electronic information retrieval systems by physicians and researchers has been minimal (Wessel, Tannery and Epstein, 2006). However, the situation is improving with the increase in online health information resources. A large number of health professionals are increasingly relying on the Internet to obtain health information for patient management and for research. Medical doctors also use other information sources such as handheld computers (Personal Digital Assistants) to access relevant information (Dee, Teolis and Todd, 2005). Despite the advantages of the Internet, some clinicians still prefer communication with colleagues and text resources (Dawes and Sampson, 2003; Coumou and Meijman, 2006).

Burton Howard and Beveridge (2005) studied the relevance of electronic health information to doctors in developing countries and found that 84% African doctors with access to electronic health information (EHI) read more articles than they did before they had such access. The study also showed that 84% of the respondents indicated that the electronic health information resources they sought most often were journals. The respondents claimed that the information obtained was highly relevant to their clinical practice, teaching and research activities as well as contributed directly to their academic productivity.

Demographic variables including age, gender, and Internet experience among others influence usage of the Internet. Bennett et al (2005), McKibbon, Fridman and Crowley (2007) indicated that search processes and performance for health care information could be affected by gender, age, searching experience and training background. Studies (Teo,Vivien, Lim, and Lai, 1999; Teo, 2001; Cullen, 2002; Lorence and Parkt, 2007; Masters, 2008; Casebeer et. al., 2002) of Internet usage among different categories of medical practitioners showed that gender influences usage of the Internet and that males were more likely to use the Internet than their female counterparts.

Theoretical Framework

This study is anchored in Technology Acceptance Model. The Technology Acceptance Model (TAM) is an outgrowth of the model of individual behavior as posited by Ajzen and Fishbein's (1980) Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). TAM was introduced by Davis (1989), Davis et al. (1989) for explaining and predicting user acceptance of information system (IS). TAM is the most well known of all the intention-based theories and commonly employed of IT usage, receiving considerable empirical support. TAM has been extensively used for studies of technology adoption and usage in general, and information technology in particular. TAM consistently explains a substantial proportion of the variance in usage intentions and behavior. According to Shih (2004), the major contribution of TAM is the identification of two key beliefs: Perceived Ease of Use (PEU) and Perceived

Usefulness (PU). TAM postulates that an individual's intention to use a system is determined by PU, defined as the extent to which a person believes that using a system will enhance his or her job performance and PEU, defined as the extent to which a person believe that using the system will be free of effort (Davis, 1989). TAM has grown to become one of the most influential models widely used in studies of the determinant of IS/IT acceptance and adoption.

Technology Acceptance Model has been validated through testing with various technologies. A number of researchers have adopted TAM in their studies. Ndubisi, Jantan and Richardson (2001) tested TAM's validity among Malaysian entrepreneurs and found that IT usage was influenced by PU and indirectly by PEU. Ramayah, Muhamad and Noraini (2003) tested the TAM by incorporating motivational variables (extrinsic and intrinsic) to Internet usage in Malaysia. The result revealed that the main driver of Internet usage is perceived usefulness, followed by perceived enjoyment and perceived ease of use. The findings also showed that perceived usefulness and perceived enjoyment have consistent impact on frequency of use and extent of daily usage.

It is hypothesized that health professionals will use the Internet if they perceive it to be easy to use (PEU). According to TAM, the easier a system is to use the more likely it will be used. Therefore, PEU has been considered to be a strong driver of usage of any technology. It is believed that health professionals will use the Internet for health information if they perceive that it is easy to use.

Research Methodology

The study adopted a descriptive survey design. The study was conducted at the UTH and School of Medicine. Lecturers and medical doctors at the School of Medicine and the UTH constituted the study population. All the lecturers and medical doctors in the various departments were invited to participate in the study. A questionnaire was used to elicit information from the respondents on Internet accessibility, motivational factors, and Internet health information utilization. The questionnaire was adapted from various previous studies (Davis, 1989; Igbaria, Guimaraes and Davis, 1995; Teo, 2001; Chew, Grant and Tote, 2004) and modified to suit the study context. The instrument contained five sections. Section A consisted of questions on biodata, access to the Internet, and frequency use of the Internet; Section B contained 10 items on purposes for using the IHIRs; Section C contained 10 items on perceived ease of use (PEU); Section D had 10 items on perceived usefulness (PU) of IHIRs; and Section E contained 6 items on motivational factors that cover Internet attributes. Completed questionnaires were verified, collated, coded and entered into the Statistical Package for the Social Sciences (SPSS) version 20 for analysis. Descriptive statistics which include frequency counts, means, standard deviations, media and modes were used in analyzing the data. The qualitative data from open-ended questions were transcribed and subjected to thematic analysis.

Ethical Considerations

The proposal was submitted to the University of Zambia Ethical Review Committee for review and approval. Informed consent was obtained from the participants. The questionnaire was anonymous.

Findings

This section presents the findings of the study.

Background of the respondents

Ninety questionnaires were distributed and 71 were returned. Three questionnaires were discarded as they contained a lot of unanswered sections. This gave a response rate of 75.6%. Forty-one (60%) were from the School of Medicine, University of Zambia, and 27 (40%) were from the University Teaching Hospital. The respondents came from 15 departments, namely: Nursing Sciences, Pathology, Surgery, Psychiatry, Public Health, Biomedical Sciences, Physiological Sciences, Physiotherapy, Internal Medicine, Obstetrics and Gynecology, Department of Pediatrics, Department of Pharmacy, Department of Radiology Department of Anesthesia, and Department of Anatomy (Table 1). Forty-three (63%) respondents were males (UNZA=21; UTH=22) while 25 (37%) respondents were females (UNZA=20; UTH=5). The youngest was 24 years old while the oldest was 70 years old. The average age was 43.4 years. Five respondents were PhD holders, 48 were holders of various Masters Degrees, and 15 were holders of first degrees. Work experience ranged from 1 to 44 years, while the average work experience was 12.3 years with a standard deviation of 9.7 years. Eighty-four percent of the respondents were of the opinion that their workload was very heavy while 16% felt that their workload was moderate.

Table 1: Distribution of respondents by department

SN	Department	Frequency	Percentage	Cumulative Percent
1	**Nursing Sciences**	***10***	***14.7***	***14.7***
2	**Pathology**	***7***	***10.3***	***25.0***
3	**Surgery**	***7***	***10.3***	***35.3***
4	**Psychiatry**	***6***	***8.8***	***44.1***
5	**Public Health**	***6***	***8.8***	***52.9***
6	**Biomedical Sciences**	***5***	***7.4***	***60.3***
7	**Physiological Sciences**	***5***	***7.4***	***67.6***
8	**Physiotherapy**	***5***	***7.4***	***75.0***
9	**Internal Medicine**	***4***	***5.9***	***80.9***
10	**Obstetrics & Gynecology**	***4***	***5.9***	***86.8***
11	**Pediatrics**	***3***	***4.4***	***91.2***

12	**Pharmacy**	***2***	***2.9***	***94.1***
13	**Radiology**	***2***	***2.9***	***97.1***
14	**Anesthesia**	***1***	***1.5***	***98.5***
15	**Anatomy**	***1***	***1.5***	***100.0***
	Total	***68***	***100.0***	

Access to the Internet

All of the 68 respondents indicated that they owned personal computers and were also using the Internet. However, two respondents indicated that they had no access to Internet at the time the survey was being conducted. Furthermore, only 26 (38%) respondents reported that they had received training on the use of the Internet. A Chi Square test was conducted to establish whether there was an association between institutional affiliation and receiving training on the use of the Internet. The findings indicated that there was an association (Chi Square=4.862; df=1; p=0.027; α=0.05); a larger number of respondents who reported having received training on how to use the Internet were those who were actively involved in teaching (i.e. from the School of Medicine). When asked to indicate where they were accessing Internet, Figure 1 shows that respondents had access to the Internet from various places. Most respondents accessed Internet at their workplaces (38%) and at their homes (32%). Further findings indicated that some respondents occasionally accessed Internet at an Internet café (14%), the Medical Library (10%), friend's home or office (3%), and at a computer laboratory (4%). Further analysis showed that 24 respondents shared computers at their workplaces; twelve of these respondents shared a computer with up to ten workmates while the other 12 respondents shared a computer with up to five workmates. Thirty-nine (66.1%) respondents indicated that they were accessing the Internet through private subscriptions to Internet Service Providers (ISPs) via their personal computers, laptops or mobile phones.

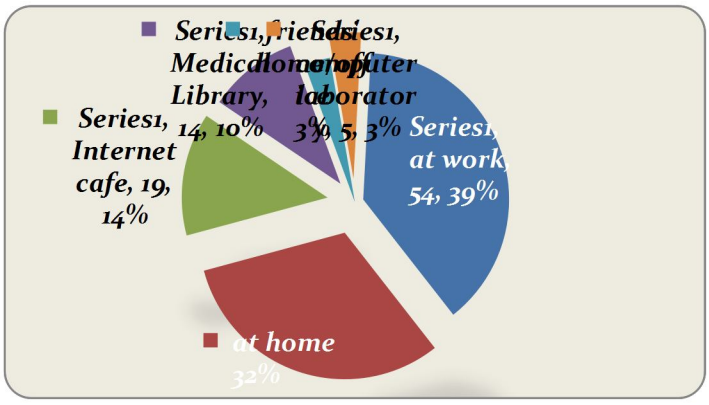

Figure 1: Internet access points

Frequency use of Internet

The researchers wanted to determine the frequency of use of IHIR among lecturers and medical doctors. When asked whether the respondents had accessed Internet in the previous day, 61 (89.7%) reported that they had while seven (10.3%) reported that they had not. Further analysis shows that 35 (58.3%) were accessing Internet everyday at their workplace; 30 (50%) were accessing Internet everyday at home; one respondent accesses Internet everyday at an Internet café; 2 respondents access Internet everyday at the Medical Library; and one respondent accesses Internet everyday in a computer laboratory (Figure 2).

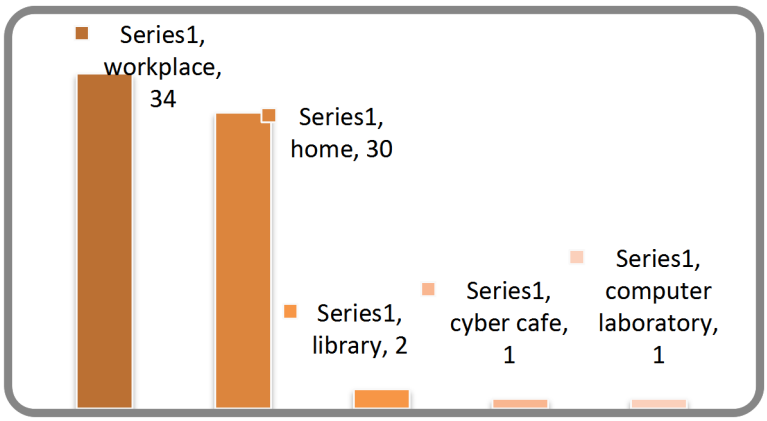

Figure 2: Daily access to Internet at access points

Purpose for using IHIR

Figure 3 shows the purposes for which health professionals used IHIR. Ninety-seven percent of the respondents used IHIR for research; 95% used IHIRs to support teaching activities; 92% used IHIRs for communication purposes; 88% used IHIRs for preparing presentations; 65% used IHIRs for preparing examinations; 63% used IHIRs for patient care; and 50% used IHIRs for administration purposes (Figure 3). A chi square test was conducted to establish whether there was any association between purpose of using IHIR and institutional affiliation at a 0.05 significance level. The results were significance in only one area: to support patient care (Chi Square=10.814; df=1; p=0.001). Respondents from UTH used IHIR more in patient care than respondents from the School of Medicine.

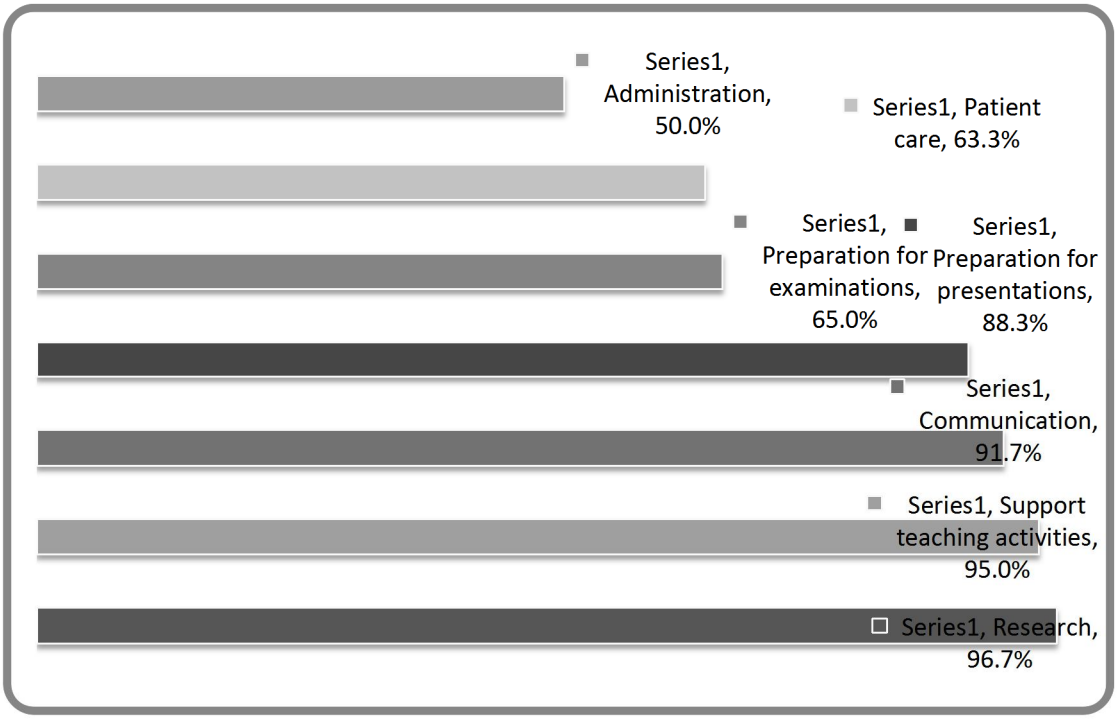

Figure 3: Purpose for using IHIRs

Respondents were asked to indicate how frequently they used IHIR for research, communication, teaching, presentations, examinations, patient care and administration purposes. Table 2 below shows that 73.5% (50) frequently used IHIR for research, 72.1% (49) frequently used IHIR for communication purposes, 66.2% (45) frequently used IHIR to support teaching activities, and 60.3% (41) frequently used IHIR to prepare for presentations. Forty-six percent (31) and 42.6% (29) used IHIR to prepare for examinations and for patient care, respectively. Only 26.5% (18) of the respondents frequently used IHIR for administration purposes.

	Frequently	Occasionally	Rarely	Never	Total (n=68)
Research	50 (73.5%)	13 (19.1%)	2 (2.9%)	1 (1.5%)	65 (95.6%)
Communication	49 (72.1%)	9 (13.2%)	3 (4.4%)	0 (0.0%)	61 (89.7%)
Teaching	45 (66.2%)	11 (16.2%)	6 (8.8%)	0 (0.0%)	62 (91.2%)
Presentations	41 (60.3%)	16 (23.5%)	5 (7.4%)	0 (0.0%)	62 (91.2%)
Patient care	31 (45.6%)	17 (25.0%)	10 (14.7%)	4 (5.9%)	62 (91.2%)
Examinations	29 (42.6%)	19 (27.9%)	9 (13.2%)	0 (0.0%)	57 (83.8%)
Administration	18 (26.5%)	10 (14.7%)	19 (27.9%)	0 (0.0%)	47 (69.1%)

Table 2: Frequency usage of IHIR

Perceived Usefulness of IHIR

Respondents were asked ten questions to assess their perceptions of the usefulness of the various IHIRs. Almost 91% of the respondents felt that using Internet could increase their productivity; 89.1% felt that using IHIRs improved the quality of their clinical work; 90.3% were of the opinion that using IHIRs enhanced their effectiveness in performing their jobs; 93.3% were of the opinion that using IHIRs enabled them to have greater control over their work; 82.7% were of the opinion that IHIRs supported critical aspects of their job for efficient and effective patient care; 90.7% were of the opinion that using health information enabled them to accomplish tasks quickly; 85.2% were of the opinion that IHIRs addressed their job related information needs; and 86.5% were of the opinion that their jobs would be difficult to perform without IHIRs. Overall, 87.1% of the respondents found the Internet useful in their work.

	agree		disagree		Total	
	Count	Percent	Count	Percent	Count	Percent
Using the Internet can increase my productivity	*59*	*90.8%*	*6*	*9.2%*	*65*	*100.0%*
Using IHIR gives me control over my work	*56*	*93.3%*	*4*	*6.7%*	*60*	*100.0%*
Using IHIR enhances my effectiveness in performing my job	*56*	*90.3%*	*6*	*9.7%*	*62*	*100.0%*
Using health information enables me to accomplish tasks more quickly	*49*	*90.7%*	*5*	*9.3%*	*54*	*100.0%*
Using IHIR improves the quality of my clinical work	*49*	*89.1%*	*6*	*10.9%*	*55*	*100.0%*
Using IHIR improves the quality of my clinical work	*45*	*88.2%*	*6*	*11.8%*	*51*	*100.0%*
My job would be difficult to perform without IHIR	*45*	*86.5%*	*7*	*13.5%*	*52*	*100.0%*
IHIR address my job related information needs	*46*	*85.2%*	*8*	*14.8%*	*54*	*100.0%*
IHIR support critical aspects of my job for efficient & effective patient care	*43*	*82.7%*	*9*	*17.3%*	*52*	*100.0%*
Overall, I find the Internet useful in my work	*54*	*87.1%*	*8*	*12.9%*	*62*	*100.0%*

Table 3: Perceived usefulness of IHIRs

Respondents were further asked to assess the usefulness of selected IHIRs which were available to them on the UNZA Website. The respondents ranked the usefulness of the IHIRs as follows: *PubMed/Medlin* (66.2%); *HINARI* (51.5%); *eGranary* (39.7%);

African Index Medicus(AIM) (38.2%); *Essential Health Links* (33.8%); *Cochrane Library* (32.4%); *Oxford Journals* (32.4%); *Wiley Online Library* (32.4%); *Cambridge University Press* (32.4%); *African Online Journals (AJOL)* (32.4%); *Bioline* (26.5%); *Annual Reviews* (26.5%); *American Physical Society* (26.5%); *Sage Online Journals* (25.0%); *De Gruyster Journals* (23.5%); *Mary Ann Liebert Inc* (22.1%); *EBSCO Host* (22.1%); *University of Chicago Press* (20.6%).

IHIRs	useful		not useful		Not stated		Total	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
PubMed/MEDLINE	45	66.2%	6	8.8%	17	25.0%	68	100.0%
HINARI	35	51.5%	7	10.3%	26	38.2%	68	100.0%
eGranary	27	39.7%	11	16.2%	30	44.1%	68	100.0%
African Index Medicus (AIM)	26	38.2%	9	13.2%	33	48.6%	68	100.0%
Essential Health Links	23	33.8%	8	11.8%	37	54.4%	68	100.0%
Cochrane Library	22	32.4%	12	35.3%	34	67.7%	68	100.0%
Oxford journals	22	32.4%	6	8.8%	40	41.2%	68	100.0%
Wiley Online Library	22	32.4%	8	11.8%	38	55.8%	68	100.0%
Cambridge University Press	22	32.4%	7	10.3%	39	57.3%	68	100.0%
African Online Journals (AJOL)	22	32.4%	13	19.1%	33	48.6%	68	100.0%
Bioline	18	26.5%	11	16.2%	39	57.3%	68	100.0%
Annual Reviews	18	26.5%	9	13.2%	41	60.3%	68	100.0%
American Physical Society	18	26.5%	9	13.2%	41	60.3%	68	100.0%
Sage Online Journals	17	25.0%	9	13.2%	42	61.8%	68	100.0%
De Gruyster journals	16	23.5%	10	14.7%	42	61.8%	68	100.0%
Mary Ann Liebert Inc	15	22.1%	11	16.2%	42	61.7%	68	100.0%
EBSCO Host	15	22.1%	8	11.8%	45	66.1%	68	100.0%
University of Chigaco Press	14	20.6%	11	16.2%	43	63.3%	68	100.0%

Table 4: Perceived usefulness of specific IHIRs

Factors that influence the use of IHIR

To determine the factors that influence the utilization of Internet health information resources among lecturers and medical doctors, responds were asked assess various issues related to Internet connectivity, their ICT related skills, and related issues.

Respondents were asked to describe how reliable Internet connectivity was at their workplace. Twenty-four percent (13) respondents stated that Internet connectivity was reliable and 29.6% (16) judged it to be fairly reliable while 46.3% (25) stated that it was unreliable. With regard to Internet speed, 26.4% reported that Internet connectivity at their workplace was very slow, 32.1% regarded Internet connectivity at their workplace to be slow, while 35.8% regarded Internet connectivity as average. On the other hand, only 5.6% of the respondents judged Internet speed at their workplace to be high.

Table 5 shows the major constraints respondents encounter when accessing IHIRs. While 33% of the health professionals did not consider availability of Internet

connectivity a constraint, 66.2% found it to be a constraint. Only 31.7% of respondents regarded availability of Internet access points a constraint. Nearly 70.0% of the health professionals considered speed of connection a constraint. About 54.2% of the respondents regarded login problems a constraint while 78.4% regarded low bandwidth a constraint.

SN	Category	Barriers	not a constraint		constraint		Total	
			Count	Row N %	Count	Row N %	Count	Row N %
1	Connectivity	availability of Internet connectivity	22	33.8%	43	66.2%	65	100.0%
2		Internet access points	43	68.3%	20	31.7%	63	100.0%
3		speed of connection	19	30.2%	44	69.8%	63	100.0%
4		login problems	27	45.8%	32	54.2%	59	100.0%
5		low bandwidth	11	21.6%	40	78.4%	51	100.0%
6	Skills & related issues	computer skills	47	78.3%	13	21.7%	60	100.0%
7		inadequate Internet search skills	45	73.8%	16	26.2%	61	100.0%
8		ease of use	50	82.0%	11	18.0%	61	100.0%
9		level of privacy	49	77.8%	14	22.2%	63	100.0%
10		language of content	51	82.3%	11	17.7%	62	100.0%
11		accessibility of websites	35	58.3%	25	41.7%	60	100.0%
12		quality & accuracy of information	41	73.2%	15	26.8%	56	100.0%
13	Other factors	high cost of access	35	59.3%	24	40.7%	59	100.0%
14		lack of time	37	59.7%	25	40.3%	62	100.0%
15		lack of interest	52	88.1%	7	11.9%	59	100.0%
16		no need	54	94.7%	3	5.3%	57	100.0%
17		too much information	54	90.0%	6	10.0%	60	100.0%
18		not able to find information	43	69.4%	19	30.6%	62	100.0%

Table 5: Factors influencing usage of IHIRs

Further analysis indicated that computer and Internet and Internet search skills were not regarded a constraint by 78.3% of the health professionals, but were regarded a constraint by 21.7% of the respondents. Other factors which were not seen as constraints by the majority of the health professionals were information overload (90.0%), lack of a need for IHIRs (94.7%), lack of interest (88.1%), level of privacy (77.8%), ease of use (82.0%), language content (82.3%), and quality and accuracy of IHIRs (73.2%). While 59.3% of the respondents did not find high cost of access a constraint, 40.7% found it to be a constraint. Accessibility of the websites was not regarded a constraint by 58.3% but a constraint by 41.7% of the respondents. Furthermore, while 59.7% of the respondents did not find lack of time a constraint, 40.3% found it to be a constraint. Further findings indicated that 30.6% of the respondents regarded inability to find information a major constraint.

Perceived Ease of Use of IHIR

Health professionals were asked to indicate the level to which they found it easy to use IHIRs. While 70% of the respondents disagreed that they found it easy to use the Internet 41.4% agreed that they found it time consuming to use the Internet to get health information. While 76.7% of the respondents disagreed that online search capabilities made it easy to locate relevant information 40.9%, on the other hand, agreed that they found it difficult to use search features of different databases. Furthermore, while 59.6% of the respondents disagreed that they were usually able to decide which databases to use for different purposes, 66.7% found it frustrating to use the Internet to access health information (Table 6). Further analysis indicated that 98.0% found it necessary to take a continuing medical education (CME) course in online information access and retrieval.

		Count	Layer N %
I find it easy to use the Internet to obtain health information	agree	17	29.8%
	disagree	40	70.2%
	Total	57	100.0%
I find it time consuming to use the Internet to get health information	disagree	34	58.6%
	agree	24	41.4%
	Total	58	100.0%
online search capabilities make it easy to locate relevant information	agree	14	23.3%
	disagree	46	76.7%
	Total	60	100.0%
I find it frustrating to use Internet to access health information	agree	36	66.7%
	disagree	18	33.3%
	Total	54	100.0%
I usually find it difficult to use search features of different databases	agree	18	40.9%
	disagree	26	59.1%
	Total	44	100.0%
I'm usually able to decide which databases to use for different purposes	agree	19	40.4%
	disagree	28	59.6%
	Total	47	100.0%

Table 6: Perceived ease of use of IHIRs

Health professionals were asked to indicate the level to which they found it easy to use selected 19 IHIRs (Table 7). Table 7 shows that 54.3-84.8% of the health professionals found the IHIRs not easily accessible. These findings seem to suggest that most of the health professionals surveyed were not aware of the availability of most of these IHIRs and were therefore not using them. Some of the health professionals indicated on the questionnaires that they were learning about the availability of most of these resources for the first time. This was also demonstrated by the fact that 11-25 respondents failed to answer some areas of this section. Further analysis showed that most of the respondents were familiar with search engines like Google (98.1%), Yahoo (87.5%), Mozilla (87.5%), and Google Scholar (72.1%). These findings seem to suggest that health professionals largely depended on these search engines for access to IHIRs. Only 17-33% respondents found it easy to access full-text articles from online journals, electronic books, reference materials, professional associations, conference/meeting/notices proceedings, and continuing medical education (CME) materials.

	easily accessible		not easily accessible		Total	
	Count	Percent	Count	Percent	Count	Percent
PubMed/MEDLINE	27	48.2%	29	51.8%	56	100.0%
eGranary	14	31.8%	30	68.2%	44	100.0%
Annual Reviews	14	35.9%	25	64.1%	39	100.0%
African Index Medicus (AIM)	13	30.2%	30	69.8%	43	100.0%
Sage online journals	12	28.6%	30	71.4%	42	100.0%
Cochrane Library	11	24.4%	34	75.6%	45	100.0%
De Gruyster journals	11	27.5%	29	72.5%	40	100.0%
Cambridge University Press	11	28.2%	28	71.8%	39	100.0%
Mary Ann Liebert Inc	10	24.4%	31	75.6%	41	100.0%
University of Chigaco Press	10	26.3%	28	73.7%	38	100.0%
Wiley Online Library	10	25.0%	30	75.0%	40	100.0%
EBSCO Host	9	22.5%	31	77.5%	40	100.0%
American Physical Society	9	23.7%	29	76.3%	38	100.0%
Oxford journals	8	20.0%	32	80.0%	40	100.0%

Table 7: Perceived ease of use of specific IHIRs

Suggestions for Improving Access to Information

Respondents were asked to make suggestions on how UNZA could improve their access to IHIRs. Thirty-seven percent (23) of the respondents suggested increased bandwidth of the local area network (LAN) at their work places. Fourteen (24%) suggested increasing access points; eight suggested conducting training in the use of IHIRs; four suggested installation of wireless Internet connectivity. Other suggestions include improved marketing of IHIRs, providing easy access to passwords, increasing subscriptions to professional journals, allowing personal computers to be connected to LAN, ensuring universal access to all, improving availability, reducing workload to allow staff to have more time to do more research, promoting e-learning, rectifying problems quickly, and shortening the process of obtaining identity cards (IDs) (Table 8).

Suggestion to improve access to IHIRs	Frequency
Increase bandwidth	26
Increase access points	14
Conduct training in the use of IHIR	8
Install wireless connectivity	6
Provide easy access to passwords on IHIR	4
Market IHIR	2
Subscribe to professional journals	2
Allow personal computers to be connected to LAN	1
Ensure universal access to all	1
Improve availability	1
Improve staffing levels	1
Promote e-learning	1
Rectify problems quickly	1

Shorten the process of obtaining IDs	1
Subsidize purchase of laptops (tablets) to staff and students	1

Table 8: Respondents' suggestions on how to improve access to IHIRs

Discussions

Access and Usage of IHIRs

The findings of this study showed that all of the respondents owned personal computers and were using the Internet. Most of the respondents accessed Internet at work and at their homes. Furthermore, the majority of the respondents accessed the Internet through private subscriptions on their personal laptops, personal computers or via their mobile phones. These findings tend to suggest that most of the health professionals rely on their personal computers and personal subscriptions to access IHIRs and this may affect the extent they utilize the IHIRs. This was confirmed by 40% of the respondents who indicated that the high cost of access to the Internet was a constraint. The high dependency on personal ICTs and private subscriptions to Internet may largely be due to inadequate and inefficient ICT infrastructure at the UTH. On the other hand, the high levels of access to Internet at home may also be attributed to the lack of time at the work places due to heavy workloads.

The findings of the study showed that respondents used IHIRs for various purposes. Most respondents frequently used IHIRs for research, teaching, and communication. Other uses of the IHIRs included preparation of presentations, preparation of examinations, patient care, and for administration. Usage was mainly dictated by the nature of work done by a particular health professional. For instance, fewer respondents in the School of Medicine used IHIRs for patient care and administration while on the other hand fewer respondents from UTH used IHIRs for preparation of examinations and teaching purposes.

Perceived Usefulness of IHIRs

The findings of the study indicate that health professionals perceived IHIRs to be very useful to their work as they provided the needed health information for their various jobs, increased productivity, enhanced effectiveness, and enabled them to have more control over their work. Furthermore, the respondents found the various IHIRs being subscribed to be useful. The findings, however, indicated that only a few respondents were familiar with the specific databases being subscribed to by the University of Zambia and consequently very few of these databases were being utilized by the respondents. On the other hand, most of the respondents were familiar with the three major search engines (Google, Yahoo, and Mozilla) and found them useful. These findings seem to suggest that most of the respondents heavily rely on search engines, than on specific databases, to access IHIRs. Consequently, this may affect the quality, relevance and usefulness of the information they retrieve for various purposes.

Perceived Ease of Use of IHIR

Although most (70.2%) respondents found it easy to use the Internet to obtain health information, 41.4% found it time consuming, 66.7% found it frustrating to use, 40.9% found it difficult to use the search features of different databases, and 40.4% were unable to select appropriate databases relevant to their specific needs. These findings seem to suggest that, overall, the respondents found it difficult to use IHIRs. This may be attributed to lack of training leading to lack of effective search skills coupled with poor information seeking behavior.

Factors affecting usage of IHIRs

The major constraints affecting the usage of the IHIRs at UTH and School of Medicine, in their order of severity, were: low bandwidth, availability of Internet, speed of connection, and login problems. The findings seem to suggest that low bandwidth, resulting into poor Internet connectivity, was the biggest constraint. This resulted into frustration among the health professionals when looking for IHIRs. Other constraints included lack of search skills which resulted into inability to select appropriate IHIRs; apparent problems logging mainly as result of difficulties in acquiring passwords from the librarians. These factors represent considerable barriers to the effective use of IHIRs. Another notable constraint was lack of awareness of the available IHIRs. Most of the respondents not aware of the specific databases the Library is subscribing to.

Conclusions

The main objective of this study was to determine the extent to which health professionals at the School of Medicine and the University Teaching Hospital were using the Internet health information resources, the purposes for which they used them, and the factors that affect their access to these information resources. The study has established that most health professionals have access to the Internet through their personal computers and through personal subscriptions to ISPs and their workplaces. Most of the IHIRs are used for research, communication purposes, teaching purposes, patient care, and preparation for examinations, presentations, and administration. The respondents' perception of the usefulness of the IHIRs was varied though very low on specific databases being subscribed to by the University. This was mainly attributed to lack of awareness of the existing databases, resulting in their low usage. Access to IHIRs is limited due to several factors including poor ICT infrastructure, lack of search skills, poor information seeking behaviour, poor marketing strategies, and to some extent lack of time.

Recommendations

The need for health professionals to have access to current, reliable and comprehensive health information resources for evidence based medical care and for professional development cannot be overemphasized. This study therefore recommends that UNZA and UTH managements should work together to improve ICT infrastructure in order to

provide efficient access to IHIRs. This includes increased bandwidth, increased access points, efficient ways of allocation of passwords to various IHIRs, provision and expansion of wireless networks, etc.Management hould develop effective marketing strategies to publicize available IHIRs to health professionals. Management should develop information literacy programmes to train health professionals in the use of IHIRs. And lastly that management should work together to provide funds for timely subscription to IHIRs.

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AVAILABILITY OF ELECTRONIC INFRASTRUCTURES AND ACCESSIBILITY OF INFORMATION RESOURCES AMONG FACULTY MEMBERS IN NIGERIA UNIVERSITIES

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Abstract

The study investigated the availability of electronic infrastructures and accessibility of electronic information resources among faculty members in Nigeria Universities. In order to determine accessibility and availability of electronic infrastructures and information resources among faculty members, three research questions were raised and a lone hypothesis was formulated thus: there no significant correlation between accessibility and availability electronic Infrastructure and electronic information resources and research output among faculty members in Nigerian universities The study adopted quantitative approach as research paradigm. Questionnaire was used as the primary instrument for data collection on accessibility and availability of electronic infrastructures /e-resources and research output of faculty members in the study. . A sampling frame of 10% of academics in each of the universities was selected giving a total of one thousand and fifty-seven (1,057) an equivalent of 10% of the population. The values of the reliability estimates range from (r=0.69) to (r=0.83). The data for the study were analysed with SPSS. The finding of the study revealed that there is significant interactive effect accessibility of information, availability of electronic infrastructures and electronic information resources among faculty members in Nigeria federal universities.

Keyword: Electronic Infrastructures, Availability, Information Resources, Accessibility and Nigerian Universities

Introduction

The emergence of electronic information resources has broken the long age barrier to valuable information resources which until now were difficult to access especially by scholars in the developing nations. For any academic library to thrive in this current dispensation of global competiveness, the library irrespective of the size of its collection must as a matter fact embrace as well deploy Information Communication Technology for effective library service. While commenting on the positive impact of electronic information resources to users community especially students, lecturers and researchers, Dadzie (2005) notes that electronic resources are invaluable research tools that complement the print–based resources that are available in a traditional library setting. The information resources and services available in institutional information systems (library, archives, records offices, documentation centers, and data centers) must be capable of supporting research activities (Shokeen and Kaushik, 2002). Agba, Kigongo-Bukenya, and Nyumba (2004) state that the shift from print to electronic information means that both faculty members and students in a university system must use these resources for better quality, efficient, and effective research more than ever.

Electronic information resources found in libraries include online databases, CD ROMs, and internet. It is important to note that electronic resources are quite expensive to acquire especially considering the slim budget allocations of university libraries (Ifijeh, 2012). The availability of electronic information resources could be smoothly managed in the library with the existence of basic infrastructure such as internet facilities, bandwidth, capable technical support, computer systems, electricity power supply, etc. Oketunji (2006) opined that the future of libraries is very much linked to their abilities to harness and sustain connectivity to available infrastructures as a base for providing effective and efficient access to information by their clientele. That is the availability of necessary infrastructure is the underlining factor for effective provision of electronic resources in libraries.

Availability, accessibility and use of information resources are indispensable to the teaching, research and community activities of faculty members in any university system. Information resources therefore, refer to the totality of documents and other non-book materials with which a library satisfies the information needs of its clientele. In addition of information sources to any library is therefore a function of its resource development processes. With deployment of electronic information resources access to information that might be restricted to the user because of distance has been resolved (Sabouri, et al 2010). Thus, information availability establishes a new standard for system and network that are always on for applications and data that are always available and for end users that are always connected. Availability of information resources also entails acquiring and also providing means by which users could get necessary information resources needed. It tries to ensure that every user gets document, which could satisfy his/her quest for information. In this paper electronic information resources are invaluable tools for study, learning and research Togia and Tsigilis (2009).

Unfortunately, unfettered access to information does not exist in any society, either in the developed or developing ones. Access to information is not equal to all classes, and the capacity for effective use of it differs markedly among individuals, classes and nations (Neelemaghan, 1985). Access to information carries with it the implication that access can be widened or restricted. This implies action either on the part of the person seeking access or on the part of a person authorized to allow access. A study carried out by Foster, Heppensta, Lazarz and Broug (2008) revealed a low level of research productivity by faculty members in African universities; which they attributed to the poor state of accessibility and utilization of electronic information resources. Publication output of faculty members in African universities in international journals was used as the indicator of research productivity in the study. The up-to-datedness of contents in courses, the continuous academic growth and competence of faculty members and the quality of learning environment depend on how effective the academic library is in identifying and connecting information on current developments in various subject fields with the concerned academic community. Hanif, Ahmed, and Nasir (1997) claim that:

In order to satisfy the diverse information needs and interests of the academic community, the library collection must be adequate in terms of quantity, quality and currency. The collection must also be accessible to the community. The provision of quality information will invariably have positive impact on the learning environment; on the contrary, if the quality of the information provided leaves much to be desired, the result would be worse.

According to Borishade (2002) one of the major objectives of the National Virtual Library Project is "to improve the quality of teaching and research in institutions of higher learning in Nigeria through the provision of access to electronic resources. Ray and Day (1998) observe that traditional library and informational services (LIS) can no longer adequately meet academic needs, because of the cost of printed materials, the ever-increasing number of academic publications, and changes in learning and teaching methods. As a result of these limitations and due to rapidly developing technology, academics must use electronic information resources effectively. Foster, Heppensta, Lazarz and Broug (2008) reported that there is a low level of research productivity by faculty members in African universities; which they attributed to the poor state of accessibility and utilization of electronic information resources. Research output of faculty members in African universities in international journals was used as the indicator of research productivity in the study. According to Foster et al., (2008), the low publication output from African universities is essentially linked with lack of/inadequate accessibility and utilization of electronic information resources by faculty members.

Oduwole and Akpati (2003) carried out a research on the accessibility and retrieval of electronic information at the library of the University of Agriculture, Abeokuta, Nigeria. The study revealed that the usage of electronic information resources cuts across all members of the university community. There was an increase in library use in the university. The increase was a result of the introduction of The Essential Electronic Agriculture Library (TEEAL) that has 130 journal titles on CD-ROM. Furthermore, Sani and Tiamiyu (2005) reported the availability and use of OPACs in University of Agriculture Abeokuta. Similarly, Anasi, (2005) reports that some of the Nigerian universities, like University of Ibadan, University of Ilorin, University of Jos, University of Lagos and Ahmadu Bello University, Zaria subscribed to ISI (Institute for Scientific Information) and EBSCOHOST database.

However Igbeka and Okpala (2004) posited that, since the 1995 introduction and availability of CD-ROM literature search into the University of Ibadan library system, the number of users of the CD-ROM facility was small to the number of registered library users. This, according to them might be a result of lack of current awareness or dissatisfaction of users owing to low information literacy skill.Mahajan (2006) explored the perception of researchers on the Internet use in research on productivity of faculty members at the Panjab University, Chandigarh, India, across three academic disciplines. It was found that scientists (99%) agreed on the positive effect of the Internet on research than the social scientists (50%), while all responses from researchers in humanities were in negation. This study therefore

investigates the perception of faculty members in Nigerian Federal Universities on the Availability and Accessibility of electronic Infrastructure and electronic information resources for Research Output

Objectives of the study

The aim of the study was to assess the perception of faculty members in Nigerian Universities on the availability and accessibility of electronic information resources for research output

1. Identify both the electronic infrastructures and information resources available for faculty members in Nigeria universities;
2. Find out the level of adequacy of electronic infrastructures for effective electronic resources provision in the University libraries;
3. to assess the extent of accessibility on electronic Infrastructure and electronic information resources among faculty members in Nigerian universities;
4. to determine the effect of availability and accessibility of electronic Infrastructure and electronic information resources among faculty members in Nigerian universities.

Research questions

The following research questions guided the study:

1. What are the level of electronic Infrastructures and information resources available for faculty members in Nigeria universities websites?
2. What is the level of adequacy of basic electronic Infrastructures support for information resources provision in the University libraries?
3. What is the extent of accessibility on electronic infrastructure and information resources among faculty members in Nigerian universities?

Hypothesis

There is no significant correlation between accessibility and availability electronic Infrastructure and electronic information resources and research productivity of faculty members in Nigerian universities.

Review of Literature

Adequate and appropriate information resources provide opportunities for individuals to get the access which has depended on the availability of emerging technologies as means for creating, storing, and distributing, retrieving, and using information resources the existing literature, such as Udoudoh (2009) and Popoola (2008) suggest that the library is central to the provision of relevant information resources and services for adequate support of teaching, learning and research in any academic environment.

Popoola and Haliso (2009) define information resources as those information-bearing materials that are in both printed and electronic formats, such as textbooks, journals, indexes, abstracts, newspapers and magazines, reports, CD-ROM databases, the Internet/E-mail, video tapes/cassettes, diskettes magnetic disk, computers, micro forms and so on. These information materials are the raw materials that libraries acquire, catalogue, stock, and make available to their patrons. According to Hanif et al (1997), a good library should be well equipped with books and periodicals in all subjects to advance study and research. The duty of a university library is to collect, organise and disseminate information to academics, research scholars and students, and support the generation of new knowledge.

Hanif et al (1997) report that there was inadequate recent publications and current journals. Besides, the information needs of the faculty members were not adequately met by the existing library services. Ray and Day (1998) observe that traditional library and informational services (LIS) can no longer adequately meet academic needs, because of the cost of printed materials, the ever-increasing number of academic publications, and changes in learning and teaching methods. As a result of these limitations and due to rapidly developing technology, academics must use electronic information resources effectively. They enumerated the advantages of electronic resources over printed resources to include:

i. obtaining information from the most appropriate source;
ii. searching for specific information for specific needs;
iii. accessing more information faster;; and
iv. the availability of resources from outside the library by dial-up access (Ray and Day, 1998).

It is common knowledge that the availability of online information, improved Internet connectivity and changes in scholarly publishing techniques have all contributed to more information being available to more researchers. According to Agulu and Aguolu (2002), resources may be available in the library and even identified bibliographically as relevant to one's subject of interest, but one may not be able access them. One may identify citations in indexes, but may not have access to the sources containing the relevant articles. The more accessible information sources are, the more likely they are to be used. Users tend to use information sources that require the least effort to access. Availability of an information source does not necessarily imply its accessibility, because the source may be available but cannot be access for one reason or the other.

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reason or the other. Leelavathi and Doraswamy (2007) observe that use of electronic information resources is still inadequate among the engineering faculty of the universities in developing countries. They present the findings of a survey on knowledge and use of digital resources by academics in Indian universities through CD-ROM databases, online databases, online journals, OPAC and so on available in the engineering college libraries. (45%) of the Academics said that they acquired the skills to use digital resources through the 'self-study' method (reading books/journals, tutorials and so on. Some of the faculty members (49.37%) opined that the information available in the digital resources is always 'adequate'. Also, (50.62%) and (41.25%) of the faculty members saw 'lack of training' and 'lack of time', respectively, as the main problems in securing access to digital resources.

Magara (2002) opines that CD-ROM and online retrieval services were the most use electronic resources in Uganda. The availability of the Internet in that country enhanced communication and resource sharing among the communities. Okello-Obura and Magara (2008) claim that users of electronic information at Makerere University, Uganda derived a lot of benefits from electronic resources which helped them in gaining access to a wider range of information, leading to improved academic performance. The major objectives of the adoption of e-resources in the university were to facilitate access to Internet-based information resources as well as timely dissemination of local and international research output. Swain and Panda (2009) observe that faculty members prefer using e-articles over electronic theses and dissertations (ETDs). Some online databases, like Emerald Management, EBSCOHOST, and PROQUEST, are fairly used while other online databases are not of high demand.

The study carried out by Idiodi (2005) reveals that, despite the advent of information and communication technology in Nigerian universities, and automation of library systems, very few users have the capability to use information technology effectively in the libraries. He concluded that a high level of computer illiteracy among librarians is one of the major factors militating against promoting higher level of information literacy of library users. However, some studies, for example, Kinengyere (2007), found out that available information is not necessarily accessed and used by users. The study shows that the availability of information does not necessarily mean actual use because the users may not be aware of the availability of such resources, they do not know how to access these resources, or do not know what the resources offer. To buttress this study Ray and Day (1998) cited limited time and lack of effective information retrieval skills as factors affecting users' access to electronic information. Therefore, a perceived lack of various resources, such as time, equipment, funding, training and insufficient information on software coupled with lack of knowledge and skills of staff, insufficient technical support and the risks associated with implementing innovations in teaching, particularly those using technologies, were cited as the most prohibiting barriers to faculty members use of electronic information resources in their teaching (Manda and Nawe, 2008).

Armstrong (2005) asserts that understanding availability of information resources requires the academic to have the ability to identify what resources are available, for exploitation, where they are available, how to access them, the merits of individual resource, type and when it is appropriate to use them. This may have great implication for academics research activities. According to Igbo (2008) it is necessary for one to decide where to look, what clues to search for and what to accept especially now that we are faced with staggering quality of information. It is therefore assume that only an academic who is information literate can do this; hence the relevance of information literacy and availability of information resources to academic research productivity cannot be over emphasized hence the need to determine how information literacy skills and availability of information resources influence academic staff research productivity of Nigerian federal universities. In conclusion, Arunachalam (2002) argued that one does not have to use technology because it is there, but one uses it if there is a genuine advantage.

Research Methodology

According to Trumbull (2000), research design is a blueprint that helps the researcher to seek, explore, and discover answers to research questions. Also, Welman, Kruger and Mitchell (2005) describe a research design as the plan according to which we obtain research participants (subjects) and gather information with a view to reaching conclusions about the research problem. The research design for this study is survey (descriptive), which is a systematic approach of collecting data to find out respondent's opinion. The population of this study is made up of the University faculty members from twelve selected federal universities in the six geographical zones in Nigeria. A sampling frame of 10% of academics in each of the universities was selected giving a total of one thousand and fifty-seven (1,057) an equivalent of 10% of the population.The values of the reliability estimates range from (r=0.69) to (r=0.83), and these indicate that the questionnaire instrument was reliable to use for data collection in the study. The data gathered were analyzed using descriptive and inferential statistics and ANOVA. The instruments used to elicit information from respondents were the questionnaire.

Results

Table 1: Questionnaire distribution and response rate

Name of university	Frequency	Percent (%)	Cumulative percent
Ahamadu Bello University	93	10.7	10.7
FUT, Yola	33	3.8	14.4
Nnamdi Azikwe University	64	7.3	21.8
Usman Dan Fodio	33	3.8	25.5
University	73	8.4	33.9
University of Benin	101	11.6	45.5
University of Ibadan	69	7.9	53.4
University of Ilorin	62	7.1	60.5
University of Jos	116	13.3	73.8
University of Lagos	70	8.0	81.8

University of Maduguiri	96	11.2	93.0
University of Nigeria,	61	7.0	100.0
Nssuka	873	100	
University of Portharcourt			
Total			

Table 1 shows that 10.7% of the respondents are from Ahamadu Bello University, 7.9% of the sample respondents are from University of Ilorin while Nnamdi Azikwe University represents 7.3 % of the respondents. The table also reveals that 8.4 % of the faculty members is from University of Benin and 7.1% of the faculty members are from university of Jos. University of Lagos has the highest percentage of 13.3 % of the sample size which implies that they have the highest number of respondents follow by university of Ibadan representing 11.6% of the sample size. 8.0% and 11.2% of the respondents are from University of Maduguiri and University of Nssuka respectively. However, Federal University of technology, Yola and Usman Dan Fodio University had the lowest number of respondents, representing 3.8% each of the sample size. 7.0% of the faculty members under study is from University of Portharcourt.

Table 3: Designation distribution of the academic staff

Designation	Frequency	Percent (%)	Cumulative percent
Professor	30	3.4	3.4
Reader	57	6.5	10.0
Senior Lecturer	228	26.1	36.1
Lecturer I	212	24.3	60.4
Lecturer II	213	24.4	84.8
Assistant Lecturer	101	11.6	96.3
Graduate Assistant	32	3.7	100.0
Total	873	100.0	

Table 2 presents the designation of the faculty members in their various institutions. Their designation is measured with seven categories. The designation distribution of the faculty members as shown in table 3 indicates that professor has the lowest percentage, representing 3.4% of the sample size while senior lecturer has the highest percentage of about 26%. This implies that there are more senior lecturers in the sample size than any other designation. 24.3 % and 24.4% of the respondents represent Lecturer I and lecturer II respectively. Assistant lecturers in the sample size are about 11.6% while 3.7% of the respondents represent the graduate assistant in the sample size.

Table 3: Highest Educational Qualification Distribution

Educational qualification	Frequency	Percent (%)	Cumulative percent
PHD	448	51.3	51.3
M. Phil	76	8.7	60.0
Master Degree	307	35.2	95.2
PGD	12	1.4	96.6
Bachelor Degree	27	3.1	99.7
Others	3	0.3	100.0
Total	873	100.0	

As shown in table 3 majority of the participants about 51% had PHD as the highest educational qualification; follow by Master degree holders representing 35.2% of the sample while 8.7% of the participants had M. Phil as the highest educational qualification. 3.1% of the participants had Bachelor Degree as the highest educational qualification. However, 1.4% of the participants are PGD holders and 0.3% of them stated that they had other qualification not listed in the questionnaire as their highest educational qualification.

Answer to Research Questions

This section provides answers to the research questions and hypothesis in the study.

1. What are the level electronic Infrastructures and electronic information resources available for faculty members in Nigeria universities websites?

The overall result shows that for most of the 8 components listed the mode is 2 which means that there are rated by the respondents as available when needed except for CD-ROM databases which its mode is 4 which implies that it is not readily available. The table reveals that computers and photocopy facilities has a mean value of 2.7071 and 2.7068 respectively. Also, Search engines, E-books and E-journals there mean scores are 2.5567, 2.0137 and 2.1489 respectively. And the e-references sources and electronic databases had mean scores of 2.4868, and 2.1604 respectively. The table also reveals that online public access catalogue has a mean of 2.2096. Based on mean scores obtained it could be deduced that photocopy facilities are the most available information resources follow by Search engines, E-books and E-journals and the lowest average score was is the availability of CD-ROM databases as type of information resources. See table 4 for detail.

Table 4: Frequency of faculty members on Availability of ER/EIR

Variables	Minimum	Maximum	Mean	Mode	Std. D
E-books	1	4	2.0137	2	0.8984
E-journals	1	4	2.1489	2	0.8925
CD-ROM	1	4	1.8648	4	0.9873
databases	1	4	2.5418	2	0.8599
Internet	1	4	2.4868	2	0.8931
E-references	1	4	2.1604	2	0.8723
sources	1	4	2.5567	2	0.9482
Electronic	1	4	2.4937	2	0.8701
databases	1	4	2.2096	2	0.9253
Search engines	1	4	2.7071	2	0. 9645
Websites	1	4	2.7068	2	0.9422
OPAC					
Computer					
Photocopy					
Facilities					

N=873.

2. What is the level adequacy of basic electronic infrastructures support for electronic information resources provision in the University libraries?

Table 5:LevelofAdequacyoftheBasicInfrastructures

Adequacyofbasicinfrastructures	Frequency	Percentage
Veryadequate	268	30.7
Adequate	302	34.6
Quiteadequate	159	18.2
Notadequate	144	16.5
Total	873	100.0

Table 5 reveals that 268(30.7%) respondents indicated that the basic electronic infrastructures support were very adequate, 302(34.6%) indicated that the basic electronic infrastructures support were adequate, 159(18.2%) indicated that infrastructures were quite adequate, Lastly, 144(16.5%) respondent indicated that electronic infrastructures supports were not adequate respectively.

3. What is the extent of accessibility of electronic Infrastructure and electronic information resources among faculty members while performing research activities?

Table 6: Frequency of the faculty member on accessibility Infrastructure and electronic information resources while performing research activities

S/N	Information Resources	Very frequentl y	Frequentl y	Often	Rarely	Never	Mean	Std. Deviatio n
1.	Computers	135 (15.5%)	688 (78.8%)	20 (2.3%)	24 (2.7%)	6 (0.7%)	4.0561	0.58874
2.	E-books	133 (5.2%)	241 (27.6%)	92 (10.5 %)	48 (5.5%)	359 (41.1%)	2.7033	1.58120
4.	E-journals	299 (34.2%)	419 (48.0%)	39 (4.5%)	48 (5.5%)	68 (7.8%)	3.9542	1.14347
5.	OPAC	211 (24.2%)	267 (30.6%)	73 (8.4%)	111 (12.7%)	211 (24.2%)	3.1787	1.52882
6.	CD-ROM databases	105 (12.0%)	126 (14.4%)	85 (9.7%)	221 (25.3%)	336 (38.5%)	2.3620	1.41892
7.	E-Abstracting	302 (34.6%)	260 (29.8%)	178 (20.4 %)	38 (4.4%)	95 (10.9%)	3.7285	1.27730
8.	Internet	153 (17.5%)	605 (69.3%)	15 (1.7%)	48 (5.5%)	52 (6.0%)	3.8694	0.96564
10.	Audiovisuals	63 (7.2%)	321 (36.8%)	96 (11.0 %)	74 (8.5%)	319 (36.5%)	2.6964	1.45363
11.	E-References sources	206 (23.8%)	390 (44.7%)	88 (10.1 %)	30 (3.4%)	157 (18.0%)	3.5292	1.36952
12.	Electronic databases	125 (14.3%)	317 (36.3%)	61 (7.0%)	99 (11.3%)	271 (31.0%)	2.9152	1.51208

13.	Digital camera	113 (12.9%)	168 (19.2%)	52 (6.0%)	229 (26.2%)	311 (35.6%)	2.4765	1.54804
14.	Search engines	183 (21.0%)	534 (61.2%)	83 (9.5%)	23 (2.6%)	50 (5.7%)	3.8900	0.95629
15.	World wide web	195 (22.3%)	603 (69.1%)	50 (5.7%)	10 (1.1%)	15/ (1.7%)	4.0916	0.68793

Table 6 shows that World Wide Web as information resources was the most frequently used out of all the other resources. This is because it has the highest mean value (M= 4.0916, SD= 0.68793) and nearly 69% said that they frequently access WWW for research activities. Also, information resources that are highly accessed or frequently used by faculty members while performing research activities were computers with mean scores of (M= 4.0561, SD= 0.58874), E-journals (M= 3.9542, SD= 1.14347), search engines (M= 3.8900, SD= 0.95629) and internet (M= 3.8694, SD= 0.96564). In addition, table shows that the following information resources were often used by faculty member for research activities; e-abstracting (M= 3.7285, SD= 1.27730), e-indexing (M= 3.6163, SD= 1.20988), e-reference sources (M= 3.5292, SD= 1.36952) and OPAC (M= 3.1787, SD= 1.52882). This can also be confirmed by the results obtained on how often these information resources were often used during research activities. Thus, it could be deduced that World Wide Web, e-books, E- journals, search engines (e.g. yahoo, mamma etc) and internet services are highly used by faculty member while performing research activities.

Hypothesis

There is no significant correlation between accessibility, availability electronic Infrastructure, electronic information resources and research output of faculty members in Nigerian universities.

Table 7: Correlation of interactive effect of accessibility and availability electronic Infrastructure and electronic information resources and research output of faculty members

		Information Accessibility skills possess	Availability of information resources by	Research Output
Information Accessibility skills possess by faculty members in Nigeria federal universities	Pearson Correlation	1	.343(**)	.473(**)
	Sig. (2-tailed)		.000	.000
	N	873	873	873
Availability of information resources by faculty members in Nigeria federal universities	Pearson Correlation	.343(**)	1	.332(**)
	Sig. (2-tailed)	.000		.000
	N	873	873	873
Research Output	Pearson Correlation	.473(**)	.332(**)	1
	Sig. (2-tailed)	.000	.000	
	N	873	873	873

** Correlation is significant at the 0.01 level (2-tailed).

Table7 above shows that there is positive and significant interactive effect between information accessibility skills possess, availability of electronic information resources by faulty members and research outputs. The relationships that exist between three variables were tested at 0.01% significant level. This implies that the higher the accessibility of information skills possess by faculty members, the higher the rate of availability of electronic information resources available to the faculty members and thus the combination of this two variables brought influence greater research output. Therefore, the null hypothesis is rejected and thus deduced that there is significant interactive effect accessibility of information skills possess and availability of electronic information resources available on research output of faculty members in Nigeria federal universities.

Discussion of Findings

Understanding and making the best use of the huge amount of information resources available is one of the key challenges facing today's users of information resources. Adams and Bonk (1995) observed that availability and accessibility of ICT facility (such as network connections) is imperative for effectiveness and efficiency in access and use of e- resources in universities. The world is currently facing what is termed information overload Thus; this research explored the relationship between information accessibility skills and availability of electronic information resources as factors influencing research productivity faculty members in Nigerian universities. The number of the available electronic information resources was found to be adequate, with the exception of CD-ROM databases. Across the universities selected, the distribution of the respondents on percentage basis was nearly uniform in terms of availability of computers, e-books, e-journals, electronic database, search engines, OPAC, Internet service, reference sources, photocopy and newspaper/magazines. This result of this study was lined with Nwezeh (2010) found that at the Obafemi Awolowo University, 95.7% of their respondents (faculty members) have access to computers in their offices, while 69.6% have Internet access in office. Thus, by implication there is low level of adoption and integration of ICT facilities (computers, the Internet and campus/Intranet/LAN) in research in the two surveyed universities.

The finding shows that there is a positive multiple combined relationship between information accessibility skills possessed by faculty members and availability electronic information resources on research productivity (r=0.493). The regression table on level between information accessibility skills possessed by faculty members and electronic information resources availability indicated that the R-value of 0.241 is significant; confirming that between information accessibility skills and information resources availability has a positive significant effect on research productivity of the respondents. This findings aligns with Kinengyere (2007), who conducted a study on the effect of information literacy on the utilization of electronic information resources in selected academic and research institutions in Uganda. The study reveals that information literacy skill is very vital in influencing utilization of available e-resources. Similarly, Popoola (2008) argues that social scientists in Nigerian universities make use of the

available library information resources and services, such as current awareness, photocopying, referencing, statistical data analysis, E-mail, selective dissemination of information and online database searching, in support of their research activities. According to him, these sources have contributed immensely to the research productivity of faculty members.

Conclusion and Recommendations

This study investigated perception of faculty members on provision of electronic infrastructures and accessibility of electronic information resources for research Output in Nigeria Universities. The study also reveals that awareness of the availability of electronic information resources services in the universities was not widespread among faculty members. The study also revealed that databases are only accessible to the faculty members through the use of basic infrastructure such as electricity, computer systems which include hardware, software and human ware, and internet facilities in both libraries and their offices. It is on note that, availability and accessibility of both electronic infrastructures and information resources to faculty members in Nigerian universities will lead to increase in research output of faculty members. It is therefore imperative that Libraries put basic infrastructures in place to ensure effective access to electronic information resources.

Based on the findings the researcher recommends the followings:

Awareness programme on availability of information resources should be given by librarians regularly to increase research productivity of academics.

In view of the fact that research output contributes towards image building for universities as well as ranking, it becomes highly necessary for universities to invest more on access to information resources especially electronic resources.

University administrations should provide more computers with Internet access in their universities. The bandwidth for Internet connectivity should be increased to improve the speed of accessing information from the Internet.

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Author's Biography

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MEDIA AND SOCIETY HEALTH: ANALYSIS OF ATTITUDE AND HABIT OF NIGERIAN UNDERGRADUATES TOWARDS EBOLA VIRUS (EVD) INFORMATION

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Abstract

The study examined the attitude and habits of undergraduates toward information on the outbreak of Ebola virus in two Universities – Bowen University, Iwo and Ladoke Akintola University of Technology, (LAUTECH), Ogbomoso. A quantitative method was adopted using questionnaire as the instrument for data collection. The study found that: Ebola is not a spiritual punishment from God but rather a universal threat which is not restricted to any social class of people. The outbreak of Ebola had led to a drastic change in health practices of some youths who are considered very mobile, and that the use of a number of media outlets could be quite effective and efficient in reaching a profoundly large audience with health campaign messages. The study concluded that since known cure or vaccine been established or discovered for the virus, individuals should play safe by not engaging in health compromising practices. For example, any cultural practice that can expose them to an infection should be avoided. Governments globally should equally rise to the occasion by deploying necessary efforts at containing a repeat of further outbreak.

Keywords: Media and Society Health; Attitude; Habit; Ebola virus Disease; Information

Introduction

Ebola Virus Disease (EVD) is a viral disease that results in non-specific symptoms early and often causes internal and external hemorrhage (bleeding) as the disease progresses which is often fatal if untreated. It is caused as a result of a RNA (ribonucleic acid) virus that infects wild animals – bats, monkeys, gorillas and chimpanzees as well as people. It is considered one of the most lethal viral infections. EVD first appeared in 1976 simultaneously in two outbreaks, one in Nzara, Sudan and the other in Yambuku, Zaire,(currently Democratic Republic of Congo, DRC).The latter occurred in a village near the Ebola River, from which the disease takes its name (World Health Organisation, 2014).

The recent outbreaks in some West African countries seem uncontrolled. It is the largest Ebola outbreak ever reported both in terms of case numbers and geographical spread. This is also the first time the disease has affected large cities – capital cities. There have been deaths in this outbreak than all others combined. Most severely affected countries,

Guinea, Liberia and Sierra Leone have weak health systems, lacking human and infrastructural resources and having only recently emerged from long periods of civil conflict. Comparatively, Mali, Senegal and Nigeria were "mildly" affected by the virus considering the extent of infection and the number of deaths recorded. The WHO declared the outbreaks in Nigeria and Senegal officially over on 5 September, 2014. The outbreak in Liberia was declared over on 9 May, 2015.

On August 8, 2014, the World Health Organization Director General declared the current outbreak a "Public Health Emergency of International Concern". There are five species/strains of Ebola named after where they were identified. They are, Zaire, Bundibugyo, Sudan, Reston, and Tai Forest, Ivory Coast. The first three, Bundibugyo ebola virus, Zaire ebola virus and Sudan ebola virus have been associated with serious and large outbreaks in Africa. It is believed that the virus causing the 2014 West Africa outbreak belongs to the Zaire specie which is considered most pathogenic (WHO, 2014). It is this outbreak that health agencies and media now dubbed "unprecedented epidemic".

The outbreak has been adjudged as different from the previous ones that have occurred in Africa over the past years. Ebola infection is much easier to control in isolated villages. The fact that virologists seem not prepared to openly discuss but are definitely considering in private that an Ebola virus could mutate to become transmissible through the air is worthy of critical consideration. If mutations of Ebola could actually take place, it would mean that just breathing would put a person at the risk of contracting Ebola. Therefore, infections could spread rapidly to every part of the globe, as H1N1 influenza virus did in 2009, after its birth in Mexico (New York Times, 2014).

Adedayo and Adepegba (2014), reported that new estimates by the World Health Organization and the United States health agency warned that the number of Ebola cases could rise up to 1.4 million people in Sierra Leone and Liberia by mid –January, 2015, unless concerted efforts to curb the outbreak improved significantly. The WHO based its calculation and prediction on reported cases only. It also stressed that knowing the true death toll of victims for Liberia is not possible since many bodies were dumped into the nearby rivers.

The outbreak has not been put under control as resources and personnel are stretched in the effort to practically handle the situation. In fact, cultural inhibitions also have a crucial role to play as some people in the affected countries do not believe that Ebola is an actual disease. Others hide under the pretext of spiritual belief. Some people used this unfortunate outbreak to fleece innocent citizens by engaging in the sale of unethical and counterfeit vaccine to these unsuspecting people. We cannot also rule out conspiracy theories as many sick people avoid hospitals or sneak out of facility centres. A very good example was the attack by gunmen at a facility centre in Liberia to free the victims of Ebola being quarantined before Liberia was eventually declared Ebola free.

The attitudinal component is a person's attitude/disposition towards performing the behavior under consideration. The likelihood of people exhibiting a particular behavior becomes strong especially when they hold a favourable attitude towards the performance of that behavior (Ajzen & Fishbein, 1980). Information is germane to making an informed decision, to govern well or otherwise, warn and achieve development. Health communication, an integral part of development communication studies has attracted the attention of experts, who have made and are still making efforts to enlighten and sensitize people about the importance of understanding their own health and other health related issues. This has been going on through the use of various mass media programmes, adverts, jingles, indigenous media as well as social media.

Health communication as a field of theory and practice engages interpersonal and mass communication strategies aimed at improving the health of individuals, organizations as well as large population through appropriate health information (Ishikawa & Kiuchi, 2010). People need to understand considerably critical health issues and behavior that can impact health outcomes of individuals and the general public.

With due cognizance of both the nature of the messages that must be communicated and the nature of young people, in this case university students, comprehensive needs, attitudinal assessment research must be designed and implemented, which should provide baseline data for appropriate intervention. Precisely, for these reasons, the present research is aimed at assessing the attitude and habit towards information on Ebola Virus among Nigerian undergraduates.

However, within the context of this study, there appears to be a lack of empirical investigation of the attitude and habit of Nigerian undergraduates toward information on Ebola Virus when it broke out. The virus is new in Nigeria and therefore, its study novel. This study, therefore, aims at laying the basis for understanding the place and study of attitude towards Ebola Virus Disease (EVD) among Nigerian undergraduates. This researcher considers investigating the students' habit and attitude towards Ebola information very relevant because of the fact that they are enlightened set of people who will form the fulcrum on which the survival of the society will finally rest. Hence, given the paucity of previous studies on Ebola, this study could serve as a further exploration of research efforts on the disease. Because of the limited data available concerning the attitude and habit of undergraduates regarding Ebola information, the goal of this study was largely descriptive.

Objectives of the study

The fundamental objective of the study was to contribute to knowledge and literature in the area of health communication. In order to efficiently accomplish this aim, the study,

1. Examined the attitude and habit of Undergraduates towards information on Ebola.
2. Investigated the various avenues through which Nigerian undergraduates obtained information on Ebola

Research Questions

The following research questions would, therefore, form the basis that the study intends to provide answers to in filling the gaps

1. What is the attitude of Nigerian Undergraduates towards Ebola virus information?.
2. What are the sources of information from which Nigerian undergraduate students obtain information on Ebola Virus Disease (EVD)?

Literature Review

Transmission of Ebola

The latest outbreak is spreading from person to person via bodily fluids like blood, vomit, semen, sweat etc. Travellers have been advised to be vigilant with regard to their health and those around them; they should stay away from people who look obviously ill, at least at a glance of three feet; avoid direct unprotected contact with people and their body fluids; they should also pay strict attention to personal hygiene by washing their hands often (WHO, 2014).

Public Health England in International SOS (2014) points out that although there have been several previous outbreaks of Ebola, exportation of the virus from an outbreak to a non-endemic country has historically been an exceptionally rare event, and has never occurred in Europe. Also, the United States Centre for Disease Control and Prevention (CDC) declared that "the likelihood of this outbreak spreading outside of West Africa is very low" and that the disease "poses little risk to the US general population at this time"

The risk of Ebola occurrence in more developed countries seems lower because they have the wherewithal needed to implement best practices even if a case or suspected case occurs. For example, in 2008, a traveler returned to the US infected with Marburg virus (a disease related to Ebola), quick and efficient control measures were established and the virus did not spread to other people (International SOS, 2014). But, on 1st October, 2014, the first case of the deadly virus was diagnosed in the US, with a 42 year old Thomas Eric Duncan who died of the virus. Surgeon Martin Salia was the second victim that died of the virus on the US soil. In Madrid, Spain, a Spanish nurse Teresa Romero was the first person to contract the virus outside the shores of Africa. Germany, Norway, France, Italy, Switzerland and the UK have treated patients who contracted the virus in Africa (BBC, 2015).

Symptoms of Ebola Virus Disease

The incubation period from infection with the virus to onset of symptoms is 2-21 days. Human beings are not infectious until they develop symptoms. First, symptoms are sudden onset of fever, fatigue, muscle pain, weakness, stomach pain, headache, loss of

appetite and sore throat. These tend to be followed by vomiting, diarrhoea, rash, signs of impaired kidney, chest pain, red eyes, cough, hiccups, difficulty in breathing, swallowing and liver dysfunction and in certain instances both internal and external bleeding.

Treatment and Vaccines for Ebola

There is not yet an approved cure for Ebola anywhere in the world. Nor is there any known vaccine available. Rumours abound about different treatment methods and preventive medications, these are, at best ineffective. Experimental treatments are still being evaluated to see if they are safe and effective. Supportive care –rehydration with oral or intravenous fluids – and treatment of specific symptoms, improve survival. However, a range of potential treatments coupled with interventions that maximize the victims' body to survive and recover including blood products, immune therapies and drug therapies and two potential vaccines that are undergoing human safety testing (WHO, 2014).

Prevention and control of Ebola Virus Disease

A seemingly good outbreak control squarely rests on applying a series of intervention programmes to include proper case management, adequate surveillance and contact tracing, an efficient laboratory service system, safe burial of victims and unrelenting social mobilization. In fact, community involvement through proper engagement could be a significant factor in order to successfully control outbreaks. Adequate education through sensitization on how Ebola spreads and creation of awareness of risk factors for Ebola infection as well as protective measures which individuals can take would be efficient avenues to reduce the spread of Ebola through human transmission.

Moreover, risk reduction message can focus on a number of things such as: Reducing the risk of human to human transmission through direct or close contact with infected people that are symptomatic, especially with their bodily fluids. Gloves and necessary personal protective materials should be used when caring for ill patients at home and regular hand washing should be intensified after visiting patients in hospitals and at home. Reducing the risk of wildlife to human transmission via contact with infected animals (bats, apes, monkeys) and the consumption of their raw meat. Animals (even ones domesticated) should be properly handled with gloves or any protective material. Also, animal products (blood and meat) should be thoroughly cooked before consumption.

Measures for containing Ebola outbreak

Prompt and safe burial of the dead, identifying those who might have been in contact with an infected person, monitoring the health of contacts for twenty one (21) days; separating the healthy from the sick to prevent further spread as well as good hygiene and maintaining a clean and healthy environment are some of the measures to contain

any outbreak of Ebola. Health care givers/workers need to always take into cognizance expected standard precautions whenever they care for patients irrespective of their presumed diagnosis. These are, hand hygiene, respiratory hygiene, use of personal protective material etc.

Theoretical framework

The thinking which informed this study can be located in two communication theories and a health belief model. This theoretical premise would help to better understand the preoccupation of this work which is to critically investigate the habit and attitude of Nigerian undergraduates to the information on the outbreak of deadly Ebola Virus Disease (EVD).

Theory of Reasoned Action

This theory predicts individual behavior by examining attitudes, beliefs, behavioural intentions and the observed expressed facts. It also underscores the validity of individuals plunging into risk behavior as a volitional exercise based on attitude, belief, the reason behind the behavior and the eventual exhibition of it. Therefore, the application of this theory cannot be accidental. The theory was an effort to understand the relationship between attitude and behavior. It was borne out of the frustration resulting from repeated failure to predict behavior from traditional measures of attitude (Fishbein, 1993). Ajzen and Fishbein proposed that the theory is based on the assumption that human beings are rational and make systematic use of available information. They sometimes consider the implications of their actions before they decide on whether tom perform or not to perform a given behavior. The theory attempts to explain the relationship among beliefs, attitudes, intentions and behavior. Montano and Kasprzyk (2002) also argue that the theory tends to be successful in explaining behavior when volitional control is high.

From the foregoing, the researcher believes that an individual usually holds a belief that a particular behavior leads to a particular outcome and he thereby evaluates the outcome and as a result forms an attitude towards that behavior. Though, the beliefs may not be fundamentally rational but are acquired as each person learns about the world around him. As the theory has been found to predict attitude-behaviour relationships (Arjen, 1977; Cochran, 1992), this researcher considers it an important theory for Ebola Virus Disease study. Since Ebola has been globally acknowledged, it would be worthwhile to employ the theory in exploring the baseline knowledge, attitude, intentions and health practice of the youths expressed in the course of the outbreak of the disease.

Theory of Planned Behaviour

This theory is an improvement on the theory of reasoned action. Ajzen (1991) proposed this theory with the addition of perceived behavioural control (PBC) to the propositions of the theory of reasoned action as an effort to take into cognizance factors outside a

person's volitional control that are capable of affecting his/her intentions and behavior. The expansion was premised on the idea that behavioral performance is determined by motivation (intention) and ability (behavioural control). Montano and Kasprzyk (2002) also submit that, perceived behavioral control is similar to Bandura's concept of self – efficacy which refers to an individual's belief in his /her ability to exhibit a particular behavior under various conditions.

Theory of planned behavior believes that perceived behavioural control is determined by control beliefs concerning the presence or absence of facilitators and barriers to behavioural performance, weighted by the perceived power or input of each factor to facilitate or inhibit behavior. Therefore, a person who holds strong control beliefs about factors that enhance behavior will have high perceived control which by extension translates to an increased intention to perform the behavior (Montano & Kasprzyk, 2002; Ajzen, 1991).

Examining the health behavior and promotion of Nigerian undergraduate especially their disposition towards Ebola Virus through this theory is premised on the conviction that the intentions and behaviour of an active and mobile sector of the economy is worthy of analysis in relation to the recent outbreak of Ebola across the continent which has been widely recognized as deadly. Therefore, the ability to perform a particular health behavior under various conditions by the undergraduate is likely to confer on him/her the laudable principle of self-efficacy.

Health Belief Model (HBM)

The HBM was developed in the 1950s to predict individual response to and utilization of screening and other preventive health services. In essence, the response and utilization of disease prevention programmes will be predicated on an individual's perceived seriousness of the disease, severity of the disease, perceived benefit of services and barriers to accessing such service.

It is based on the understanding that a person will take a health - related action if that person – feels that a negative health condition can be avoided, has a positive expectation by taking a recommended action, will avoid a negative health condition, and believes that he/she can successfully take a recommended health action.The model was spelt out in terms of perceived susceptibility, perceived severity, perceived benefits and perceived barriers. The individual's beliefs or perceptions of likely susceptibility to an illness and perceptions of the severity of the consequences of having the illness constitute perceived threat as well as perceived benefit of action in contrast to the barrier to acting.

A proper assessment of health behavior both in terms of potential benefits in reducing possible vulnerability and severity of the illness including perceived barriers to action, will to some extent determine whether or not an individual will engage in any health compromising behavior. Rimer (2002), Bogart and Delahanty, (2004) suggest that

access to cues leads to action. These cues refer to external and internal stimuli within the environment that could trigger appropriate health behavior. This becomes quite relevant considering the opportunities that undergraduate have as young and mobile and the freedom they enjoy which may predispose them to taking critical health decisions.

The two theories have been chosen for this study because they have been found to be better predictors of health related behavior than other models (Fishbein, 1993; Terry, Gallois & McCamish, 1993). It is assumed, therefore, that, every decision-making process usually involves an individual processing the information available to him/her, and later deciding on what to do after reflecting on the consequences of performing the behavior. The theories are considered relevant to behavior change. The model applied is also relevant in that a person who has critically evaluated available information and cues would engage in taking appropriate health decision.

The study area

The geographical scope of this study revolves round two states – Oyo State – Ladoke Akintola University of Technology, Ogbomoso (LAUTECH), and Osun State – Bowen University, Iwo. Bowen is a privately owned institution while LAUTECH is a state/public owned institution. The population represented students from different socio-economic backgrounds and nationalities. They (universities) were chosen to reflect the composition of university system and to ensure that people of different status were taken into consideration.

Method

The study adopted a quantitative technique to generate data. It also adopted survey as the design. A questionnaire was constructed and administered on the students to gather quantitative data. A total of 400 respondents properly filled the questionnaire out of 420 administered (200 from each school). The respondents were drawn from all levels of undergraduates (100 – 600). They were drawn through available sample as the researcher and his assistants went from one classroom to another to administer the questionnaire only on those considered capable of and willing to provide information regarding the questionnaire as students of colleges of health sciences were equally involved. The retrieval was done almost immediately. The data from the questionnaire were presented in simple percentage.

In terms of the respondents' demography, they were young ranging from 16 -30 years. They were selected from 100 to 600 levels. Both sexes – male and female were involved in the study. Their level of education and exposure was relatively high. This was a major factor that the researcher considered in drawing the sample because most undergraduates are quite mobile and adventurous as they can travel anywhere at any time across the globe.

ResearchQuestion1: What is the attitude of Nigerian undergraduates toward Ebola Virus information? Items 1 – 3 in table 1 were used to answer this.

Table 1: Respondents' Responses to Research Question One

Items	Options	Frequency	Percentage
Do you agree that Ebola is a spiritual punishment from God?	Yes	20	5%
	No	380	95%
Is Ebola a threat only to poor people?	**Yes**	8	2%
	No	392	98%
I have changed my health practices because of Ebola	Yes	240	60%
	No	160	40%

Table 1 reveals that a clear majority 380 of the respondents constituting (95%) did not agree that Ebola is a spiritual punishment from God. Though, 20 respondents amounting to (5%) which is quite negligible agreed that the disease must have been an affliction from the Almighty God. This, perhaps, could explain the level of commitment to religion by Nigerians and the need to stress the importance of aggressive enlightenment on Ebola by religious bodies and leaders among their adherents.

It equally indicates that 392 (98%) of the respondents declared that Ebola is not a disease of the poor alone but a disease that knows no economic or social status. Surprisingly, 8 respondents constituting (2%) claimed that the disease could be ascribed to the poor. A sizeable number 240 of the respondents, representing 60% affirmed that they have changed their health practices since the outbreak of Ebola in Nigeria which seemingly may be considered to some extent as underscoring the effectiveness of the various campaign messages by organizations and governments. Noteworthy is the 160 (40%) of the respondents who still held the view that nothing has really changed concerning their health practices irrespective of the outbreak of Ebola Virus.

Research Question 2: What are the sources of information from which Nigerian undergraduate students obtain information on Ebola Virus Disease (EVD) ? Item 4 contained the data that answered this.

Item 4: How did you get information on Ebola?

Table 2: Respondents' sources of information on Ebola

	FREQUENCY	**%**
Radio	16	4%
Television	24	6%
Newspaper	4	1%

Social Media	32	8%
More than one source	324	81%
TOTAL	400	100

Table 4 shows that 324 (81%) of the respondents pointed out that they obtained information about Ebola from more than one source affirming the efficacy and effectiveness of combining a number of media outlets in reaching out to the public for maximum and significant influence.

Table 5: Respondents' Demographic Distribution

Age	F	%	Sex	F	%	Levels	F	%
16 -20	200	50	Male	100	25	100-200	60	15
21 -25	150	37.5	Female	300	75	300-400	150	37.5
26 -30	50	12.5	-	-		500- 600	190	47.5
Total	400	100	-	400	100		400	100

Table 5 briefly summarises the demographic details of the respondents from the three tertiary institutions depicting their age range, sex and academic levels. It typifies the various characteristics that are usually found in any tertiary institution and the institutions that were used as samples are, therefore, no exception.

Discussion of the findings

From the submissions, majority of the respondents declared that Ebola virus is not a spiritual punishment. Though, a negligible percent claimed that the virus is a spiritual punishment, it became apparent that, the fact that majority claimed otherwise is a clear demonstration of the level of seriousness that people attached to the outbreak of the virus and the eagerness and readiness to do something about it so that it would not kill so many people. Findings also revealed that the respondents completely agreed that the virus is not a poor man's disease but a scourge that threatens the whole of mankind if something urgent and serious was not done by the concerned stakeholders. Therefore, the need for all (stakeholders) to be involved in any conceivable effort aimed at checkmating and curtailing the spread of the virus. The fact that the West and even Europe were affected by the virus showed that no one is immuned, irrespective of one's social status and background (race).

The outbreak of the virus had made significant impact on the respondents' health practices. In fact, a preponderant majority of the respondents affirmed that the outbreak made quite some noticeable impact on them. On the other side, a sizeable number of the respondents were of the opinion that the outbreak of the virus had really not brought any difference in their health practices. This buttresses the principle of planned behavior that intentions and behavior of an individual can improve or harm one. A recognizable majority claimed that they obtained information about Ebola from a plethora of media sources. This explained and exemplified the effectiveness of the employment of a

combination of media sources in reaching a wider audience especially a campaign message that is directed toward the youths.

A large proportion of the respondents agreed that the virus does not spread by air. This showed that the modes of transmission of the virus were well known to the respondents and would likely avoid any mistake of engaging in any practice that could put them in danger. Surprisingly, most of the respondents confirmed that they still relish the consumption of bush meat as a delicacy. This to the understanding of the researcher can portend a grave danger as the primary source of infection of the virus remained the bat and bat fruits. In line with this, almost all the respondents declared that they would not need the use of any protective measures which lends credence to the earlier claim of danger in the consumption of bush meat. This seems not to align partly with the proposition of health belief model that people are likely to take any health related decision that will not compromise their health based on perceived susceptibility to illness.

Of note is the fact that nearly all the respondents were unanimous that media sensitization on Ebola was quite adequate. The surveillance, information and education functions of the media were properly carried out. In caring for an infected person, majority of the respondents stated that they would honestly cater for siblings that may be infected by the virus as a result of the bond between them. But, some of them thought otherwise and pointed out that they would not bother to cater for an infected sibling because of the inherent danger associated with such a risky step.

Analyses of the findings have really underscored the fact that students' habit and attitude as exemplified by the data were volitional which is in agreement with the argument by Montano and Kasprzyk (2002). The claim that they (respondents) use available sources information also affirmed the postulation of Ajzen and Fishbein that human beings are rational and systematically use available information – they (the respondents) really put to good use the information they garnered through various media sources. Also, the responses of the respondents equally highlight the position of Rimer (2002), Bogart and Delahanty (2004) that access to cues often leads to action. Again, the exportation of the Virus from Liberia to Nigeria through Patrick Sawyer and even to Europe and the West actually nullified the claim by Public Health England in International SOS (2014) that its exportation to a non-endemic country has been an 'exceptionally' rare event. The outbreak has (seemingly) influenced the health practices of the undergraduates as they have claimed to be more careful with health related activities, no thanks to the outbreak of EVD in Nigeria and the aggressive sensitization from all fronts..

Conclusion

This study revealed that Nigerian undergraduates' attitude toward Ebola was negative. They showed that they were really concerned about their health and would not take any chances at preventing any endangering health venture. They were unmistakable in their

position that the virus could infect both the highly and the lowly placed in the society. It equally became evident that nearly all available media of communication were deployed to relay information on Ebola as suggested by the submission of the respondents. This creditably enhanced the efficiency of the campaign messages. The study apparently revealed that the outbreak of the virus might not at the initial stage directly affect the respondents. This can be explained because of the fact that attitude cannot be easily changed. Since cure and vaccine for the virus have not been found or discovered, people need to be careful especially with their health practices. Government should get actively involved in health related issues as a healthy citizenry would translate to a healthy society.

Recommendations

From the findings of the study, it is recommended that:the high tempo with which media sensitization was carried out on Ebola at the outset of its outbreak should be encouraged whenever any major scourge of any disease is detected/reported; schools especially residential ones should ensure that health facilities are adequately provided in order to take care of emergency needs;traditional practices that can endanger the lives of innocent citizens should be jettisoned in this age of civilization and information;health care givers should be adequately taken care of and appreciated considering the risks which they are exposed to during the course of their duties.

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INFLUENCE OF NEGATIVE POLITICAL ADVERTISEMENTS ON VOTERS CHOICES IN THE 2015 PRESIDENTIAL ELECTION IN NIGERIA

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Abstract

This research focused on influence of negative political advertisements on the voting choices of the Nigerian electorate in the 2015 presidential election. Survey was the research design. A total of 2400 copies of the questionnaire were distributed in the selected capitals of the selected states across the six geopolitical zones in the country. A total of 2091 copies representing 87.1% were found usable for the analysis. The two sampling techniques used were multi-stage sampling and simple random sampling. Two key findings of the study, among others, were that while negative political advertisements did not influence the voting choices of the electorate during the election, as attested to by a majority of the respondents (1223:80.9%), they (negative political advertisements) did not also dissuade the voters from coming out to vote in the presidential election. The study recommends, among others that political parties and their campaign organisations should focus more on issues-based campaign than on attacking their political opponents.

Key words: Influence, negative political advertisements, 2015 presidential election, voters' choices, Nigeria

Introduction

From time immemorial, advertising has played a crucial role economically, political, socially, culturally and educationally in the marketing of goods and services not only in Nigeria but also globally. One area in which advertising has played a great role, sometimes unethically is the area of political advertising- which has to do with the selling of the image of a candidate and his/her respective political party in order win the votes of the electorate during election. But it is quite appalling that because of the nature of politics which is like war not only in Nigeria but even in some of the so-called developed countries, politicians, especially candidates and their respective political parties throw mud at each other, while relegating real campaign issues to the background. This now results in negative political advertising or attack advertising, which is the process of disseminating ludicrous and ridiculous messages against political opponents and their respective political parties in order to lower their image in the eyes of right thinking members of society. Negative political advertising is basically a smear campaign aimed at finding faults in political opponents and their respective political parties. Other scholars have written on diverse aspects of political advertising,

especially negative political advertising (See: Djupe & Peterson, 2002; Goldstein & Freedman, 2002; Lau & Pomper, 2004; Martin, 2004; as well as Peterson & Djupe, 2005).

However, never in the political history of Nigeria has an election made the country to be so tension-soaked as the 2015 presidential election. In fact some analysts and pundits saw the 2015 presidential election as not only a make or mar one, but that it was going to be the precursor to an alleged predication by the Central Intelligence Agency (CIA) of America that Nigeria would disintegrate in the year 2015. Moreover, the two leading political parties, All Progressives Congress (APC) and the People's Democratic Party (PDP), including their respective presidential candidates- General Muhammadu Buhari (Rtd) and Dr. Goodluck Jonathan did not help matters, by throwing mud at each other. It is instructive to note that the code of the Advertising Practitioners Council of Nigeria (APCON), especially the section on "Guideline on Political Advertising" was jettisoned by these political actors.

However, some samplers of the negative political advertisements by both the APC and the PDP will suffice here:

The punch newspaper of January 16, 2015, page 21 had the following negative political advert targeted at Buhari: Headline- "Fellow Nigerians! Can you see that these are people hypocrites? The body text of advert showed some negative comments made by Mallam Nasir El-Rufai in the past against General Buhari, including the pictures of both of them. The pay-off line of that advert was: "Will you put your life in the hands of this man. Nigerians! Shine your eyes. The advert was sponsored by "Independent Campaign Group".

The Punch newspaper of January 19, 2015 carried a negative political advert targeted at General Buhari, thus: "Nigerians be warned! Nigeria…" I have set before thee life and death. Therefore, choose life that both thee thy seed may live." Deut 30 vs 19. The advert contained pictures of former rulers of from the North, specifically North-West who died in office such as Murtala Mohammed; Sani Abacha and Musa Yar'Adua, while the picture of General Buhari had a question mark on it with the cutline: General Muhammad Buhari from North West again? Age 72 years. Under these pictures were the following: "Will you allow history to repeat itself? Enough of state burials. Nigerians, vote wisely, vote Goodluck Jonathan, Northern presidency should wait till 2019". The advert was sponsored by Ayo Fayose, Governor, Ekiti State.

The Punch newspaper of Monday, February 2, 2015, on page 25 carried a negative political advert targeted at Jonathan: Headline-"The Jonathan And PDP I Know- By Femi Fani-Kayode". The body text had the following- "On Security: President Goodluck Jonathan has handed our country over to a bunch of butchers who have no value for human life. Under his watch our people continue to die and die whilst he sits in the Presidential Villa and drinks champagne". This was one of the series of articles written by Fani-Kayode when he was in the opposition. He would later join the

Jonathan's campaign team and became the Head of Media/Publicity, The PDP Presidential Campaign Organisation (PDPPCO). The advert was sponsored by "change.com"

The Punch newspaper of February 3, 2015, on page 37 had the following negative political advert targeted at Jonathan: Headline- "On FeBuhari 14, do your duty to Nigeria", with the picture of President Jonathan decked in military attire, taking salute. The body text had the following- "vote out the Commander-in-Chief under whose watch, a minister spent 10 billion naira to hire privates jets". The pay-off line was "Nigeria deserves better than Goodluck". The advert was sponsored by "The Restoration Group (South-West).

Arising from the above, the focus of this study is to evaluate influence of negative political advertisements on the voting choices of the Nigerian electorate in the 2015 presidential election.

Statement of the Problem

Just like product/service advertising, political advertising definitely has some effects. If it were not so, politicians and political parties would not spend millions of naira and even dollars on it. In spite of this, there are divergent views from scholars about the influence of negative political advertisements in electioneering. According to Zaluzec (2010), using the 2004 and 2008 presidential elections in America as case studies, noted that not only do negative political advertisements, especially fear appeal in presidential election campaign play an integral role in capturing the attention of voters, but that they may also determine the outcome of an election.

Jackson, Mondak and Huckfeldt (2008), in a study entitled "examining the possible corrosive impact of negative advertising on citizens' attitudes towards politics", argue that although negative political advertisements have been depicted by some observers as a scourge on politics, thereby discouraging voter turnout and also producing corrosive effects on the attitude of the electorate. They discovered that there was no empirical support for the allegations levied against negative political advertisements. Corollary to the above submissions, what influence (if any) did negative political advertisements have on the voting choices of the Nigerian electorate in the 2015 presidential election. This study seeks to provide answer to this question, hence the study examined the influence of negative political advertisements on voters' choices in the 2015 presidential election in Nigeria.

Objectives

In broad terms, this research seeks to evaluate influence of negative political advertisements on voters' choices in the 2015 presidential election in Nigeria, but specifically, it is to:

1. Determine the Nigerian electorate attention to negative political advertisements during the 2015 presidential election campaign in Nigeria and the extent of such attention.
2. Ascertain how the electorate perceived negative political advertisements during the 2015 presidential election campaign in Nigeria.
3. Find if the negative political advertisements used during the 2015 presidential election campaign influenced the electorate voting choices and the extent of such influence.

Research Questions

The following are the research questions guiding the study:

1. What attention did the Nigerian electorate pay to negative political advertisements during the 2015 presidential election campaign in Nigeria and what is the extent of the attention?
2. What ways did the electorate perceive the negative political advertisements during the 2015 presidential election campaign in Nigeria?
3. What is the influence of the negative political advertisements during the 2015 presidential election in Nigeria on voters' choices and what is the extent of such influence?

Significance of the Study

This research is significant in the following ways: it will make political parties and their respective candidates to focus on issues-based campaign, instead of dissipating energy on attacking their opponents; it will make the Advertising Practitioners Council of Nigeria (APCON) to be alive to its responsibility by not only educating political parties and their candidates on the codes of political advertising, but also vetting political advertisements, before they are disseminated; it will contribute to the existing but scanty empirical studies on negative political advertisements and electioneering in Nigeria.

Literature Review

There is no gainsaying the fact that a lot of studies have been done on political advertising, especially negative political advertising in the developed countries, partly because of the sophistication of their political system and also partly because of the high level of political literacy, in tandem with a vibrant media. But that cannot said about a developing country like Nigeria, where some other factors other than political advertising can determine the success of a candidate and his/her political party at the polls.

Stevens, Allen and Sullivan (2008:527), in their study on "What's Good for the Goose is Bad for the Gander: Negative Political Advertising, Partisanship and Turnout", using focus group research design, discovered that there could be certain circumstances in which negative political advertisements could affect voter turnout; they also showed in their study that when partisans perceive the criticisms of their own party's candidate to be fair, they are less likely to say they will vote. In addition, they also found out that negative political advertisements not only might affect the total voter turnout during elections, but also have important and varying impact on the electorate.

Pinkleton, Um and Austin (2002:13), in their study entitled "An Exploration of the Effect of Negative Political Advertising on Political Decision Making", using the experimental research design, found out that the respondents who were exposed to negative political advertisements found it less useful for political decision-making and were more negative towards political campaign than were the respondents exposed to positive advertising. In a study by Asemah and Edegoh (2012:248), with the title "New Media and Political Advertising in Nigeria: Prospects and Challenges", using Likert scale, they found out that negative political advertising through the new media did not make the electorate to believe that they were better informed; and that political advertisements through the new media that attacked the opposing candidates and parties did not have more impact on the electorate.

According to Lipsitz, Norton and Teigen (2005), 82% of Americans disliked attack advertisements, while 53% believed that the ethics and values of election campaign have worsened since 1985; they argue further that the voting public see attack advertisements an element of smear campaign; while Gann and Bonneau (2012), believed that voters were open to candidates attacking each other if the issues in question were "appropriate". Franz and Ridout (2007), in their study entitled "Does Political Advertising persuade?", discovered considerable evidence that political advertising persuades; and that its impact varies depending on the characteristics of the people involved. For Brader (2005), in a study entitled "Striking a Responsive Chord: How Political Ads Motivate and Persuade Voters by Appealing to Emotions", he discovered for the first time that political advertisements can change the way citizens get involved and make choices simply by using images and music to evoke emotions; and that campaign achieve their goals in part by appealing to emotions, and emotional appeals can promote democratically desirable behaviour.

Furthermore, in a study by Lau,Sigelman, Heldman, and Babbitt (1999:851), with the title "The Effects of Negative Political Advertisements: A Meta-Analytic Assessment", they found out that negative political advertisements are not more effective than positive political advertisements and they (negative political advertisements) did not seem to have detrimental effects on the American political system. In a study Schenk-Hamlin, Procter and Rumsey (2000:53), entitled "The Influence of Negative Advertising Frames on Political Cynicism and Politician Accountability" using content analysis and experimental research designs, the authors identified two advertising frames- candidate frames and ad hoc issue advertisements and two experiments and argued that they

separately induced political cynicism and politician accountability. They also discovered that participants were more likely to generate cynical comments and hold politicians accountable for the country's ills when reading candidate theme advertisements than ad hoc issue advertisements.

Roddy and Garramone (2009:415), in their own study entitled "Appeals and Strategies of Negative Political Advertising", using the experimental research design, found out that when attack commercials on television are followed by a response from the target, issue-attack commercials are more effective than image attack commercials. They also discovered that although the respondents evaluated a negative-response commercial less favourably than a positive-response commercial, the negative response commercial was more effective in discouraging voting for the attacking candidate. From the literature reviewed so far, only the work of Asemah and Edegoh (2012), was on Nigeria, even when its focus was not really on negative political advertisements and the impact on the electorate, the rest are based on America and Europe. This research will therefore make an attempt at contributing to scanty empirical literature on influence of negative political advertisements on voters' choices during elections.

Methodology

Research Design

This study used the survey method of scientific inquiry. Survey was quite appropriate in eliciting people's views on the issue. According to Brown, Cozby, Kee and Worden (1999), survey research design employs careful sampling techniques to obtain an accurate description of an entire population.

Population

The population of this research included all those who are educated, media-literate and politically-conscious in the study areas across the six geopolitical zones of Nigeria. The estimated population of the study who were mainly students, members of civil society organisations, the working class, and a few academics was at least 600,000

Sample Size

The sample size was 400 from the selected area of the study in the selected state in each of the geopolitical zones. This was based on Glen (1992) sample size determination table, as cited by Singh and Masuku (2014), which states that at + or – 5 precision levels, where confidence level is 95% and P=0.5, a population of over 100,000 should have a sample size of 400.

Sampling Techniques

The sampling techniques used were multi-stage and simple random sampling techniques. The multi-stage sampling technique was used to divide Nigeria into six geopolitical zones, then a state was selected from each of the zones, while the capital of the selected state formed the area of the study. This is represented in the table below:

Table 1: Areas of the Study by Geo-Political Zones, States and Capitals

S/N	GEOPOLITICAL ZONES	STATES	CAPITALS
1	North-Central	Benue	Makurdi
2	North-East	Taraba	Jalingo
3	North-West	Kaduna	Kaduna
4	South-East	Enugu	Enugu
5	South-South	Rivers	Port-Harcourt
6	South-West	Lagos	Ikeja

Instrument for Data Collection

The instrument for collecting data for this study was the questionnaire. The first part of the questionnaire was on the demographics of the respondents, while the second part was on the research questions.

Procedure for Data Collection

In this study, 2400 copies of questionnaire were distributed in the selected capitals in the selected states across the six geopolitical zones in Nigeria. Out of this figure, 2091 copies, representing 87.1% were returned and found useful. The response rate is very encouraging because according to Ohaja (2003), a response rate that is below 70% may render the research findings suspect. However, the number of copies returned and the percentages, according to geopolitical zones are shown in the table below:

Table 2: Number of Copies of Questionnaire Returned by Geo-Political Zone

South-East	South-South	South-West	North-Central	North-East	North-West
347(86.8%)	345(86.3%)	367(91.8%)	345(86.3%)	343(85.8%)	344(86%)

In Table 2 above, the response rate of the South-East was 347 (86.8%); South-South- 345 (86.3%); South-West- 367 (91.8%); North-Central- 345 (86.3%); North-East- 343(85.8%) and North-West- 344 (86%).

Table 3: Respondents' Demographic Data

Item	South-East	South-South	South-West	North-Central	North-East	North-West
1. Sex Male Female **Total**	217(62.5%) 130(37.5%) **347(100%)**	236(68.4%) 109(31.6%) **345(100%)**	242(65.9%) 125(34.1%) **367(100%)**	271(78.6%) 74(21.4%) **345(100%)**	303(88.3%) 40(11.7%) **343(100%)**	299(87.2%) 45(12.8%) **344(100%)**
2. Age 18-22 23-27 28-32 33-37 38-above **Total**	42(12.1%) 85(24.5%) 90(25.9%) 93(26.8%) 37(10.7%) **347(100%)**	65(18.8%) 72(20.9%) 77(22.3%) 88(25.5%) 43(12.5%) **345(100%)**	72(19.6%) 58(15.8%) 63(17.2%) 97(26.4%) 77(21%) **367(100%)**	72(20.9%) 68(19.7%) 83(24.1%) 78(22.6%) 44(12.7%) **345(100%)**	31(9.0%) 57(16.6%) 97(28.3) 85(24.9%) 73(21.2%) **343(100%)**	33(9.6%) 59(17.2%) 90(26.2%) 89(25.8%) 73(21.2%) **344(100%)**
3. Education SSCE/equivalent HND/BA/B.SC MA/MSc/M.Tech Ph.D **Total**	84 (24.2%) 193(55.6%) 67 (19.3%) 3 (0.9%) 347(100%)	74(21.4%) 184(53.3%) 82(23.8%) 5(1.5%) 345(100%)	78(21.3%) 192(52.3%) 90(24.5%) 7(1.9%) 367(100%)	62(18%) 184(53.3%) 97(28.1%) 2(0.6%) 345(100%)	72(21.1%) 179(52.2%) 91(26.5%) 1(0.3%) 343(100%)	81(23.6%) 169(49.1%) 92(26.5%) 2(0.6%) 344(100%)
4.Party Affiliation	**Responses**			**Percentage**		

APC	841	40.2%
PDP	745	35.6%
Others	371	17.7%
None	134	6.5
Total	**2091**	**100**

In Table 3 above, the respondents from the South-East were 217(62.5%) males and 130(37.5%) females; South-South- 236(68.4%) males and 109(31.6%) females; South-West- 242(65.9%) males and 125(34.1%) females; North-Central- 271(78.6%) males and 74(21.4%); North east- 303(88.3%) males and 40(11.7%) females; and North-West - 299(87.2%) males and 45(12.8%) females; the age-groups of the respondents according to the geopolitical zones are as follows: South-East: 18-22(42:12.1%), 23-27(85:24.5%), 28-32(90:25.9%), 33-37(93:26.8%), 38 & above(37:10.7%); South-South: 18-22(65:18.8%), 23-27(72:20.9%), 28-32(77:22.3%), 33-37(88:25.5%), 38 & above(43:12.5%); South-West: 18-22(72:18.8%), 23-27(58:15.8%), 28-32(63:17.2%), 33-37(97:26.4%), 38 & above(77:21%); North-Central: 18-22(72:20.9%), 23-27(68:19.7%), 28-32(83:24.1%), 33-37(78:22.6%), 38 & above(44:12.7%); North-East: 18-22(31:9.0%), 23-27(57:16.6%), 28-32(997:28.3%), 33-37(85:24.9%), 38 & above(73:21.2%); North-West:18-22(33:9.6%), 23-27(59:17.2%), 28-32(90:26.2%), 33-37(89:25.8%), 38 & above(73(21.2%).

Furthermore, the educational qualifications of the respondents by geo-political zone are as follows: South-East: SSCE/its equivalent (84:24.2%), HND/BA/B.Sc/its equivalent (193:55.6%), MA/M.Sc/its equivalent (67:19.3%), Ph.D (3:0.9%); South-South: SSCE/its equivalent (74:21.4%), HND/BA/B.Sc/its equivalent (184:53.3%), MA/M.Sc/its equivalent (82:23.8%); Ph.D (5:1.5%); South-West: SSCE/its equivalent (78:21.3%), HND/BA/B.Sc/its equivalent(192:52.3%), MA/M.Sc/its equivalent (90:24.5%), Ph.D (7:1.9%); North-Central: SSCE/its equivalent (62:18%), HND/BA/B.Sc/its equivalent (184:53.3%), MA/M.Sc/equivalent (97:28.1%), Ph.D (2:0.6%); North-East: SSCE/its equivalent (72:21.1%), HND/BA/B.Sc/its equivalent (179:52.2%), MA/M.Sc/its equivalent (91:26.5%), Ph.D (1:0.3%); North-West: SSCE/its equivalent (81:23.6%), HND/BA/B.Sc/its equivalent (169:49.1%), MA/M.Sc/its equivalent (92:26.5%), Ph.D (2:0.6%); while 841 of the respondents, representing 40.2%, are members of the All Progressives Congress (APC); 745(35.6%), are members of the People's Democratic Party (PDP); 371(17.7%), belong other political parties; while 134(6.5%), do not belong to or have sympathies for any political party.

Method of Data Analysis

The study used frequency tables, simple percentages and Likert scale for the research questions. For the Likert scale, a benchmark of 3.0 was specified for the Likert Scale. It was used to determine the perception of the respondents on the use of negative or attack political advertisements by the two major political parties in the 2015 presidential

election. This benchmark is arrived at by dividing the total values on the scale by 5 points, thus:

$$\frac{5+4+3+2+1}{5} = \frac{15}{5} = 3.0$$

Therefore, if a statement has a mean value that equals or is greater than3.0, then it is accepted, if otherwise, it is rejected. Therefore to get the mean score for each statement, the scores recorded under Strongly Agree (SA), Agree(A), Undecided(U), Disagree(D) and Strongly Disagree(SD) were multiplied by their scale points- 5, 4, 3, 2, and 1and then divided by the total score- 2091 copies of the question returned and found usable . It is important to note that "F" stands for "Frequency".

Presentation and Analysis of Data

Research Question 1: What attention did the Nigerian electorate pay to negative political advertisements during the 2015 presidential election campaign in Nigeria and what is the extent of the attention? The essence of this research question was to first of all find out from the respondents if they paid attention to the barrage of negative political advertisements from the two main political parties- APC and PDP, during the campaign; the frequency of the attention and the political party that used negative political advertisements most. Below is the presentation of the data:

Table 4: Respondents Views on Research Question 1

Items	**Frequency/percentage**
Paid Attention	
Yes	525(25.1%)
No	1491(71.3%)
Not sure	75(3.6%)
Total	**2091(100%)**
Frequency of Attention	
Very often	214(40.8%)
Often	179(34.1%)
Less often	132(25.1%)
Total	**525(100%)**
Most Used Negative Political Advert Party	
APC	107(20.4%)
PDP	358(68.2%)
Not sure	60(11.4%)
Total	**525(100%)**

In Table 4 above, 525 of the respondents, representing 25.1%, said paid attention to the negative political advertisements churned out by two leading political parties during

the campaign; 1491(71.3%), said no; while 75 (3.6%), said they were not sure; out of the 525 respondents who stated that they paid attention to negative political advertisements during the 2015 presidential election campaign, 214 of them, representing 40.8%, said they paid attention "very often; 179 (34.1%), said "often"; while 132 (25.1%), said "less often"; while 107 of the respondents, representing 20.4%, said "APC" used negative political advertisements most during the 2015 presidential election campaign; 358(68.2%), said "PDP"; while 60 (11.4%), said they were not sure.

Research Question 2: What ways did the electorate perceive the negative political advertisements during the 2015 presidential election campaign in Nigeria? For both research questions 2 and 3, all the respondents who said "no' and 'not sure" in Table 7 above, were asked to skip questions under research question 1 and answer these two research questions. For research question 2 specifically, the Likert Scale was used

Table 5: Respondents' Perception of the Use of Negative Political Advertisements During the 2015 Presidential Election Campaign

S/N	Items	SA	A	U	D	SD	Mean Score	Decision
		F	F	F	F	F		
1	Negative political advertisements heat up the country during election period.	792	841	409	49	-	4.1	Accepted
2	Negative political advertisements do not contribute to issues-based campaign.	947	899	185	60	-	4.3	Accepted
3	Negative political advertisements show that the attacking candidates/parties have nothing to offer.	720	975	273	123	-	4.1	Accepted
4	The use of negative political advertisements by an attacking candidate/party results in voter sympathies for the attacked candidate/party.	614	820	314	226	117	3.8	Accepted
5	Negative political advertisements can dissuade some of the electorate from voting.	320	214	592	879	86	2.9	Rejected

6	The use of negative political advertisements indicates that the attacking candidate/party is scared of the attacked candidate/party.	887	779	396	29	-	4.2	Accepted

In table 5 above, apart from item 5, which has a mean score of 2.9, which renders the statement invalid, the mean scores of all other hypothetical statements are more than the benchmark of 3.0., meaning that the statements are valid and are therefore accepted.

Research Question 3: What is the influence of the negative political advertisements during the 2015 presidential election in Nigeria on voters' choices and what is the extent of such influence? This research question was quite fundamental because it touched on the essence of the study. In this case, the researcher asked the respondents if they voted during the 2015 presidential election; if negative political advertisements determined their choice of candidate; as well as the extent to which the negative political advertisements influenced their choice of candidate. Below is the presentation of the results:

Table 6: Respondents' Views on Negative Political Adverts in 2015 Election

Items	**Frequency/percentage**
Voted	
Yes	1511(72.3%)
No	580 (27.7%)
Influence of Negative Political Adverts on Choice of Candidate	
Yes	198 (13.2%)
No	1223 (80.9%)
Not sure	90 (5.9%)
Extent of Influence of Negative Political Adverts	
A large extent	42 (21.2%)
Some extent	112 (56.6%)
A little extent	44 (22.2%)

In Table 6 above, 1511 of the respondents, representing (72.3%) said they voted during the 2015 presidential election; while 580 (27.7%), said 'no"; 198 of the respondents, representing 13.2%, said negative political advertisements influenced their choice of the candidate/party; 1223 (80.9%), said "no"; while 90 (5.9%), said they were not sure; while 42 of the respondents said negative political advertisements influenced by their choice of candidate/party during the 2015 presidential election to "a large extent"; 112 (56.6%), said 'some extent"; while 44 (22.2%), said "a little extent"

Table 7: Respondents' Reasons for the Inability of Negative Political Advertisements to Influence their Voting Choices During the 2015 Presidential Election

	Frequency	**Percentage**
I had made up my mind on the candidate/party to vote for.	411	33.6
I saw those negative advertisements as lies aimed at tarnishing the image of my preferred candidate/party	273	22.3
The more the negative political advertisements, the more sympathies grew for my preferred candidate/party	275	22.5
I believed that the attacking candidate/party ought to have focused on why should vote for them than on why should not vote for the other candidate/party	264	21.6
Total	**1223**	**100**

Table 7 above, represents the collation of the reasons that made a majority of the respondents not to be influenced by negative political advertisements during the campaign for the 2015 presidential election.

Discussion of Findings

In spite of the pervasiveness and ubiquity of political advertisements, especially political advertisements, by both APC and the PDP during the 2015 presidential election in Nigeria, a majority of the electorate were not swayed by such. It was discovered that only 525 of the respondents, representing 25.1%, really paid attention to negative political advertisements. It is possible that these were the people who probably were looking for something to reinforce their pre-existing beliefs about a particular candidate/party, while a majority- 1491, representing 71.3%, did not pay attention to negative political advertisements; in other words, negative political advertisements did not constitute a factor in their political behaviour. The findings also revealed that a majority of the respondents believed that the PDP used more negative political advertisements than their opponent- the APC. This could not have been surprising to those who were media-literate enough during the campaign, because the candidate of the APC, General Buhari (Rtd), who was later elected the president, had massive followership in the country, especially in the North, and had been a symbol of the opposition in the country, having contested under different political platforms in 2003, 2007, 2011 and lost, but won in 2015. So the PDP deployed so much attack political advertisements at his person, most such advertisements bordering on his past when he was a military Head of State in Nigeria between 1984-1985.

These attack advertisements were really mud-throwing and muck-raking. Furthermore, the results from the Likert scale indicated that the respondents accepted the fact that negative political advertisements heat up the country during election period; negative political advertisements do not contribute to issues-based campaign; negative political advertisements show that the attacking candidate/party do not have anything to offer; the use of negative political advertisements by an attacking candidate/party results in voter sympathy for the attacked candidate/party; and that the use of negative political advertisements indicates that the attacking candidate/party is scared of the attacked candidate/party. However, the respondents rejected the statement that negative political advertisements can dissuade some of the electorate from voting.

Conclusion

The major objective of this study was to evaluate influence of negative political advertisements on the voting choices of the electorate in the 2015 presidential election in Nigeria. The study was guided by three research questions. Apart from frequency table and simple percentages, the study also used the Likert Scale to elicit the views of the respondents. However, it should be noted that in spite of the perceived potential and impact of advertising in society, when it comes to political advertising, especially negative political advertisements; other factors could undermine the advertising efforts. When a people seem to be fed with a political party, no amount of negative political advertising targeted at the opponents of such a party will work; and this was quite instructive with the Nigerian situation in the 2015 presidential election.

Recommendations

The Advertising Practitioners Council of Nigeria (APCON): It is quite surprising that the APCON's Advertising Standards Panel (ASP), the body that vets all advertisements in Nigeria before they are disseminated could not checkmate the avalanche of reckless political advertisements churned out during the presidential campaign. This serves therefore as a clarion call to APCON to enlighten political parties, their candidates and campaign organisations to abide by the relevant section of the APCON Code on Political Advertising. This may help future political advertisements to be issues-based.

The Independent National Electoral Commission (INEC): As the body in charge of elections and other related matters in Nigeria, it should, before campaign starts, draw out the rules of engagement of political advertising by liaising with APCON to organise workshops, seminars and symposia on how the political parties can avoid petty issues and focus on what they have in their manifestoes. This, no doubt, will conduce to a healthy democratic culture.

Political parties: The political parties in Nigeria today seem not to have any ideological leaning, and so anything goes. Parties are supposed to have think-tanks that will think through most of their decisions and actions. To this end, political parties should focus more on real issues than on petty issues. Their political advertisements should explain

why they should continue in power or why they are the better alternatives. This can be done through their focusing on key sectors of the economy. Moreover, political parties should know that a majority of the Nigerian electorate are not media-literate, so they depend on opinion leaders and even godfathers on their voting choices, so spending huge sums of money on negative political advertisements may not be effective or may even work in favour of the most attacked party. So political parties should concentrate on real campaign issues and the resist the temptation to throw mud at opponents.

The media: Although the mass media, especially broadcast need money from advertisements to keep them afloat, the age-long societal expectations of social responsibility should not be jettisoned. The Nigerian media can still contribute to a healthy democratic culture in Nigeria, by rejecting some negative political advertisements that can heat up the polity. Money alone should not be the defining essence of a media organisation.

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IMPACT OF COMPUTER ASSISTED INSTRUCTION PACKAGES ON JUNIOR SECONDARY CREATIVE ARTS IN OGBOMOSO, NIGERIA

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Abstract

The purpose of this study was to investigate the computer assisted instructional package impacts on creative arts student of junior secondary school in Ogbomoso. Nigeria. The pretest, posttest control group design was used for the study. One hundred and twenty (120) students were randomly selected (60 males and 60 females) from two secondary schools that took part in the study. The students were randomly assigned to the experimental and control groups respectively. The subjects in the experimental group were taught using computer assisted instructional package (CAIP) on Creative Arts while the control group were taught using conventional method. The treatment for the study was the Computer Assisted Instructional Packages CAIP and the main instrument used was Creative Arts Test (CAT) Both the instrument and the treatments were subjected to content and face validation. A 50-item Creative Art Test (CAT) was administered to the students as pretest and posttest. Two hypotheses were postulated and tested at 0.05 level of significance. The analysis revealed that there was a significant difference between the scores of students taught creative arts with the Computer Assisted Instructional Packages and those taught using conventional method and also there was no significant difference between the mean achievement scores of male and female students taught creative arts with the Computer Assisted Instructional Packages. Based on these findings, it is recommended that creative arts teachers should be encouraged to use the Computer Assisted Instructional Packages for teaching related concepts in Cultural and Creative arts

Keywords: Computer Assisted Instructional Package, Creative Arts Test, Creative Arts, Gender, Nigeria.

Introduction

Man lives in the world of creativity which is guided by the arts. It is a very wide human activity involving the use of skills. Arts is imaginative, creative, and aesthetics in nature. It is a purely individual expression, which shows in all our ways of life (Becta, 2003) ways Otonye (2003) defined arts as the practical demonstration of skills, bore out of the creativity which involving the brain, the eyes and the hand. It is an entrance into a world of sensation and experience Arts is an integral part to child education, aiming at enriching the child's world of emotion, through expressing, opinions, and dreams. Arts introduce culture through history, understand, and identify society along with individual (Peşkersoy, 2010). Arts study human being in his communication with the culture, his appreciation and promoting of small-scale industries. Art is a universal medium of expression, developed through aesthetic, awareness, emotional for perceptual and

creative activities (Zwirn, & Graham, 2010). The creativity tendency in individual child is develop through creative arts curriculum in the Junior Secondary Schools.

Cultural and Creative Arts is subject bore out of the mandate given to Nigerian Educational Research and Development Council (NERDC) by the Federal Government of Nigeria to develop, reviewed and restructure school curricula to be in line with the new National Policy on Education. In line with Government adoption of the 9-year Universal Basic Education (UBE) programme. The curriculum accommodates the fundamentals of both the National Economic Empowerment and Development Strategies (NEEDS) and the Millennium Development Goals (Rufai 2010).

Cultural and Creative arts can be defined as the synthesis of Dance Drama, Fine Art, Media Arts and Music which are made by man in creative way, within the culture and environment context, these are together combined to form arts in align with the cultural background of the child within an environment (N.T.I. 2000). Creative art is a compulsory subject in 9 year basic curriculum in Nigeria Junior Secondary Schools. The aim of Creative arts is to develop the knowledge and appreciation of child-own cultural heritage in relation to other culture and promotes intellectual of the child through knowledge and skill acquisition in Dance Drama, Fine Art, Media Art and Music. As an academic oriented subject, it inculcates in child the creative ability, level of appreciation of values and qualities of different work of arts. Creative arts helps to acquire vocational skill, knowledge in the construction, use and maintenance of tools, materials and equipments through drawings (Usman, Odewumi, Obotuke, Apolola, & Ogunyinka, 2014). It is also developing the child knowledge and appreciation of child cultural heritage in relation to other culture, promoting skill acquisition and imbibes in every child social interaction, fosters vocational skills and ability to maintain tools and equipments and finally promotes intellectual development of the child through knowledge and accusation of modern technologies (Ibrahim, 2009).

Information and Communication Technology is referred to as an effective media for communication that the teachers used for instruction purposes these includes the use of computer and electronic gadgets. It is the media borne out of communication revolution that helps the teacher in the classroom for learning (Gorjian, Moosavinia, Ebrahimi Kavari, Asgari, & Hydarei, 2011).Information and Communication Technology eliminates time barriers and geographical barriers in education both for learners and teacher (Mooij, 2007). Information and communication technologies are diverse set of technology tools and resources used to communicate, store and manage information. These technologies include computer, the internet, broadcasting technologies and telephone. ICTs are essential tools in any educational system. They have the potentials of being used to meet the learning needs of individuals, promote equality of educational opportunities, offer higher quality learning materials, increase self-reliance and independent learning among student and improve teachers' professional development (Abolade & Yusuf, 2005).

Computer Assisted Instruction Packages is the collaboration of the curriculum content of Creative arts in a refined and designed computer instructional devises to achieving a stated teaching goals. It has been found to be effective method for delivering instruction using different software (Yusuf & Afolabi, 2010). Moreso, Umaru (2003) submitted that Computer Assisted Instruction Packages serves as a tutor in teaching and learning process, as well as computer software.

Study on computer and creative arts, revealed that students used computer to play Music, Drama and Poetry for entertainment, it is also used to draw, design, and print wrappers of music, drama and poetry. Computer is used to take pictures, edit pictures, choose suitable colours, mix colours, separate colours, create charts and graphic works through such software s Adobe, Corel Draw and Super Paint (Russet, 2014). The internet has also become a global shop window letting students exhibits their works to a wide and disparate audience, enabling artist to create an online portfolio for the world to see and appreciate (Lou, Guo, Zhu, Shin, Dzan 2011).

Moreover, the relevance of computer technology to creative world is numerous especially in the production of digital arts, most of the digital devices add technological effects to their productions in repertoire. Artists use digital camera and its software to prepare initial studies of graphical world, explore the direction it might take and the production of the final piece (Reid, Zhang, & Chen, 2003). Digital device allows students to isolate or enlarge element of an image for closer study and replication. Students alter and emphasise texture, tone colour, shape with digital camera with the latest computer software such as Photoshop and photo paint, it also solarise an image by separating the light and dark. Students believe these digital techniques help them to see the different layers of an image and the hidden colours (Sung & Ou, 2002).

Ronen and Eliahu, (2000) submitted that Internet broadens students' artistic and philosophical horizons. He further expressed that the students make contact online with their peers and practicing artists whose work they admire, this foster friendship and promotes understanding of the subject. The students relates with each other by sharing ideas, discussing and sending arts works, images, pictures, postal, by correspondents through e-mailing. Tao and Gunstone (1999) explained that computers foster colour experimentation while software packages give students rapid result and countless new tools to try out colour formation and colour blending. Students used different colour combinations and variations on graphical prints.

Adekunle, (2002) opined that computer holds out the opportunity to revolutionist colour world, quality printing, colour separation and improvement in the management of graphics. He further stressed that computer capability to show motion, symbolic representation, picture and sound, which are useful to artists through the multimedia devices that combine sound and visual, go a long way in creating an entertainment avenue for creative artist while working on the system.

Solaarin, (2014) explained that computer are grouped among the functional graphical tools as well as a media of instructions. He further emphasized CDrom packages as a moving image useful for graphical illustration and audio track on a large monitor with speakers and CDs as a device for storing vital educational work and arts products for easy carrying and movement from one place to the other. He stressed software possibilities as display chart or three dimensional images on screen for artists to pick.

The Computer Assisted Instruction Packages become imperative in teaching and learning, having the benefit as very useful and successful mode of teaching and learning (Adegoke, 2011). It is a tutor, and a playing medium for learners (Hsu, 2007). Computer assisted instructional helps learning at any time (Lin, (2003). It creates avenue for learners to practice different educational assignment individually without any teacher (Lu, 2003). The following study have shown that computer assisted instructional packages are successfully in the following teaching subjects; in technical education, (Paul & Babaworo 2006), Physics, (Gambari & Mogbo, 2006), Geography (Egunjobi, 2002). Statistics, (Busturk, 2005), Metal analysis, (Liao, 2007), Biology (Yusuf & Afolabi, 2010), Mathematics, (Maitoned, Dupaul & Jitendra 2005), Musculus skeletal, (Ford, Mazzone & Taylor, 2005), English, (Kılıçkaya, 2007) and Physical Education, (Alhayek, 2004), while related study have shown positive and affirmative views on the results of CAIP and creative Music (Gao, 2007).

On gender and computer, it was observed that male dominated and its usage belonged to techies comprised mostly of men, studies revealed that there is no statistically significance validating gender differences in pattern of online interaction between male and female students (Huynh, Lee, & Schuldt, 2005). In another study on gender and computer use in an academic institution, the male and female students were supplied with laptop computers for the period of four years, it was discovered that women were less positive about computers uses than men despite the number of years of their exposure to computer (Mitra, Lenzmeier, Avon, Qu, Hazen, 2000).

Statement of problem

The pedagogy of creative arts in Nigeria school is nonetheless facing with several challenges, which include the dearth of both teachers and relevant textbooks to give clear and adequate direction to both the teacher and the students. A few numbers of books that exist on the subject usually address only one aspect of the subject particularly the visual art as against all the areas. Therefore Computer Assisted Instructional Package will fill the existing gap because, an attempt at having difficult topics in Dance, Drama, Fine Art, Media Arts and Music treated in a package for the students. Since, using computer in the classroom for instructional purposes has been found to be effective device for classroom instruction, promotes active learning and enrichment of collaborative learning (Tekos & Solomonidou, 2009).

Purpose of the study

The study sought to investigate the computer assisted instructional package impacts on Junior Secondary Creative Arts in Ogbomoso. Oyo State, Nigeria. Specifically, the study examined:

1. The difference in the performance of secondary school students taught creative arts using computer assisted instructional package and those taught using conventional method.
2. The difference in the performances of male and female students taught creative arts using computer assisted instructional package.

Research questions

The study sought to answer two research questions below:

1. What is the difference in the performance of secondary school students taught creative arts using computer assisted instructional package and those taught using conventional method?
2. What is the difference in the performances of male and female students taught creative arts using computer assisted instructional package?

Research Hypotheses

The following null hypotheses were tested in the study.

Ho_1 There is no significant difference in the performance of secondary school students taught creative arts using computer assisted instructional packages and those taught using conventional method

Ho_2 There is no significant difference in the performance of male and female students taught creative arts using computer assisted instructional packages and those taught using conventional method.

Research Design

This study was a quasi-experimental type of the pre-test, post-test, non- randomized, control group design. The design is a 2x2 factorial design.

Sample and sampling technique

The population for this study was made up of the entire Junior Secondary Class two (JSII) students in Ogbomoso. Nigeria. The sample subjects were drawn from two co-educational schools where Creative arts are taught. The sample from co-educational schools was selected by the use of stratified random sampling technique. This method was chosen so that the gender variable could be appropriately represented. One hundred

and twenty (120) students were randomly selected for the study from each of the two schools. In all there were sixty (60) males and sixty (60) females. The students were taught the same topics namely, types of drawings, element of drama, functions of dance, use of music, with both conventional method and computer assisted instructional package.

Research instrument

The main instrument used in generating data for this study was the Computer AssistedInstructional Package (CAIP)and the test instrument which is Creative Arts Test (CAT) which was made up of twenty (50) multiple choice objective items designed to measure specific learning outcomes related to the concept of the study. The treatment instrument, Computer Assisted Instructional Package (CAIP), was a self-instructional, interactive package that lasted for eight hours. It contained six lessons structured into modules. Research instrument employed the test instruments Creative Arts Test (CAT)was made up of 50 items multiple-choice objective test with five option each, selected from validated National Examination Council Creative Arts question papers. The Creative Arts Test (CAT) was used to measure the performance of students in the experimental and control group for pre-test (covariate) and post test. The Computer Assisted Instruction Packages was developed by a professional computer programmer, with the assistance of a Professor of Visual Arts. The development of Computer Assisted Instruction Packages followed a systematic approach of instructional development model put forward by Morrison, Ross, and Kemp Model. The MRK model consists of nine interrelated steps from identifying instruction design problems and specifying them to the evaluation instruments (Gustafson and Branch 2002). The Computer Assisted Instruction Packages was divided into six topics of six lessons, of forty minutes each on the content of the Junior Secondary Creative Arts curriculum. For the experimental group, the Computer Assisted Instruction Packages were used to disseminate the content of the lesson by the computer instructor, while the traditional group was taught accordingly. The total scores of each of the students at the pre-test and post-test were calculated. In testing the hypothesis Analysis of Covariance (ANCOVA) static was used.

Method of data collection

The data for testing the hypotheses were collected from the pre test and post test administered to the subjects used in the study. Each of the tests was marked and scored over 50. The experimental groups were exposed to creative arts lesson using Computer Assisted Instructional Package for the period of six weeks while the control group was taught the lesson with conventional method. The total number of lesson within Six weeks was twelve periods lasted for forty minutes per period. After the duration of six weeks of treatment for the experimental group and six weeks of conventional method with control group, post test was administered to both groups at the same duration. For the experiment group, multimedia projector was used to teach the lessons. The computer instructor handles the projector with the assistance of the creative arts teacher. The

second researcher taught the conventional group with the appropriate instructional materials. The scores obtained from two intact classes of 60 students experimental group and 60 students control group were computed and used in testing hypotheses. The (ANCOVA) Analysis of Covariance statistic was used to calculate the student pre-test and post-test scores of each student. The level of the significance adopted for the analysis was $P \leq 0.05$. This level of significance formed the basis for accepting or rejecting each of the hypotheses

Result

Hypothesis One *There is no significant difference between the mean achievement scores of creative arts students taught with the Computer Assisted Instruction Packages and those taught with conventional method.*

This hypothesis was tested using the ANCOVA statistic methods to compare the means scores of student in experimental group with the pre-test scores serving as covariates, the result is as reflected in table 1.

Table 1: Analysis of Covariance (ANCOVA) on the Post-test Performance Scores of Students in the Experimental and Control Group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	54.332	1	54.332	1.676	.201
Intercept	537.927	1	537.927	16.592	.000
Pre test	54.332	1	54.332	16.592	.000
Treat	1880.401	58	32.421		
Error	183.613	37	4.963		
Total	85114.000	60			
Corrected total	1934.733	59			

Table 1 indicates that the calculated F value of 1.676 is significant because the significant value of .201 is lesser than 0.05 alpha levels. The result implies that there is significant difference between post-test mean scores of students. That is, students score is significantly differ from both taught using Computer Assisted Instructional Packages and conventional method. Therefore, the null hypothesis is rejected.

Hypothesis Two: *There is no significant difference between the meanachievement scores of male and female creative artsstudents taught with the Computer AssistedInstruction Packages.*

This hypothesis was tested using the ANCOVA statistic methods to compare the means scores of student in experimental group (stratified into male and female) with the pre-test scores serving as covariates, the result is as reflected in table 2.

Table 2: Analysis of Covariance (ANCOVA) on the Post-test Scores of male and female in the Experimental and Control Group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.022	1	.022	.022	.001
Intercept	245.351	1	245.351	7.279	.009
Pre test	.022	1	.022	.001	.980
Treat	1954.961	1	33.706		
Error	84911.00	58	33.706		
Total	84911.000	60			
Corrected total	1954.983	59			

Table 2 indicates that the calculated F value of .022 is significant because the significant value of .980 is bigger than 0.05 alpha levels. The result implies that there is no significant difference between post-test mean scores of the both male and female students. That is, students score is not differ significantly from both taught using Computer Assisted Instructional Packages and conventional method. Therefore, the null hypothesis is accepted.

Discussion of findings

The present results of the analyses related to the hypothesis one indicated significant difference in the performances of students in experimental group (computer assisted instructional packages) and conventional method of teaching that those in experimental group performed better than those with conventional teaching. The present results of the analyses related to the hypothesis two indicated a no significant difference in the performances of male and female in the experimental group (computer assisted instructional packages) and conventional method of teaching. This finding agree with earlier findings of Egunjobi, (2002) in Geography, Udousoro, (2000) in Mathematics, and Okoro, and Etukudo, (2001) in Chemistry, of Fakomogbon, Adetayo. Oyebode, Enuwa (2014), on Mathematics and Anchor and Ukwuru, (2014) on chemical reaction and equilibrum conducted in Nigeria which confirmed that CAIP has been effective in enhancing students' performance in other subjects than the conventional classroom instruction.

This finding shows that gender influence on the performance of students in creative arts whether they were taught with CAIP. The findings agreed with the studies of Okoro and Etukudo (2001), Anulobi (2009) respectively. And also, disagree with Ash (2005), Basturk (2005) and Dantala (2006) who found no significant difference between male and female students taught physics and history using Computer Assisted Instructional Packages. The findings contradict Yusuf and Afolabi (2010), Anchor and Ukwuru, (2014) that gender has no influence in the academic performance of male and female students exposed to Computer Assisted Instructional Packages. Thus, this shows that

computer-assisted instruction packages enhanced the performance of both male and female students.

Findings indicated significant difference between the performances of students exposed to Computer Assisted Instructional Packages and those with conventional method. Thus, the students taught with innovative ideas especially technologies did not degenerate on outcome assessments and that if new technologies are integrated into teaching and learning, there is greater student involvement in learning, and greater engagement equals to higher achievement. The findings recorded better performance of students in Computer Assisted Instructional Packages.

Conclusions

Since Computer Assisted Instructional Packages like other new innovation technology in the field of teaching and learning enhanced, promotes and improved the academic performance of students in the schools. The government should be encouraged to develop relevant Computer Assisted Instructional Packages for usage within the Nigerian Schools System.

Recommendations

From the findings of the present study, the following recommendations are made: The curriculum planners should design and encourage the use of computer in teaching / learning and be made mandatory for teachers and students. Seminal and trainings should be given to teachers on the planning, designing, production and use of computer instructional packages and that school should be equipped with internet facilities, instructional packages for teaching and learning purposes.

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SCIENCE TEACHERS' DISPOSITION TO THE USE OF ELECTRONIC BOOKS AS RESOURCES FOR SCIENCE TEACHING IN ILORIN, NIGERIA

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Abstract

The dismal performance of Nigerian students in School Certificate science subjects has been attributed among other things to inadequate availability of textbooks and the high cost of available ones. The advent of the Internet comes with the presentation of soft copies of many science textbooks on the web, some of which could be accessed by teachers at minimal cost. This study was conducted to find out science teachers disposition to the use of electronic books in Ilorin, Kwara State, Nigeria. A researcher-designed questionnaire was administered directly to one hundred science teachers selected by stratified random sampling. Results indicated that 75% of the total responses of the teachers indicated positive disposition towards the use of e-books. While there was no significant difference in the disposition of experienced and less experienced science teachers to the use of electronic books, there was significant difference in the disposition of male and female science teachers to the use of electronic books, with males having a better disposition than females. It was recommended that proprietors of schools should provide good Internet and computer facilities in their schools to facilitate easy download of e-books since teachers were positively disposed to their use.

Keywords: Science, Science Teachers, Use, Electronic Books, Gender, Teaching Experience

Introduction

Textbooks are important tools in the teaching and learning processes. Apart from serving as the source of academic information for many categories of students, textbooks also serve as important reference materials for teachers. Teachers utilize textbooks for various purposes. They read textbooks to complement the knowledge they have acquired in school and do so constantly to keep them abreast of new developments in their area of specialization. Teachers use textbooks directly as instructional materials in the classroom or laboratory. They also use textbooks to prepare lesson plans and set assignments and tests. According to Yusuf (2000), textbooks used to be the most available instructional media and they form the most widely used medium of instruction in education, hence, the role of textbooks as an instructional medium for both teachers

and students cannot be overemphasized since they play supportive role to the teacher and equally serve as substitute to him or her at critical time of disseminating information and knowledge to the learner (Opobiyi, 2008).

The persistent poor academic performance of Nigerian students in School Certificate science subjects has been traced to so many factors which include teaching by unqualified teachers, inconsistency in government policy, inadequate number of teachers and support staff, inadequate provision of instructional materials, inadequate laboratory facilities, poor infrastructure in schools, poor students' attitude to study, and inadequate availability of textbooks (Carpenter, Bullock & Potter, 2006; Opobiyi, 2008). Figure 1 presents a summary of available data on the performance of candidates in science subjects in the May/June West African Senior School Certificate Examinations conducted by the West African Examinations Council (WAEC) between 2008 and 2014.

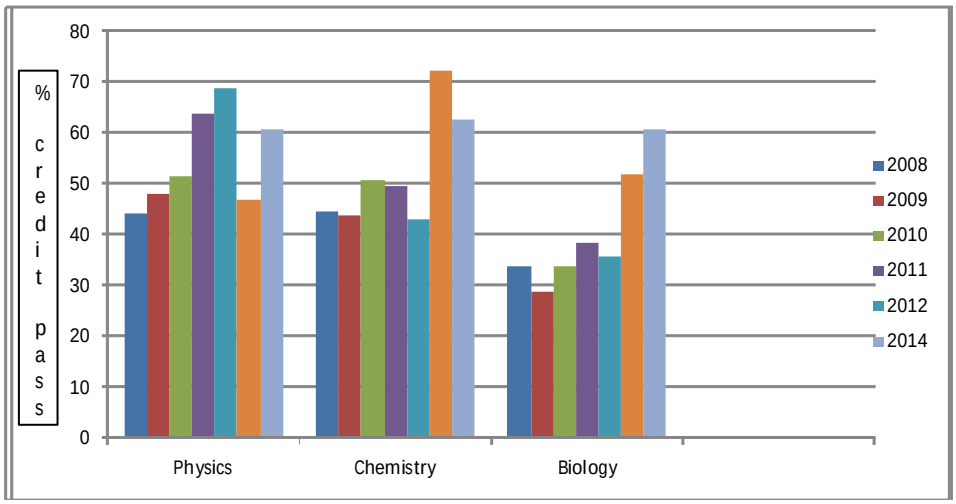

Figure 1: Performance of Nigerian students in the science subjects in the May/June School Certificate Examinations conducted by the West African Examinations Council between 2008 and 2014.

Source: Statistics Division, West African Examinations Council (WAEC), National Head Office, Yaba, Lagos, Nigeria.

Figure 1 indicates that for most of the time, the percentage credit pass was less than 50%. For any nation yearning to become technologically advanced, this is not the type of results it should be producing at this level. If this trend is not reversed, it would be difficult to attain the most desired technological advancement the nation yearns for. Since inadequate availability of textbooks has been indicated as one of the factors contributing to this type of result, it suffices to say that an improvement in teachers' access to and use of textbooks could go a long way in ameliorating the dismal performance of students in the science subjects. If teachers have better access to

textbooks, there is a better hope that they will utilize the books and this could impact positively on the performance of their students.

The Internet is undoubtedly one of the greatest achievements of man. For now, it remains one of the most valuable inventions that have positively impacted on every facet of the human sociology. With the advent of the Internet, information is now available at the finger tips of many all over the world. When Internet came, access to it was an issue and still remains an issue in many parts of the world. However, with each passing day, the issue of access gradually fades. The Internet has impacted tremendously in the education sector. One of the major areas in which the Internet has brought relief in the education sector is the making of textbooks available on the World Wide Web (www). Textbooks available in the soft form on the web are referred to as electronic books (e-books).

Today, many textbooks which are available in the hard form are also available in the soft form on the internet and could be easily accessed on the web. A major barrier to teachers' access to textbooks is the high cost of many science textbooks. Hence, with the continuous downward trend in the cost of Internet connectivity, especially through hand held electronic devices like cell phones, this barrier has been ameliorated. Today, with just a few clicks, science teachers can have access to many textbooks that could be of use to them. Many of these books can be downloaded on their computers and printed if desired. Teachers can keep many soft copies of textbooks in their laptops and refer to them from time to time. Indeed, this could enrich the library of the teachers.

It is one thing for e-books to be available to teachers, it is another thing for them to use the books. In Nigeria, many teachers still have constraints in accessing the web in terms of not having personal computers, and their schools not having Internet facility. However, they have cell phones and this could be used at least to download some information from the Internet, even if it is just a little portion of an e-book which can be of tremendous use. Another frequently discussed barrier to e-book use is the discomfort of reading from the screen. However according to Folb, Wessel, and Czechowski (2011), because academic users commonly use e-books for ready reference, screen reading may be less of a barrier to adoption than it initially appears. Users prefer to read short sections of books online but prefer print for reading an entire book (Shelburne, 2009; Nicholas, Rowlands, Clark, Huntington, Jamali, & Olle, 2008). A study conducted by Nicholas et al. (2008) in the United Kingdom reported that 62.6% of students and 57.8% of faculty read entirely on screen the last time they used an e-book; only 6.4% and 6.5%, respectively, printed materials to read.

In this particular study, the word 'disposition' is taken to mean the character attitude or feelings of the science teachers towards the use of electronic books. Experienced teachers were taken to be teachers with a minimum of five consecutive years of science teaching in a secondary school, while less experienced teachers were taken to be teachers with less than five years of teaching.

The issue of gender in the use of ICT in education is inconclusive. According to Dholakia, Dholakia, and Kshetri (2003), gender is one of the most important factors that could influence ICT adoption and use and this does not exclude the use of e-books. While some studies on the use of e-books indicated significant difference between male and female students on the use of e-books in favour of the males (Daramola, 2013; Liu and Huang, 2008), others have indicated differences in favour of females. For instance, Huang, Liang, and Chiu (2013) indicated that girls were more satisfied with reading an e-book than the boys but that the gender difference was not significant. However, their findings in respect of attitudes, reading behaviors and outcomes of reading e-books showed significant differences between males and females in favour of the females. This inconclusiveness results to the inclusion of gender as one of the variables in this study.

Ilorin is the Capital City of Kwara State in the North-Central geo-political zone of Nigeria. The city is dominated by the Yorubas and western education is highly valued in this community. Being the seat of the State Government, it is a cosmopolitan city with optimum social infrastructure typical of a developing state. The city has three Universities, one Polytechnic and two Colleges of Education. There are many secondary schools both public and private. The city enjoys the presence of all the major mobile communication networks in Nigeria and this places the digital connectivity of the city on the high side. Some of the secondary schools have computer rooms with limited number of computers. A few of the schools are connected to the Internet.

Purpose of the Study

The main purpose of this study was to investigate science teachers disposition to the use of e-books as a resource for teaching science in a developing environment. The specific objectives were to:

1. Determine the significant difference in the use of electronic books by less experienced and experienced science teachers.
2. Find out whether or not male and female teachers differ significantly in their use of electronic books.

Research Question

The following research question was answered in this study:

1. What is the disposition of science teachers to the use of electronic books?

Research Hypotheses

The following research hypotheses were put to test in this study:

1. There is no significant difference in the disposition of less experienced and experienced science teachers to the use of electronic books.
2. There is no significant difference in the disposition of male and female science teachers to the use of electronic books.

Research Methodology

The research is a descriptive one of the survey type. In a survey research, information are obtained from the respondents and are used to describe the population. This is a survey research because information was obtained from respondents to describe them with regards to their use of e-books.The target population for the study comprised of all secondary school science teachers in Ilorin metropolis. Stratified random sampling technique was used to select 120 science teachers from public and private secondary schools in all the three local government areas in the metropolis. The sampling was done to select equal number of teachers from public and private schools. Forty teachers were selected from each of the local government areas. More female science teachers were found on the field, hence seventy females and fifty males were sampled. In the end, one hundred respondents filled the questionnaire appropriately for data analysis. This comprised of 36 males and 64 females.

he research instrument used for this research study is a researcher-designed questionnaire prepared for science teachers. The questionnaire was eclectic, as its components were derived from a combination of numerous ideas and from faculty members in the Faculty of Education, University of Ilorin as well as ideas from related literature. The questionnaire consisted of two sections in line with the objectives of the study. Section A elicited biographical information of the respondents. Such information consists of the school of the respondents, teachers' gender, qualifications, years of teaching experience, and other vital information relevant to the study. Section B which requested for information on the use of e-books for teaching science consisted of twelve statements. The teachers were asked to respond on a four point Likert scale of Strongly Agree, Agree, Disagree and Strongly Disagree.

The instrument was given to two experts in educational research in the Department of Science Education, University of Ilorin for content validity after which it was revised to accommodate the useful suggestions offered by them. The reliability of the instrument was determined by administering it to twenty science teachers outside the area covered by this study. Using Pearson Product Moment Correlation Coefficient, a reliability index of 0.71 was obtained for the instrument.

Data was collected through direct administration. The researchers made personal visits to all selected schools in Ilorin metropolis to administer the questionnaire. Copies of the questionnaire were retrieved immediately after they have been filled. One hundred and twenty copies of the questionnaire were administered and since the researchers waited to retrieve the questionnaire, all of them were retrieved. However, on inspection, twenty of the retrieved copies were not properly filled and could not be used for data analysis. Hence one hundred copies of the filled questionnaire were captured in the data analysis. Frequency count and Chi-square statistics were employed in analyzing the data collected to answer the research questions and test the hypotheses.

Data Analysis and Results

Research question 1: What is the disposition of science teachers to the use of electronic books?

Table 2: Data on science teachers' disposition to the use of electronic books as a resource for teaching science in Ilorin

S/N	USE	SA	A	D	SD
1.	Electronic books could be used in teaching secondary school science.	20	37	1	1
2.	Knowledge of e-books does assist me in teaching my students.	19	36	1	3
3.	Electronic books can help teachers in updating their knowledge.	32	26	0	1
4.	The use of e-books in education could make teachers more efficient.	23	12	15	19
5.	Teachers' gender could influence their use of e-books for teaching in secondary schools.	7	13	12	27
6.	The use of e-books in education could make the teaching process faster	29	17	9	4
7.	Technological facilities could enable teachers interact with their colleagues in other parts of the world.	26	29	0	4
8.	Using e-books for teaching could ignite students interest	21	33	1	4
9.	I use e-books as a source of materials for teaching	17	25	14	3
10.	I use e-book for other purposes other than for teaching.	13	29	8	4
11.	I use e-books for preparing my lesson notes	10	23	15	11
12.	I refer my students to e-books as references.	14	23	12	10
	Total	**231**	**303**	**88**	**91**

The statements in the questionnaire border on the attitude of the teachers towards the use of e-books, and their actual use of e-books as instructional materials. All the statements are positive, hence, a positive response (agree or strongly agree) indicates a

positive disposition towards the use of e-books. From table 2, the total responses for strongly agree is 231, while that for agree is 303. Hence, the total number of positive response (i.e. agree and strongly disagree) is 534 which translates into 75% of the total response, and the total number of negative response (i.e. disagree and strongly disagree) is 179 which translates into 25% of the total response. Hence, a large majority of the science teachers are positively disposed to the use of electronic books as a resource for science teaching.

Hypothesis 1: **There is no significant difference in the disposition of less experienced and experienced science teachers to the use of electronic books.**
The data presented on table 2 is used to test hypothesis 1.

Table 2: Item by item Chi-Square analysis of the use of electronic books by experienced and less experienced teachers at 0.05 alpha level

S/N	Use	Calculated Chi-Square	Calculated P-Value	Decision
1.	Electronic books could be used in teaching secondary school science.	1.729	0.631	H_0 not rejected
2.	Knowledge of e-books does assist me in teaching my students.	0.898	0.826	H_0 not rejected
3.	Electronic books can help teachers in updating their knowledge.	1.230	0.541	H_0 not rejected
4.	The use of e-books in education could make teachers more efficient.	9.540	0.023	H_0 rejected
5.	Teachers' gender could influence their use of e-books for teaching in secondary schools.	2.731	0.435	H_0 not rejected
6.	The use of e-books in education could make the teaching process faster	6.488	0.090	H_0 not rejected
7.	Technological facilities could enable teachers interact with their colleagues in other parts of the world.	43.650	0.000	H_0 rejected
8.	Using e-books for teaching could ignite students interest	4.802	0.187	H_0 not rejected
9.	I use e-books as a source of materials for teaching	6.416	0.093	H_0 not rejected
10.	I use e-book for other purposes	5.990	0.112	H_0 not rejected

	other than for teaching.			
11.	I use e-books for preparing my lesson notes	2.966	0.397	H_0 not rejected
12.	I refer my students to e-books as references.	7.509	0.057	H_0 not rejected

From the analysis presented on table 2, the hypothesis is not rejected for ten out of the twelve items because the calculate p-value for each of them is greater than the alpha level of 0.05 at which the hypotheses are put to test. For the remaining two items, the hypothesis is rejected because the calculated p-value for each of them is less than the alpha level of 0.05. Hence, hypothesis 1 which states that there is no significant difference in the disposition of less experienced and experienced science teachers to the use of electronic books is hereby not rejected meaning that there is no significant difference in the disposition of less experienced and experienced science teachers to the use of electronic books.

Hypothesis 2: **There is no significant difference in the disposition of male and female science teachers to the use of electronic books.**

Table 3: Item by item Chi-Square and composite analysis of the disposition of male and female science teachers to the use of electronic books at 0.05 alpha level

Item	Gender	Frequency for Strongly Agree	Frequency for Agree	Frequency for Disagree	Frequency for Strongly Disagree	calculated	P – value	Remark
1.	Male Female	17(11.2) 14(19.8)	17(22.7) 46(40.3)	0(1.1) 3(1.9)	2(1.1) 1(1.9)	9.910	0.019	H_0 rejected
2.	Male Female	15(12.2) 19(21.8)	20(22.0) 41(39.0)	0(4) 1(0.6)	1(1.4) 3(2.6)	2.018	0.569	H_0 not rejected
3.	Male Female	25(19.1) 28(33.9)	9(15.5) 34(27.5)	0(0) 0(0)	2(1.4) 2(2.6)	7.449	0.024	H_0 rejected
4.	Male Female	15(7.6) 6(13.4)	10(14.4) 30(25.6)	5(6.1) 12(10.9)	6(7.9) 16(14.1)	14.589	0.002	H_0 rejected
5.	Male Female	6(4.3) 6(7.7)	8(8.6) 16(15.4)	10(8.6) 14(15.4)	12(14.4) 28(25.6)	2.054	0.561	H_0 not rejected
6.	Male Female	18(8.3) 5(14.7)	6(5.4) 9(9.6)	9(12.6) 26(22.4)	3(9.7) 24(17.3)	26.799	0.000	H_0 rejected
7.	Male Female	20(17.6) 29(31.4)	13(15.8) 31(28.2)	1(0.7) 1(1.3)	2(1.8) 3(3.2)	1.494	0.684	H_0 not rejected
8.	Male Female	16(14.4) 24(25.8)	16(14.4) 34(33.9)	0(0.7) 2(1.3)	1(1.8) 4(3.2)	1.959	0.581	H_0 not rejected

9.	Male Female	14(10.8) 16(19.2)	12(10.4) 17(18.6)	7(10.8) 23(19.2)	3(4.0) 8(7.0)	4.298	0.231	H_0 not rejected
10.	Male Female	12(7.2) 8(12.8)	17(17.3) 31(30.7)	5(9.7) 22(17.3)	2(1.8) 3(3.2)	8.623	0.035	H_0 rejected
11.	Male Female	5(4.0) 6(7.0)	17(14.4) 23(25.6)	8(11.9) 25(21.1)	6(5.8) 10(10.2)	3.156	0.368	H_0 not rejected
12.	Male Female	16(8.3) 7(14.7)	13(14.4) 27(25.6)	4(9.4) 22.(16.6)	3(4.0) 8(7.0)	16.619	0.001	H_0 rejected
Total	Male Female	179(125) 168(222)	161(180) 339(320)	49(75.9) 151(128)	43(55.1) 110(97.9)	55.335	0.000	H_0 rejected

From table 3, the hypothesis is rejected for six of the items out of twelve because the calculate p-value for each of them is less than the alpha level of 0.05 at which the hypotheses are put to test. For the remaining six items, the hypothesis is not rejected because the calculated p-value for each of them is greater than the alpha level. Hence, a decision could not be reached on hypothesis 2 based on the number of items for which the hypothesis is rejected or not rejected as done for hypothesis 1. Therefore, the Chi-square of the entire data obtained for males and females was run and this gave a value of 55.335 and a p-value of 0.000 which is less than the alpha level of 0.05. Decision on hypothesis 2 was taken based on this and hypothesis 2 is therefore rejected. This means that significant difference existed in the disposition of male and female science teachers to the use of electronic books. The direction of the significant difference was determined from the analysis of responses of males and females as presented on table 4.

Table 4: Analysis of the frequencies of the responses of males and females

	SA	**%SA**	**A**	**%A**	**D**	**%D**	**SD**	**%SD**	**Total frequency of response**
Male	179	41.4	161	37.3	49	11.3	43	10	432
Female	168	22	339	44	151	20	110	14	768

SA= Strongly agree, A= Agree, D= Disagree, and SD= Strongly disagree

Thirty six (36) male teachers and sixty four (64) female teachers participated in this study, as more female science teachers were found on the field. Hence, the total frequency of the responses for each SA, A, D, and SD were analysed on the basis of percentage independently for each of the groups (male and female) before any comparison across the two groups. Table 4 reveals that there were more positive responses among the males i.e. 41.4% (strongly agree) and 37.3% (Agree) than among the females i.e.22% (strongly agree) and 44% (agree). Total frequency of positive

response among males was therefore 78.7% as against 66% among the females. Hence the significant difference between the disposition of males and females is in favour of males since the males had a higher percentage of positive responses among themselves than females.

Discussion

The finding in this study that the science teachers were positively disposed to using e-books as instructional materials is a welcome development. This is expected to expand the knowledge of the teachers in their various fields. This result also gives some idea of the level of access of the science teachers to the Internet, for access to the Internet could be a motivation for developing positive disposition to e-books. It also means the teachers were aware of e-books. A related study conducted by Abdullah and Gibb (2008) sought to find out the use and usability of e-books by students of the University of Strathclyde. The survey revealed that e-book awareness and use amongst students was lower than anticipated as 57 percent of students indicated that they were not aware of the availability of e-books from the library while 60 per cent of them had not used an e-book before. Further result obtained by Abdullah and Gibb (2008) is similar to that obtained in this study, as it was found out that in spite of the low levels of e-book awareness and use, the non-e-book users in their study indicated their desire to learn more about e-books i.e. they were positively disposed to the use of e-books. However, a study conducted by Rowlands, Nicholas, Jamali, and Huntington (2007) to assess academic users' awareness, perceptions and existing levels of use of e-books indicated a different result as the survey findings indicated the need to encourage users' acceptance of e-books.

A study was conducted by Folb et al. (2011) to assess use, and factors affecting use of e-books by all patron groups of an academic health sciences library serving the University of Pittsburg and health system–affiliated patrons. They found out that Library e-books were used by 55.4% of respondents. Use of e-books on the basis of role varied as 21.3% of faculty reported having assigned all or part of an e-book for class readings, while 86% of interns, residents, and fellows reported using an e-book to support clinical care.

The present study also found out that no significant difference existed in the disposition of less experienced and experienced science teachers to the use of electronic books. This is the case in ten out of the twelve items in the instrument as shown on table 2. By implication, the number of years of teaching experience of the teachers had no influence on their disposition to the use of electronic books and since it is evident in table 1 that 75% of the total response of the teachers were positive towards the use of electronic books, it suffices to say that the teachers irrespective of their number of years of teaching experience were positively disposed to the use of electronic books.

The finding that males had a better disposition to the use of electronic books than females is similar to the submission of previous research findings indicating that males dominate in the use of ICT. Many studies have found gender disparity in ICT

achievement in favour of males (Ajunwa, 2000; Awodeji, 1997; Geissler & Horridge, 1993; etc). According to Becker and Sterling (1987), even when males and females were given equal access, men were more likely to be the main ICT users than women. Bolarin (1987) was of the opinion that higher achievement by males may be due to more opportunities given to them in life compared to those given to females. Tenson (1999) also cited lack of ICT experience for female users as an important factor in determining their attitude and anxieties towards ICT. However, some other studies have found no disparity in the attitude, use and achievement in ICT between males and females (Anaekwe, 1997; Ibe, 2004; Madu, 2004; and Nwosu, 1991). Hence, gender differences in ICT literacy are quite inconclusive.

Conclusion

The conclusion from this study is that the science teachers in Ilorin were positively disposed to using e-books as instructional materials. Hence, if the teachers have the necessary facilities for accessing electronic books on the Internet, they will make use of them as reference materials, and this could ameliorate the problem of inadequate textbooks as being currently experienced in some schools. Since no significant difference was found in the disposition of experienced and less experienced science teachers to the use of electronic books, it can be concluded that the teachers' years of experience had no influence on their disposition to the use of electronic books. Conversely, there was gender disparity in the disposition of male and female science teachers to the use of electronic books as males showed a better disposition.

Recommendations

Based on the findings of this study, the following recommendations are hereby put forward:

Proprietors of schools should tap into the positive disposition of science teachers towards the use of electronic books by putting in place all necessary facilities that will enable teachers' access to the Internet so that they can have unhindered access to electronic books and use them to improve their productivity.

Since the teachers are positively disposed towards electronic books, they should be encouraged by their employers to own their own laptops as this will enhance their access to and use of electronic books. The results reveal that the teachers were positively disposed to electronic books. In the light of this, it is recommended that they should endeavour to acquire the basic competence in computer operation that will enable them source for, and download electronic books from the Internet as this will enhance their capability in accessing these books.

Special effort should be made by government and school proprietors at getting female teachers to be more interested in the use of ICT in education generally. This could be achieved by enabling some women to take the lead in in-house training on ICTs

organized by schools. School authorities should stock the libraries with electronic books in CD-ROMS for teachers to access as well.

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A SURVEY OF CLOUD COMPUTING AWARENESS, SECURITY IMPLICATION AND ADOPTION IN NIGERIA IT BASED ENTERPRISES

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Abstract

The advancement in information technology (IT) infrastructures and the overwhelming pervasive Internet accessibility has tremendously change the way computing is done in IT based enterprises. The recent hype of Cloud Computing that utilizes the existing Internet infrastructure to provide pay-as-you-go services to diverse community of businesses has emerged to alleviate and reduce the cost of computing tremendously. This paper examined the awareness of the Nigerian business enterprisesand their readiness in adopting cloud computing. It was found that the trend of awareness and adoption were very minimal with many being sceptical although few businesses were aware of the cloud technology. The survey also revealed that the stakeholders were precarious of the security-level of the cloud-based computing.

Keywords: Cloud-Based Computing, Security Implications, Cloud Awareness, Cloud Adoption, Enterprises, Technology.

Introduction

Modern day businesses enterprises are more dependent on information technology infrastructure to conduct their businesses at a more convenient and consistent manner than before. They are able to gain new ground and provide new goods and services at a faster rate than before with culminating effect of more customer base and huge profit. All the benefits derivable form IT based services are not without hitch due to cost implications of acquisition, set-up and day-to-day running of the IT facility. A huge investment is also required in software acquisition and maintenance owing to licensing fees or hiring of in-house developers. In addition to these cost, companies in Nigeria face an enormous challenge of inadequate power supply from the public power source and had to depend mostly on internally generated power sources either by running electricity power generating sets that consume fuel round the clock to avoid interrupted service or total service failure.

The recent development and paradigm shift in IT infrastructure provisioning where users access services based on their requirements without regard to where the services are hosted is referred to as utility computing or more recently as cloud computing (Buyya et.al. 2009). The basic idea behind this technology is that the hardware and software infrastructures are provided as a service made available on subscription bases via pay-as-you- go model to companies who subscribed to it. Companies deployed their

application on the remote infrastructure without concern on how the underlying infrastructures will be sourced or provisioned in case of expansion. Cloud provider in turn operates by providing infrastructure; platform and software application supported by state of the art data centres.

When IT needs of companies are no more of a concern to them, it afford them the opportunity to concentrate on their area of expertise and reduce their investments on IT infrastructures and manpower considerably, thereby gaining adequate and huge returns on their investments and improve on their corporate culture and improved service delivery and expertise. How much are the business enterprises in Nigeria aware of this promising technology and how prepared are they in adopting it? These are the major research questions that we addressed in this paper. It is worth noting that average Companies in Nigeria spend substantial amount of money on fuel to power their electricity generating set in other to keep their IT infrastructure running and a huge amount keeping IT personnel and other nontechnical staff in charge of IT. By moving to cloud computing they tend to reduce this cost considerably.

The rest of the paper is structured as follow; section 2 discusses the related works to the research. In section 3, we provided an expanded review of cloud computing itself identifying the deployment and service models and the state of cloud computing in Nigeria. Section 4 presented survey methodology and the key findings and discussions were followed in section 5 where we also look at the security implication of the cloud services. The challenges facing Cloud Technology were highlighted in section 6. Recommendations to improve discussed technology enterprise were discussed in section 7 while the conclusion of the research work is given section 8.

Related works

Several works have been conducted to look into the challenges and prospects of cloud computing to enterprises business computing. In (Asad, 2009) the challenges facing adoption of cloud computing were identified to include traditional challenges, security challenges and technical challenges. He also highlighted that reduced cost in IT infrastructure investments as the most important benefit of cloud computing. In (Erdogmus, 2009) other benefits of cloud computing were identified to include “scalability, reliability, security, ease of deployment, and ease of management for customers, traded off against worries of trust, privacy, availability, performance, ownership, and supplier persistence”.

In addition, Motahari-Nezhad et.al (2009) briefly discussed the benefits and risks of using cloud computing from a business perspective. They highlighted the lack of environments for helping businesses migrate their legacy applications to the cloud. In addition, they pointed out the difficulties of finding and integrating different cloud services for a given set of business requirements. They also proposed a conceptual architecture for a virtual business environment where individuals and SMEs can start and operate a virtual business using cloud-based services.

Other works have also survey the of some market research firms have also published the business potential of cloud computing, IDC a market research and analysis firm reported that the worldwide spending on Cloud services to be $16 million in 2008 and projected an increase to $42 billion by 2012. All these points to the importance that research community are directed toward the benefits of cloud computing. This study is unique in this direction as itexamines how companies and organizations in Nigeria are able to identify the benefits this potential technology portends as a catalyst to business development and their preparedness to adopt this technology.

Cloud Computing

There are many definitions of cloud computing in the research community. However most of these definitions fell short of full description of Cloud Computing paradigm and are usually given from the perspectives of individual technology provider in their whitepapers. A more encompassing working definition was given in a document by the United State National Institute of Standards and Technology (NIST) which encompass the consensus areas of cloud computing attributes (Mell and Gance, 2009). NIST definition of cloud is given as follows:

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell and Gance , 2009).. This definition highlights the basic features of cloud computing and it's widely acceptability in most US government documents. The definition also highlights five basic characteristics of cloud computing to include the following essential attributes:

i. On-demand self-service: Computing resources such as server, network storage etc can be provisioned to consumer without any interaction with the service provider.
ii. Broad Network Access: cloud service is heterogeneously available over the network to wide diverse user platforms such PDAs, cell phones, laptops etc.
iii. Resource Pooling: the resources (storage, network bandwidth, etc) provisioned to the user are heterogeneously, transparently and dynamically pooled by the providers to the consumers irrespective of their location.
iv. Rapid elasticity: the provided resource can be dynamically scaled-up or scaled-down according to consumer needs.
v. Measured Service: all the service rendered is utility based and are appropriately and transparently measured to bill the consumer based on the consumption rate.

Cloud Service and Deployment Models

Different providers such Amazon EC2, Microsoft Azure, Google App Engine to mention but a few provides diverse cloud service models. The cloud computing service models currently in vogue include the following.

Cloud Software as a Service (SaaS)

This service model has the capability to provide provider's applications running on a cloud infrastructure to the consumer through various client devices in a thin client interface such as a web browser (e.g., web-based email). The underlying cloud infrastructures including network, servers, operating systems, storage, or even individual application capabilities are under the full control of the service provider. Only the user specific configuration settings may be required.

Cloud Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.

Cloud Infrastructure as a Service (IaaS)

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems; storage, deployed applications, and possibly limited control of select networking components (for instance, host firewalls).

Cloud Deployment Models:

Private cloud:

The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

Community cloud:

The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (for instance, mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise.

Public cloud:

The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

Hybrid cloud:

The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds).

Cloud Computing in Nigeria

Nigeria as one of the developing nations is growing faster in information technology from analogue to digital and from standalone to distributed computing. However, the awareness of cloud computing potentiality is still very low in the country. Cloud computing services and its applications has a huge amount of benefit and opportunity in Nigeria considering the large number of growing communication and networking companies operating in the country. Additionally, consider the large number of growing Small and Medium Scale Enterprises in Nigeria, there is need for the awareness and application of cloud computing in their businesses in order to assist them economically, in term of flexibility, effectiveness, Consistency in service delivery, energy efficiency and security consciousness.

Cloud Security Implications

There are several security challenges arise from the emergence of cloud computing technology, which require urgent and critical attention in order to facilitate the effectiveness of the technology and remove fear of its adoption. The security component could be added to the security layer and be delivered as Security as a Service (Sloan, 2009). He explored and solved the cloud computing technologies and discusses about the challenges posed in security of technology.

Stringent access controls and data backup schedule (Kaufman, 2009) including tested encryption schema must be included in the package of cloud computing provider, in order to ensure maximum Confidentiality, Integrity and Availability. Various cloud technology available in the market today are not using the same clouds for their operation, which according to Kim (2009) could eventually result to a situation whereby cloud integration services will require different approach of security implication. In another perspective, presently, the cloud computing technology has no any single regulatory body charge with the duty of regulating the standard of cloud computing security. There is need for the provision of security requirement parallel to the requirement of business activities.

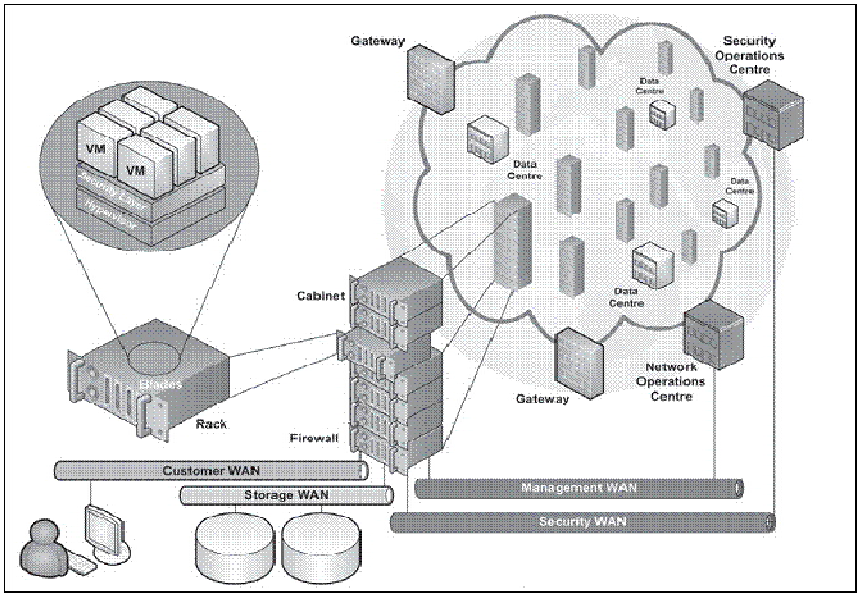

Figure 3.4.1.: Cloud Computing Security Architecture.
Source: (Sloan, K. 2009)

Security Components in Cloud Computing

Authentication and Identification mechanisms are varies for different services in cloud computing. The most commonly adopted security mechanisms in cloud computing are What User know (i.e password, token), What User have (i.e Smartcard), and Who User is (i.e biometric test). The combination of these mechanisms is highly secured than any other type except for its cumbersomeness. For example Google and Yahoo employ Request Token mechanism for authentication while Amazon AWS employs a custom mechanism which mirrors the identification and authentication.

Secure Socket Layer (SSL) technology is a secure web based technology to enhance the security of communication between the cloud services and consumer activities in order to prevent all form of foresee Security Threat. All various forms of cloud computing attacks including XSS, CSRF flaw in indexing design of Zoho have been successful on cloud and makes it highly vulnerable to attacks (Mansfield-Devine, 2008). Viega, (2009) propounded that there should always be a verification mechanism in Security as a Service model (SaaS) to verify client requests before execution in order to prevent an intruders who may also have access to code binaries.

In order to guarantee the privacy of information hosted on the server in cloud technology, Data Encryption and Validation is another security component where information in cloud is encrypted, and can only be decrypted at the client level with a key. However, it is recommended that data be quickly decrypted at the client level as it might need high processing power. It is also highly recommended that the cloud services be runs using https which is a Socket Secure Layer.

The client of cloud technology should maintain their own data backups in order to provide a continuous access to their data even at the extreme situations such as data providers going bankruptcy or disaster at data center etc. (Viega, 2009). Combination of security mechanisms should also be used to provide a granular security in a cloud environment. Intrusion Detection is another security panacea for vulnerability detection in cloud as proposed by Vieira et al. (2009)

Antivirus is another type security mechanisms on the cloud to reduce the threat of malware. It is however recommended that the antivirus be updated regularly in order to be up-to-date with the database of the provider. In order to detect various forms of intrusion within the cloud and prevent them from entering the cloud, Firewalls could be implemented as software or at the hardware level at each gateway.

The security components in cloud environment is incomplete without relating the Legal Issues as applicable to the sourcing arrangements of Data Protection Act 1998 (DPA), confidentiality and Integrity. The intricacies over confidentiality and integrity as well as database (server) maintainer or owner should be resolved in order to enhance the security of the cloud. A specific contract should also be made between the service providers in order to prevent data search and seizure by as proposed by the UK government as published in the news article Computer Fraud & Security (August, 2009).

Methodology

The Survey Design

A questionnaire was prepared for some staff of Small and Medium Businesses (SMBs) and Small and Medium Enterprises Development Agency (SMEDAN) of Nigeria, to find out the adoption, security implication and eventual usage of cloud computing in their various sectors. The next is finding out whether the claims of the stakeholder on the existence and exploration of cloud computing are genuine. Personal interview was also used in order to gather the response of some staff of Small and Medium Businesses in Nigeria. Finally, the collation of the available data for presentation and analysis is done. Some of the existence Small and Medium Businesses consulted for the research are in Communication Sector like MTN Nigeria, Globalcom Nigeria, Multilink Nigeria, Starcom Nigeria, Education, industry and Banking sector of the economy.

Interviews and Questionnaire

The interview was conducted for the staff of some selected economy sectors to find the cloud computing existence, cost implication and its security challenges within their organization. The aim is to evaluate the proliferation of cloud computing and examine its cost and security implication on the Small and Medium Businesses in the country, which is one of the determinant of country economy's growth index. Ten (10) staff each

were interview in five sectors of the economy i.e Communication, Education, Industry and Banking. Online questionnaire were also set and dispatched for the general response. The result of the interview was tabulated and analyzed below:

Table 1: Presentation of the Questionnaire

	Staff					
Economy Sectors	**Cloud Adoption (10)**		**Cost Implication (10)**		**Security Challenges**	
	Yes	**No**	**Higher**	**Normal**	**Highly Secured**	**Susceptible to Threats**
Communication	6	4	2	4	2	4
Education	1	9	1	0	0	1
Agriculture	0	10	0	0	0	0
Industry	2	8	1	1	1	1
Banking	3	7	1	2	1	2
Total	**12**	**38**	**5**	**7**	**4**	**8**

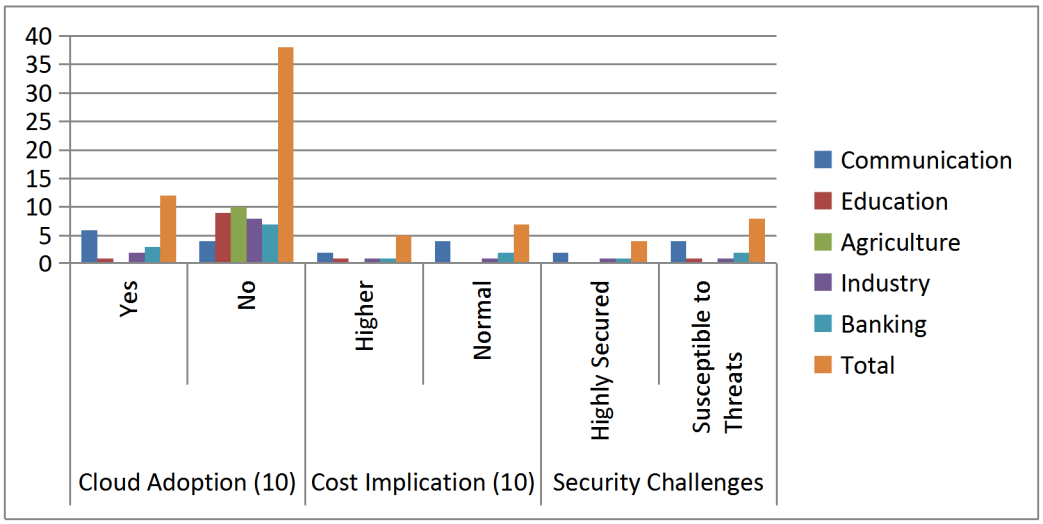

Fig. 4.1: Bar chart of the result of questionnaire in various sector of economic

Analysis and Discussion of the Results

From the table 4.1 above, it was observed that out of 50 interviewed staff, only 12 staff attested to the adoption of cloud computing in their organization while the remaining 38 staff confirmed the non-availability of cloud computing infrastructures. It was also observed that the cost implication of cloud computing as attest by 7 staff out of 12 staff

is normal, considering various factors and cost benefits of the technology, which outweigh its cost implications. The table finally shows that 8 staff out of 12 staff that attested to the adoption of cloud computing in their organization declined the low level of security of the technology, while only 4 agree that the security level of the technology is alright. The deduction from the table was that the awareness of the cloud computing technology is still very low in Nigeria and those that are aware are afraid of cost implication in order to subscribe. Also, because of the network oriented nature of the cloud computing technology, there are lot of security issues that still has to be patched in order to avoid various vulnerabilities posed by the network.

Challenges of Cloud Computing

The under listed are some of the identified challenges associated with the Cloud Technology and its deployment.

i. Free service from Provider
ii. Malware Infection (Zero day vulnerability allows USB malware to run automatically)
iii. Network Intrusions
iv. Online fraud
v. Unauthorized information revealed like patient records
vi. Denial of service attack

Recommendations

The following are the recommendations based on the finding and analysis of the research work:

1. The Cloud Service Providers should enhance efforts in order to create awareness on the benefits of cloud computing most especially in the developing nation.
2. The cloud service providers should make an appropriate consideration for the small scale business to encourage their participation.
3. The cloud computing security should be enhanced to facilitate participation.

Conclusion

It is worthwhile to note that the cloud computing activities and subscriptions in the developing nation like Nigeria is still very low. The researchers discovered that the level of awareness among the stakeholders and enterprises is low due to several factors. Those already engaged in the system is being afraid of the security implication, and those intend to engage is being scare of cost implication due to the nature of economy of the country. The cloud computing service providers like Google, Amazon among other need to double their efforts in creating awareness on the benefits of the system to encourage those that need the system. Furthermore, the deployment of the system should be considerate so as not to scare away the interested enterprises.

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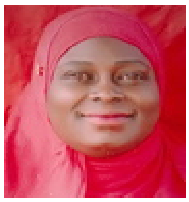

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DESIGN OF A WEB BASED MATHEMATICAL APPLICATION FOR HIGH SCHOOL

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Abstract

Mathematics is a subject in high school that students have found so tasking and challenging. There is an increase in failure in mathematics as recorded for students who sat for WAEC and JAMB in Nigeria in the last two years. This study therefore designed a mathematics web based application using the Javaserver Faces (JSF) technology framework, Glassfish server and Prime Faces technology to help students improve and develop their abilities in assignments solution, summations, and mathematics projects and increase their reasoning. The results shows that the application designed makes students to grab the understanding of mathematics concepts better help the students solve problems faster and easier and also increase their performance in mathematics.

Keywords: Design, Web Based Application, High School.

Introduction

The universe cannot be read until we have learnt the language and become familiar with the characteristics in which it is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means, it is humanly impossible to comprehend a single word without mathematics Galileo Galilee (1564-1642)

Mathematics provides a language for quantifying, measuring, comparing, and reasoning, identifying patterns and communicating precisely. It is a language children can bring into the world they create (Kleiman, 1991, p51). Mathematics is a subject in high school that students have found so tasking and challenging. In the last two years, SSCE records show that the number of students that failed mathematics in WAEC and JAMB is approximately 51% of the entire population of student that sat for the examination. The failure could be due to one or many factors (Salman, Mohammed, Ogunlade, Ayinlaa, 2012) : Lack of frequent practice by students, Poor mathematical background, Laziness on the part of students and teachers, More Unqualified teachers or few number of professional math's teachers. Majority of after school educational programs or school lessons are funded by private organizations primarily to check the increasing number of mathematics failure in Nigeria. Many more of these programs (online and offline) are designed to support the academic growth of students in several levels especially in secondary schools. Several techniques have been employed to help students improve in mathematics (Paul, 2014). The following are some of the works reviewed to determine

the strength, weaknesses, and methodologies in other to identify some of the problems. Rhonda and Elaine (2009) proposed the Computer Assisted Instruction (CAI) in solving the problem of massive failure in mathematics. According to Rhonda and Elaine, Student simply access some form of math tutorial/ practice software in a computer laboratory setting or online and work independently to build their computational skill level while addressing their mathematical deficits. Most of the available CAI is designed to identify skill deficiency and use artificial intelligence systems to help students master increasingly challenging material through continuous personal assessment. Many of the CAI is a commercial product. Some examples by them include My Math Lab, Math Zone, ALEKS, Plato, and Cognitive nationwide. An advantage is that many of these CIA in computers can be networked in a school laboratory and students can be tasked with the challenge of healthy mathematics competition remotely. CIA can only be used to supplement and not to substitute instructor-led classroom teaching. Laura, Peter, Giasemi, Mike (2006, p.3) proposed resolving the issue of mass failure by using a mobile (portable and personal) application taking the advantage of the whole world going mobile. These mobile applications can provide several electronic copy of mathematics course material to students, including due dates for assignments and information about timetable, and specific mathematics topics. Example is the mobile learning organizer which has been developed and tested at the University of Birmingham (Holme and Sharples 2002).

Also, Collaborative learning, the nature of learning through engagement with other peers, mentors, or faculty enhanced student learning in a number of ways. Student-to-student collaboration allowed students to compare and contrast experiences with their peers, allowing students to discover ways to overcome obstacles (Keegan, 2007) or to issues in their day-to-day practice (Kelley et al., 2008). Using asynchronous discussion boards, provided students time to consider their views and try them out with colleagues (Mayer, 2000). Chris, April, Heather, Danett (2007) suggests the use of online mathematics after school Training Toolkit. The Toolkit, designed to provide after school the resources students need to resolve their mathematical problems with fun, innovation and academically enriching activities that not only engage students, but extend their knowledge and increase academic achievement. The Toolkit provides afterschool practitioners with a wealth of guidance for integrating literacy, mathematics, science, the arts, homework help, and technology into their programs. Each section of the Toolkit is organized around a set of content-area practices, or effective approaches to teaching and learning in the afterschool environment. The intended audience of the toolkit includes afterschool math project, assignments and practice. However, afterschool instructors and other staff find the information contained within these materials to be useful. Seven afterschool mathematics practices have been identified to date: Finding Math, Math Center, Math Games, Math Tools, Math Tutoring, Family Connections and Math Projects. Also. all the reviewed literature above failed to identify some key points which include:Most of their work failed to address the fact that poor students may not be able to afford buying a personal computer, students in remote areas may not have consistent internet access and so may not have entry to the online applications, some of these applications are very expensive; buying a newer version of

the application becomes a challenging especially in terms of cost, access to some of these mathematical programs especially those on computers is quite challenging since they are not engineered locally, previous works have failed to provide algorithms on how the results of the mathematical computations were gotten as this goes a long way to help the curious students follow the algorithm to arrive at the result presented by the application.

We therefore design a free online application for solving mathematical problems remotely. The design is aso a web based system that can be accessed via the internet. Typically, it is composed of modules; an XHTML GUI user interface which eases the human-computer interaction; a JavaBeans controller which holds the production rules of the solutions, and CSS for the styling of the pages. The system designed makes use of JavaServer Faces technology. The technology is highly dynamic and allows for the use of other technology with it. In modeling the designed system, the Unified Modeling Language is used. Also, the flowchart is used to describe the program flow. UML is a language or notation intended for analyzing, describing and documenting all aspects of a software system. It is a standardized system for modeling software systems. Class diagrams are used to model classes, interfaces, objects, packages, collaboration and the associations among them. The class diagram for the system is shown in Figure 3.1

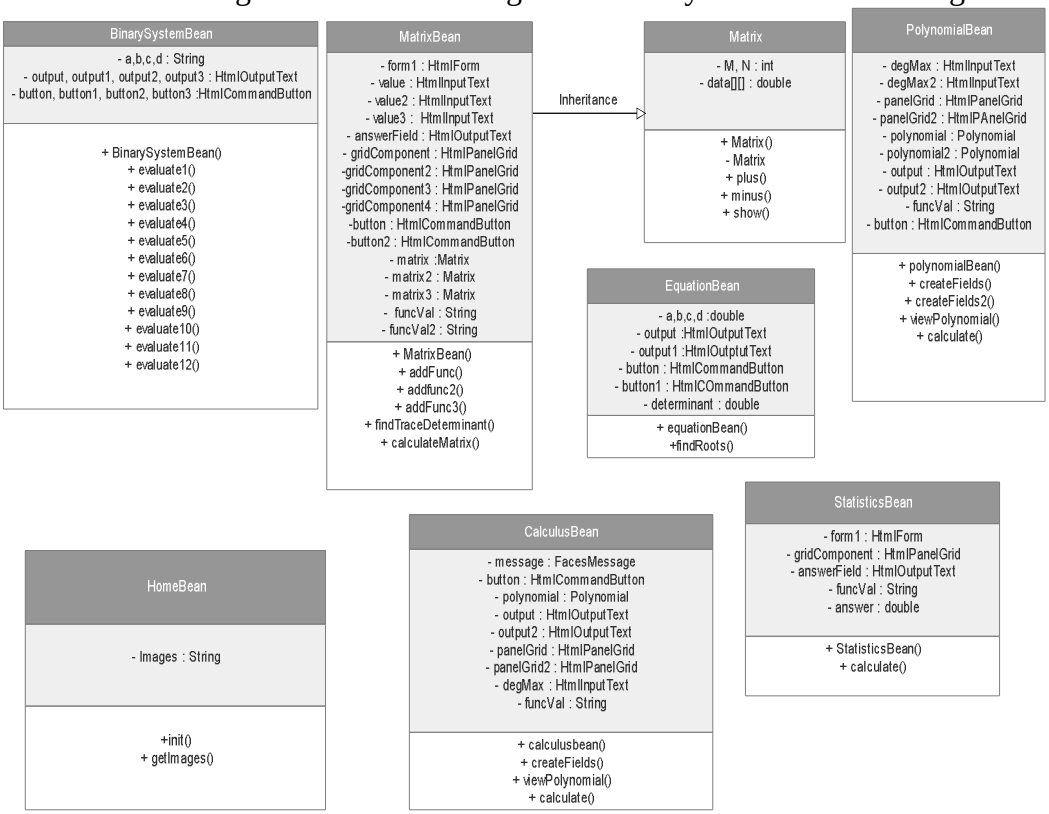

Figure 3.1 class diagram

A use case diagram is used to model the interactions between a system's clients (in this case, mathematics students) and its use cases. It shows the kind of relationship among actors and use cases without providing the details. An actor is a role of an object or objects outside the system that interacts directly with it in a use case. The actor has class-like properties. A use case is a unit of functionality of the system or a class and so an object with different roles would be modeled by several actors.

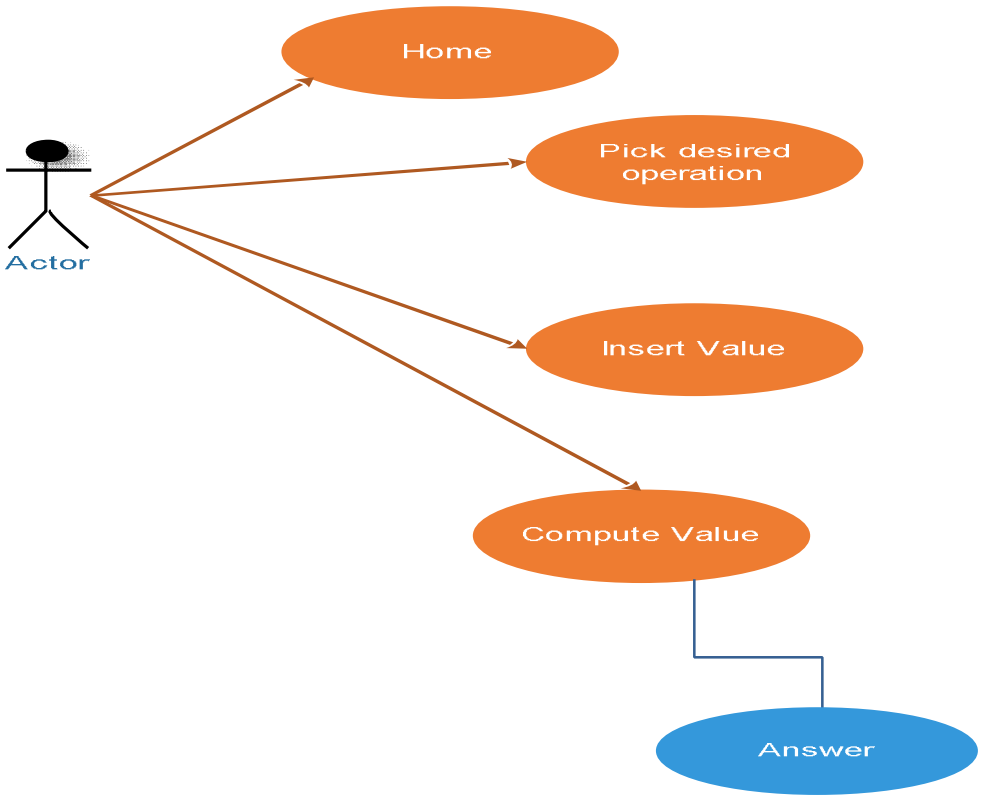

Figure 3.2 Use case diagrams

An activity diagram shows the dynamic view of the system by capturing the flow from one activity to the next within a system and is semantically equivalent to state diagrams. It is basically a flow chart to represent the flow from one activity to another activity. The activity can be describes as an operation of the system. The control flow is drawn from one operation to another. The flow can be branched or current. Activity diagrams deals with all types of flow control by using different elements like fork, join and more. It illustrates the steps involved in an operation or process.

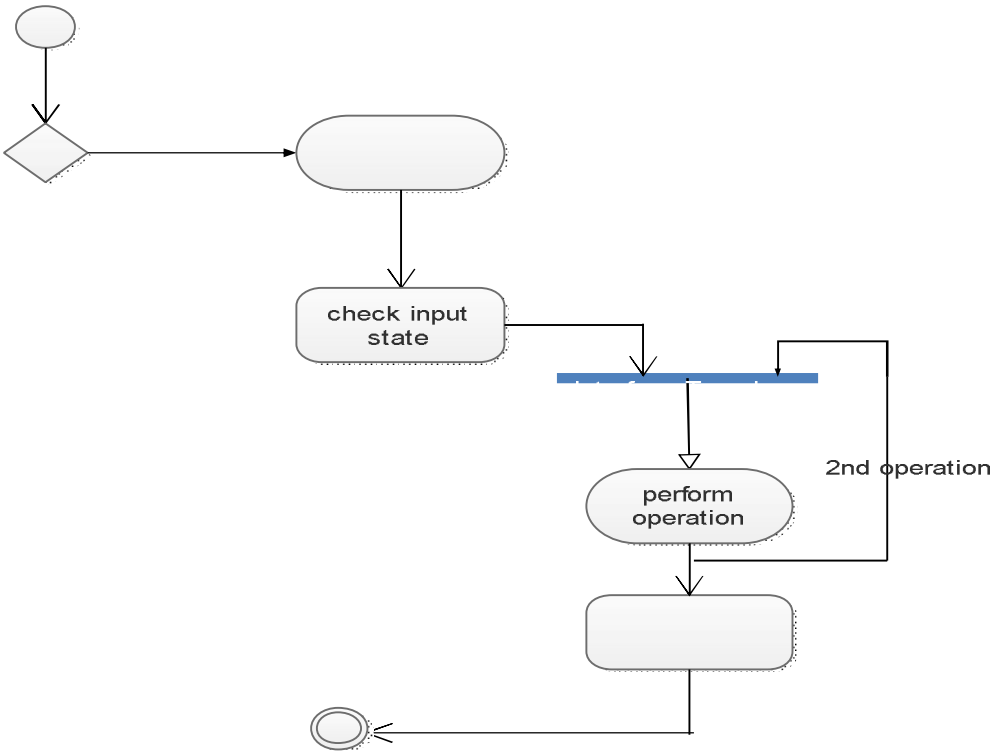

Figure 3.3 Activity diagram

Sequenced diagrams emphasize the order of messages at a moment in time. They show a group of objects and the message that are sent and received arranged sequentially according to their temporal progression. Sequence diagram are used to illustrate the dynamic view of the system. UML sequence diagram shows simple interactions between object arranged in a time sequence. It shows the objects with their lifeline and the exchange of messages between objects. It may also show the creation of new objects. Sequence diagrams are sometimes called Event-trace diagrams, event scenarios, and timing diagrams.

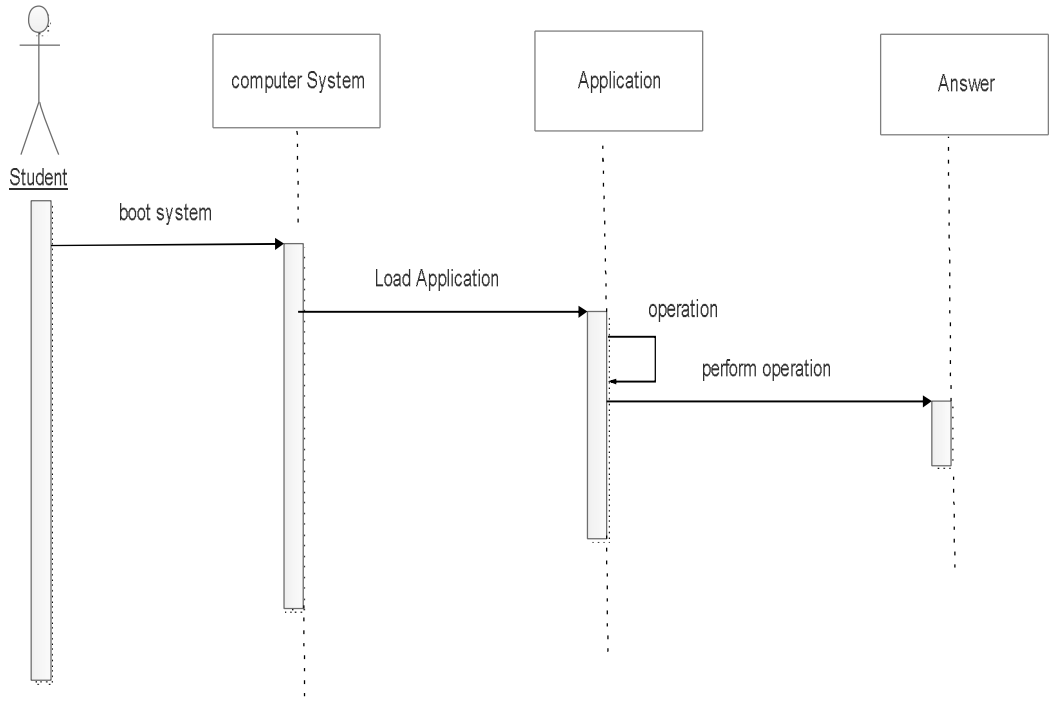

Figure 3.4 Sequence Diagram

This design is modeled in packages; Web Pages (containing several xhtml files writing with prime face technology), Source Packages (contains java classes as either backing bean or controllers), and Libraries.

Program Flowchart

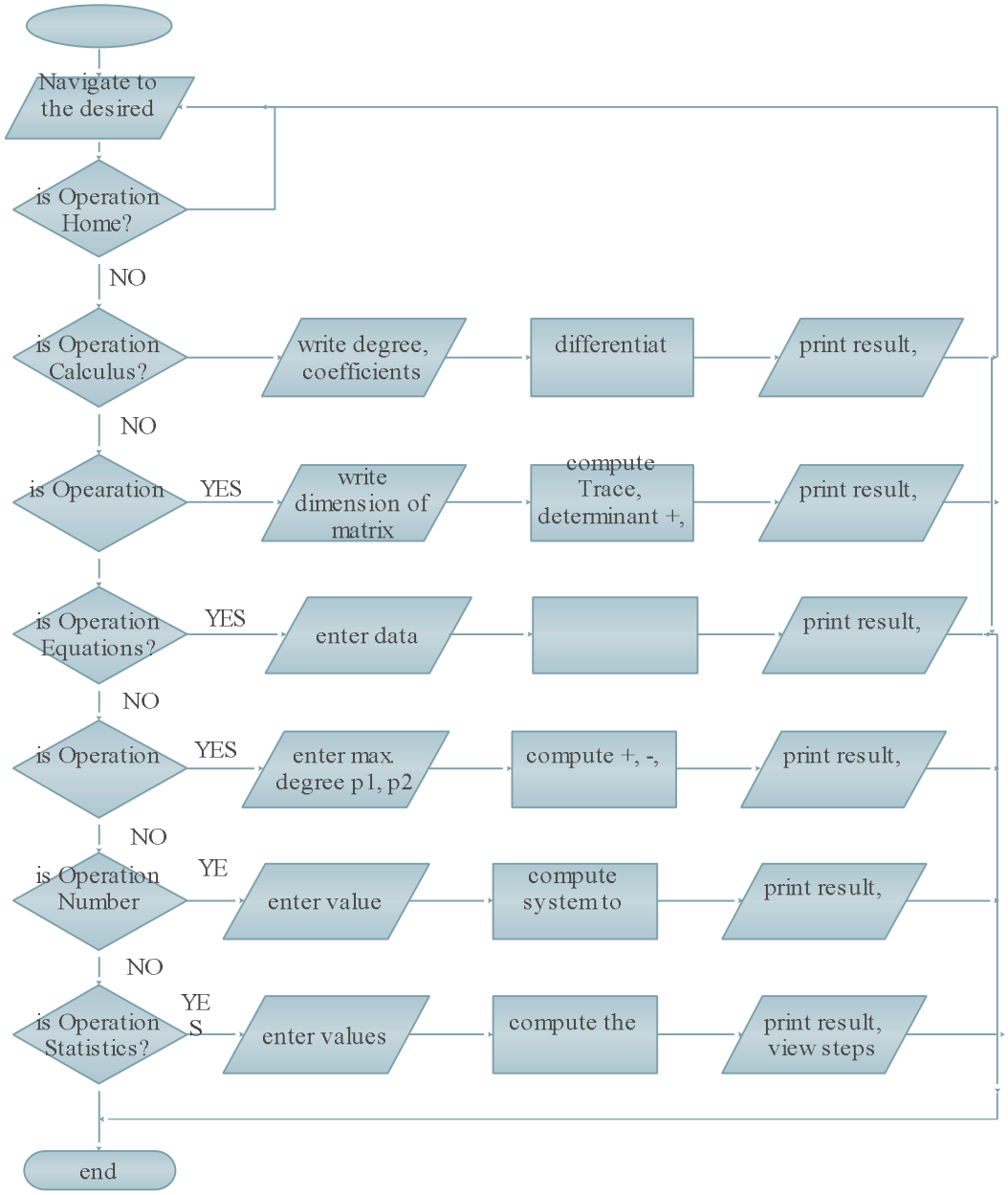

Figure 3.5: showing the program flowchart

Results and Discussion

The design structure, hardware requirement, software requirement and the evaluation of the entire system is the spotlight of this chapter. How the system design is implemented, its specification and evaluation is discussed here.
The structured design is detailed with the design of the section which the user can interact with. The section has to do with menu design, interface design, input and output design.

Menu design

A menu is a graphical control element of which several options are available to the user.

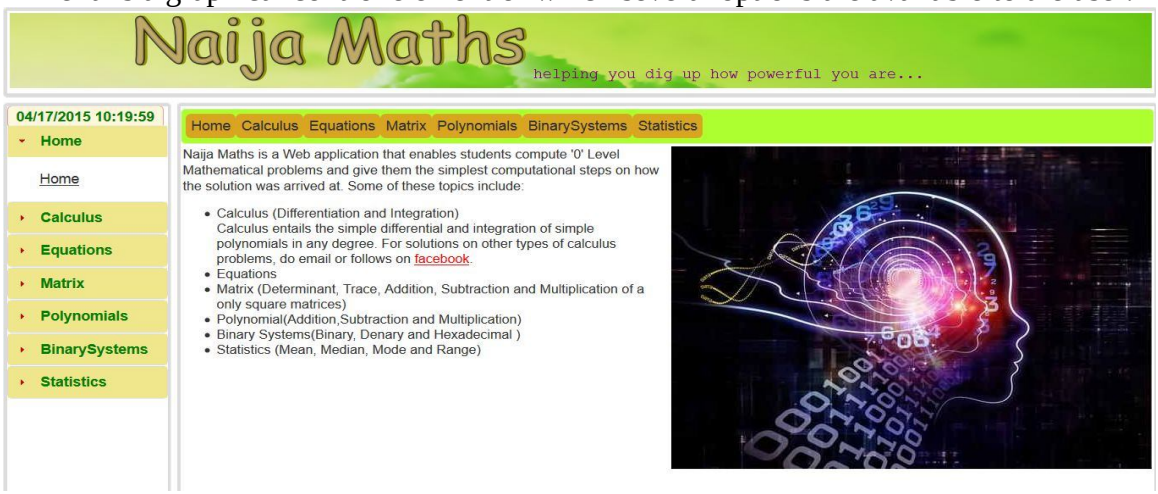

Figure 4.1 shows the general outlook of the Menu design

Form/ Interface design

This is made up of forms that help the user to make judicious use of the application. They are easy to use forms which a user with little or no supervision can use. The interface design is made up of drop down selection list, navigation buttons and dynamically generated boxes to accept data input.

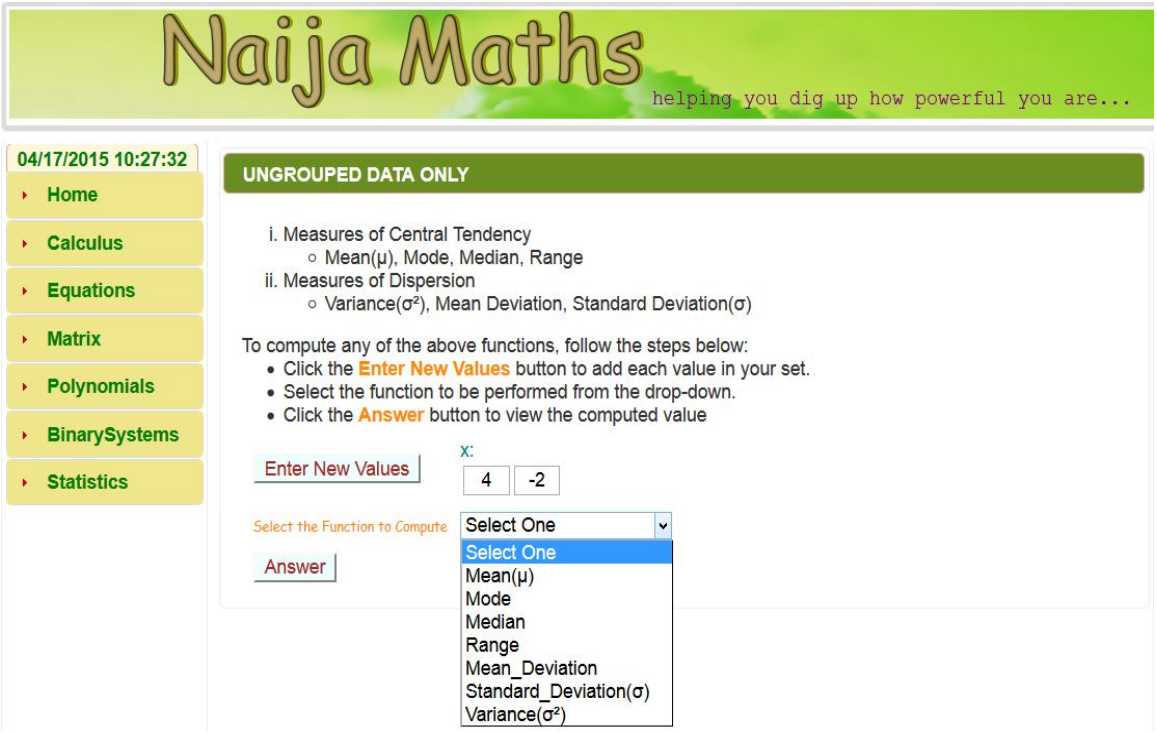

Figure 4.2 showing the interface design of the statistic page

Input Design

In the input design, user-oriented inputs are converted into a computer based system format with Java. It also includes determining method of input, and entry on to the screen. Data is accepted via the keyboard. In this app, importance is given to the Graphical User Interface (GUI), which is an important factor in developing efficient and user-friendly software. For inputting user's data, attractive forms are designed. User can dynamically generate text field for inputting the data to be processed. For example in the statistical page, input text field are generated based on the unlimited number of input data entered by the user.

Figure 4.3 shows the input design of Naija Maths

Output design

Computer's output is the most important and direct source of information to the user. The design should be efficient, logical and simple. Output design should improve the systems relations with the user and helps in decision making. The output media in the output design is the visual display of the underlying already processed information. The output design here includes the steps or simple algorithm to how the answer of the computation came about. The general outlook of the output design is designed to be very simple to use as shown in Figure 4.4.

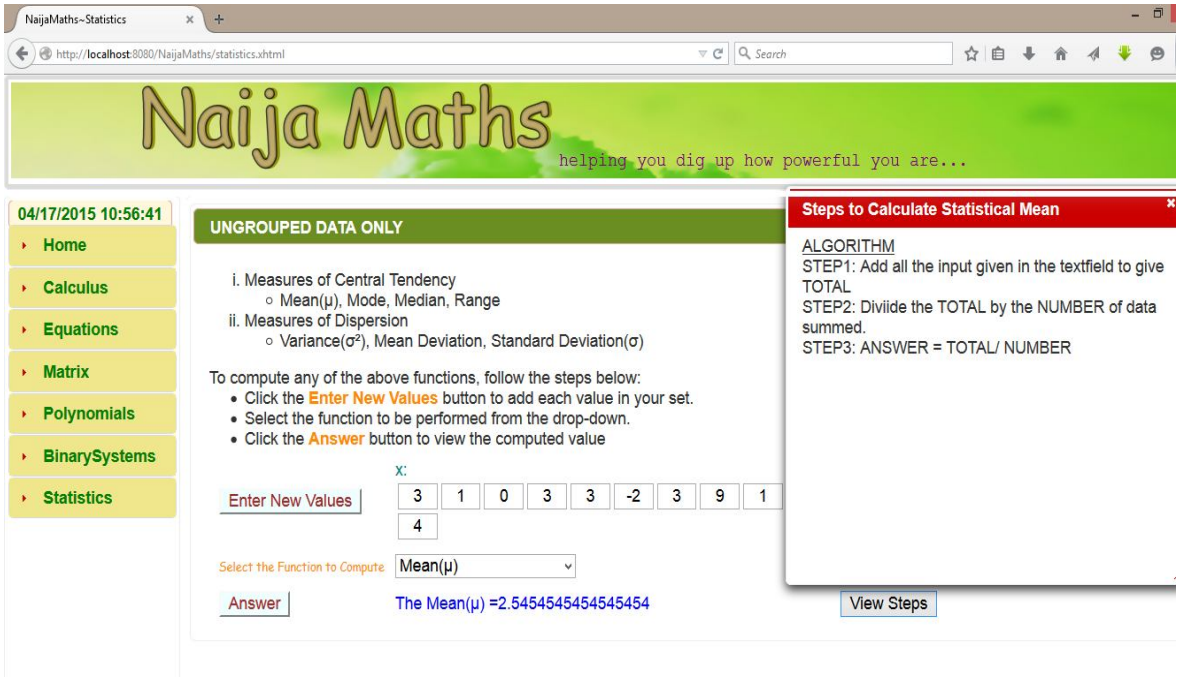

Figure 4.4 shows the output design of Naija Maths

The application developed (Naija Maths) needs both software and hardware requirements to be implemented. This requirement is part of the development process through the process of delivering the system. The system specification gives the details of what the system should do and the necessary requirement for the system to operate under normal condition. The requirement is both hardware and software. There are several benefits of the designed system: called (Naija Maths). It can be accessed remotely, it contains the algorithm for every computation done, helping students work the mathematical steps to arrive at the correct answer themselves, it enforces a clean separation of presentation and business logic making the application so efficient, Naija Maths provides some set of mathematical quotes by mathematics prodigy which is believed should be a boost for students to want to study more and ensures an expedite way to arriving at correct answers for the computation.

Conclusion

Due to the fact that mathematics cannot be in anyway avoided in high school education, this web application will help students grab the understanding of mathematics so simply and fast when used. It also provides the user the corresponding algorithm of each solution, helping students work towards the correct answer thereby students improve their mathematical abilities over time by using the designed system called Naija Maths,

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DEPLOYMENT OF RFID BASED CARD FOR UNIVERSITY STAFF AND STUDENTS AND ITS SIGNIFICANCE ON PRIVACY

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Abstract

Over the years, computer security has been an art and science that deals with different policy models, mechanisms that enforce these policies such as confidentiality, availability and integrity, and how security goals can be achieved if there is violation of any of these policies. However, recently, there has been growing interest in one-technology that replaced the popular barcodes as identifiers on products. Moreover, this RFID (Radio Frequency Identification) technology is offering a wide range of possibilities to help organization track their asset as well as people. With this approach, research have shown that there is a growing concern from law defenders on how information gathered on this RFID chips could trespass on personal privacy. This paper provides an analytical framework for use by the university to decide whether to deploy a RFID based (ID) cards to identify and/or store electronically the data of staff and student, describing the benefits of RFID technology and its effectiveness as a security mechanism and alsostudying its technological features, current applications, and future trends. This paper also focuses on staff and student's personal safety, and some of the important implication of RFID technology, with respect to privacy. It is hoped that information from this study may be useful in identifying the kind of data needed to be stored on the RFID chip to reduce rogue access threat on staff and student's privacy while complementing the university's management.

Key Words: RFID, Security, Tags, Readers, frequency bands.

Introduction

Radio Frequency Identification Technology also known as RFID is a successor to the popular optical barcode that was once used during the World War II to recognize friendly aircraft. It is a wireless communication technology used to identify tagged products or people (Rieback, Crispo &Tanenbaum, 2006). RFID system is made up of three components (see fig.1). These are:

i. A tag (also called a transponder), consists of tiny silicon chip and an antenna. RFID tags are usually with or without batteries. Tags without batteries are called "passive" tags. Passive tags operate within different frequency bands. Those with low frequency operates within the range of (124 kHz- 135 kHz), while high frequency tags (13.56 MHz) and also, ultra high frequency tags operates within the range of 860 MHz- 960 MHz (and sometimes 2.45 GHz).However, tags with batteries are categorized into "semi-passive" tags, whose batteries power their circuitry and "active" tags, whose batteries power their transmission and can initiate communication. Sarma et al. (2002).
ii. A reader (also known as interrogator), can either be stationary or mobile. A

stationary reader is used to track tagged products while mobile reader is used to monitor inventory on a retail store flow (Knospe&Pohl, 2004). Also, there are two types of tag-reader couplings:

- Inductive coupling: it uses frequency below 30 MHz. The reader antenna coil induces a voltage in the tag coil by an alternating magnetic field it generates. Transfer of data from the reader to the tag is based on Amplitude Shift Keying (ASK) while the tag uses load modulation to transfer data back to the reader.
- Back scatter coupling: this is normally used for frequencies below 100MHz. in this case the tag antenna receives energy and signal from the electromagnetic field emitted by the reader.

In order to transfer data back to the reader, the reflected power is thereby modulated by the tag. (Knospe &Pohl, 2004).This process is called (modulated backscatter). The reader usually sends collected data to a background application system for further processing. Stationary reader are directly connected to these systems via RS 232 or USB interfaces while mobile readers can connect via Standard Networks Protocols to background systems via wireless link and TCP/IP. In RFID tags, it is clear that communication is initiated by either the reader or the tag.

iii. RFID controllers: they are also known as the "brains of any RFID system(Myerson, 2007). The controller is usually a PC or a workstation, that runs an application software or database in any network. A database, stores

Information about RFID tagged objects. The controller uses information gathered by the readers to; Alert suppliers and keep inventory whenever there is a need for new inventory; Track/monitor the movement of objects, and also redirecting the objects throughout a system; Authenticate and grant authorization, for example, keyless entry systems and Debit a customer's account for example, Point of Sale (POS) application.

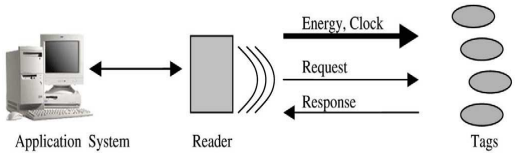

Fig.1: overview of an RFID system with passive tags (Sarma et al. 2002).

However, the main function of RFID tags is to store information and before we can retrieve and understand the information stored on RFID tag, there must be an access to the reader and its corresponding database as indicated in figure 2. below.

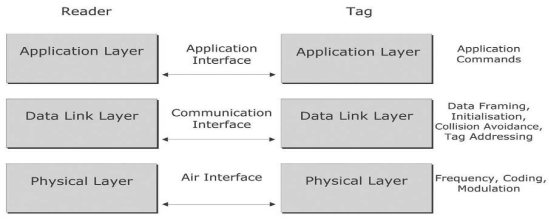

Fig.2. depicts an RFID communication model. (Hunt, Puglia, &Puglia, 2007)

Hunt, Puglia, and Puglia (2007) indicate that RFID technology is potentially applicable to every industry, commerce or service and in other areas, where there is the need for data collection, individual security. Amongst which are:

- ***Retail and consumer Packaging:*** such as supply chain management, carton and crate tracking, Item tracking, pharmaceuticals, inventory tracking.
- ***Transportation and Distribution:***applicable in the area of toll collection such as roads and bridges.
- ***Sports:*** that is, the use of RFID to track participants in major sport events.
- ***Cars keyless starting systems:*** this involves an evaluated RFID used by some cars manufacturers for starting cars without using key.
- ***Ticketing:*** with respect to sports is a new kind of tickets containing RFID, designed for special sports events.
- ***Airport :*** using RFID to track airline passengers and baggages.
- ***Security and Access Control****: such as a*nti- counterfeiting, computer system access, forgery prevention, room, laboratory/facility access, passport and Visa management, employee identification and animal tracking.
- ***Health care systems:*** building a Smart hospital using RFID technologies such as tracking equipments, patients, staff and documents. Also using the RFID technology in identifying the bags of blood and identifying the new arrival patients by providing them with a wristband with an embedded tag storing a unique number and some information about them.
- ***Point of Sale (POS):*** *such as* automated payments in stores, and customer recognition.
- ***Library Systems*****:** this is using RFID technology to prevent books stealing, also, in Library Book Collection and special Collection Access.
- ***Monitoring and Sensing:*** use of RFID to monitor locations within a facility and also, it can be used measure and monitor pressure, temperature, volume, and weight.

However, in the context of this paper work the major concern is the adoption of an RFID-based card for both staff and students in the University environments and why there could be issues concerning privacy. According to privacy advocates, (Hunt, Puglia &Puglia, 2007), RFID technology, if not properly used could jeopardize consumer privacy. Moreover, RFID raises two main privacy concerns for users which are: Clandestine Tracking and Inventorying.

Clandestine scanning of tags is a kind of threat where read range allows tag to respond to reader's interrogation without alerting their respective owners (Garfinkel &Rosenberg, 2005). Tags emit unique identifiers, even tags that protect data with cryptographic algorithms. Consequently, a student or staff with an RFID-based card effectively broadcast a fixed serial number to nearby readers. Since a reader can determine and retrieve important information such as what is your name, what type of RFID-enabled card are you carrying; the bank you are using, where you shop and so forth. Thus, a student or staff is vulnerable to clandestine inventorying. Therefore, the threat to privacy grows when a tag serial number is combined with personal information. Although, clandestine tracking is not limited to RFID alone, it also affects many other wireless devices such as Bluetooth enabled ones (Rieback, Crispo &Tanenbaum, 2006). However, the perpetual privacy debate has led to a variety of technical proposals that contains RFID-specific "Privacy Enhancing Technologies (PETs)"for securing RFID data, its effectiveness as an identification method and a security mechanism to mitigate the risks to consumer privacy when RFID technology is being deployed. This shall be discussed further in the latter part of this paper.

Effectiveness Of RFID Technology As Regard Security And Identification

As regard to cost, only passive tags are applicable to more massive wide scale deployment of RFID –based cards.

However, what comes to mind whenever there is the need for security is what are the kind of attacks/threats, their effects and their frequencies, so that the scope of the security can be defined. Therefore, in this paper RFID effectiveness would be measured by examining different ways in which this technology has responded to various security threats (Myerson, 2007) .The four categories of attacks that are unique to RFID devices are the following:

***War-walking and lifting*:** war-driving often called wireless LAN driving is a technique that make use of Wi-Fi based laptop to detect Wi-Fi wireless network. The perpetrator of war-driving uses the device to read, retrieve information from tags of goods purchased that a passerby carries in a shopping bag. They could disable the RFID deactivation mechanisms when not properly deactivated. However, war walking is more bold than war-driving. War-walkers do not need a wireless device to find the RFID tags, with fake cards they can bypass physical checks and find the system that uses RFID to monitor the movement of conference attendees (Myerson, 2007). An example of this happened in December, 2003 at the WSIS meetings at a conference center. The crackers wanted to show that RFID raises a lot of privacy issues without putting into consideration the physical security. However, this threat can be mitigated by deploying RFID tracking system. This tracking system is capable of sensing when a product is removed and then take photograph of the responsible person, an example is the Gillette's RFID tracking system.

Weak cryptography: as discussed earlier, the university might want to adopt low-cost passive tags which are basically for access control, Weis et al. (2003).However, low-cost passive tags do not allow basic cryptography, due to their limited power and little memory and size of the chip. In contrast security and authentication may be improved by enhancing their capabilities using minimalist cryptography. Another way of enhancing the technology is to adopt other protection mechanisms at the software/hardware level if one mechanism fails, such as firewalls, RFID monitoring, and Intrusion Detection System.

Denial of Service: RFID signals are said to be very easy to block or jam, Knight (2006). This may be achieved through flooding with radio waves and block RFID scanning by using electromagnetic fog. Therefore, what countermeasures needed to mitigate these threats should be considered before RFID is fully implemented. *Counterfeiting*: this threat simply means switching an original tag with a fake reader, Garfinkel (2004.) The replaced reader is then modified to allow the control of an authentic reader nearby from a distance to write fake serial numbers on the tags. Also, it can be modified to change the original data stored in the readers' database and replace it with invalid data automatically. However, this can be mitigated by ensuring that a legitimate reader can reject a fake RFID number counterfeited on the tag or in the database, (Myerson, 2007). An example is the Authenticated RFID Platform offered by 3M and Texas instruments. This tag has more processing power than their counterpart passive tag and is more expensive. The power allows tag when activated to generate a machine-readable security stamp containing a based Public Key Infrastructure based digital signature, and to validate the digital signature, 3M's authentication system is used.

Basically, passive tags don't have data on the chip encrypted and could lead to illegitimate access while sophisticated tags do. Concerning the Return on Investment, the university may not want to invest much on these RFID-based cards for staff and students (Myerson, 2007). Therefore, various countermeasure policies should be determined before the implementing the technology.

Using RFID Cards As A Security Mechanism And Possible Data To Be Transmitted

As mentioned before, one of the RFID technology applications is for the access control to the buildings. Here we will apply this technology as a security mechanism (and especially for identification purpose) in the university campuses. Today, RFID is not just used for identification, study have shown that it has been re-invented as data bearing devices, Thiesse (2007). It is clear that information stored on campus barcode cards are barely reference numbers that link the card to the holder's records in the School Information System. However, modern application, such as RFID embedded card can have all the basic information stored directly on the card, which will be discussed alongside with its uses and advantages of their storage capabilities could bring to the University system. The following are the different uses of RFID-based card and the data needed to be broadcast.

***Tracking and Monitoring*:** RFID technology facilitates tracking and monitoring of individuals activities and whereabouts.The University management can use this RFID-embedded card on students and staff to track a group of people, monitor individual movement and eliminating anonymity by placing RFID readers in a strategic location within the school premises.

Library Management System: The University librarians can use RFID-based card of students and staff to track books, student library account, such as your name, identification number, borrowed books, book title, ISBN number, due dates, fine imposed and the likes, Coyle (2005). Also, this could be used to authenticate whether you are a bonafide candidate of the university by comparing the data on cards to that of the back-end system.

Identification and Authentication: one of the objectives of this paper work is to find out how effective RFID technology as an identification method is. Research have also shown that RFID tags in cards can be used for identification by authenticating the pass-holder before granting access, for example an *access* to any school facility. This could be achieved through its capabilities to read and retrieve information such as matriculation numbers of students and staff numbers.

***Medical Registration and Appointment Management*:** although, queuing cannot be ruled out in our day to day activities; it has been discovered that there is always a queue of patients waiting in the university clinic, either for registration, or to see the General Practitioner (GP). Students go as far as booking an appointment with a GP on phone. Coyle (2005), also indicates that,with an RFID-based card, registration could be done in a twinkling of an eye since RFID has the capability to read/write. All needed to be done is to place the card on the reader and the necessary information such as your name, age, gender, student number, date of birth would be entered into the system database. Also, in the case of appointment management information such as patient's history could be retrieved in the same manner.

Door Pass (Entry and Exit): it clear that the use of swipe card is common to manage access control, without this swiping of this card, which requires a proper positioning, otherwise you would be denied entrance or exit.

However, (Knospe & Pohl, 2004), argued that, RFID-based card enables entrance and exit with its ability to function without direct line of sight and can also communicate with hundreds of tags at the same time rather than one at a time.

Lecture Attendance: presently, the University Management System has adopted the marking of attendance by students after each lecture to track the number of students present. This method will not only cause distractions but a weak way of authentication. Using RFID-based card enables the University Management System in facilitating the maintenance of attendance lists.

***Log visits to various lab facilities*:** for security concerns there is need to keep tracks of who was in the laboratory and at what time. Such logs could be very useful in the event of any violation of security policies, Garfinkel(2004). Basically, RFID tags are capable of keeping a log of who gets in and out of some important areas in the University buildings. This approach is different from access control in the sense that we can query the information on them even from within a wallet where the students or staff may have carefully packed his or her card.

Fig. (3) Shows a design to a university that uses RFID technology for identifying students and staff.
Fig. design of a university that uses RFID technology

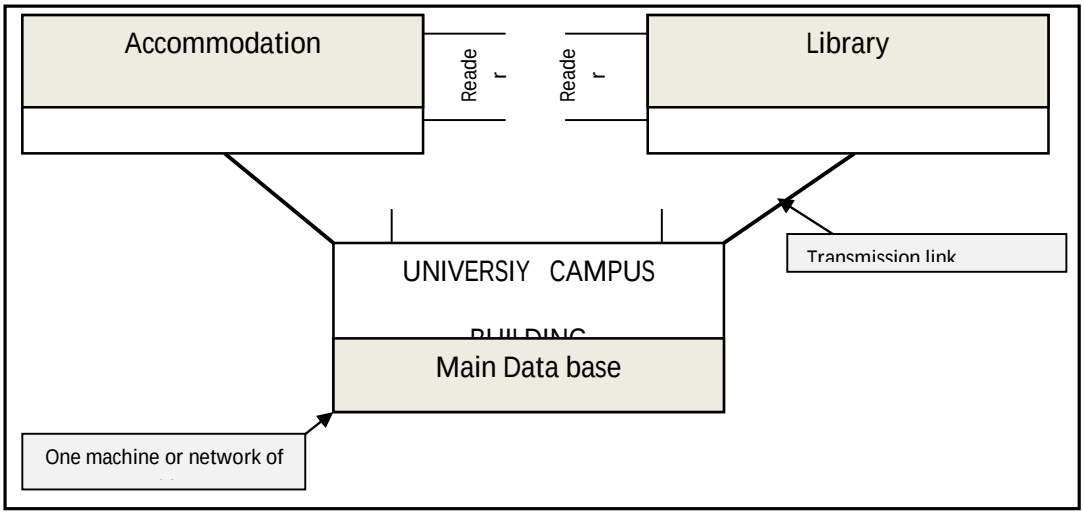

Fig (3): system's layout

It is assumed that all the students and staff members have a "card", which is an RFID tag in a physical format used for control access purposes , where the data of the card may be in the following format: (University code + faculty code + department code + student or staff member unique number). From the layout it can be seen that we have the university campus, the university library and the university accommodation building. In each building entrance an RFID reader is installed, also a data base machine(s) is available in this building. A communication link is used to connect the three data base machines.

The function of this system is to permit access to the students and university staff. For example all students must be able to enter the university campus, and then all those students must be provided with RFID tags familiar with the reader at the campus entrance. From the data stored on the tag we can select which student or staff member is able to enter the campus, the library or the accommodation building. The data base in the campus building is the main data base that we can rely on. It contains the database of the students and staff members who are permitted to enter the campus, the library, the

accommodation and building, while the data base machine located at the library building or the accommodation building contains a data base for those who have the authority to enter the library or the accommodation from the students and staff.

The benefit of locating data base machine(s) for library and accommodation is to make the readers located at the entrance of these buildings communicate directly with the nearest data base machine(s), in this case there is no need to make a request from the main data base machine(s) located at the campus building, but that does not mean there is no connection between the database machines, such as if an update is made on a user profile in the main database machine (located at the university campus) in the field of the user database specified for the library, then the user profile in the library database must be updated.

Uses of Data Retrieved By Rogue Receivers

Despite RFID tags myriad uses, and its ability to optimize supply chains, it can also violate a person's privacy by tracking the tagged item's owner. Rogue receiver can secretly planted around the campus, especially the active readers that have much wider scanning region than those of passive readers. As discussed earlier, passive tags operates within different frequency bands. In contrast, active tags have batteries that power their transmission and communication. Rogue receivers could scan crowd such as students or staff for vital information such as bank account details, high value notes (Garfinkel &Rosenberg, 2005). Digital passport could also be scanned to target nationalities for example, your place of origin. Also, data retrieved by rogue receivers could be used to keep track of any of the university staff. They can be used to mimic legitimate RFID tags on the card by writing formatted data on blank tags, Thiesse (2007 .This method is called spoofing also known as a relay attack see (fig.4). Another example of this is when an item in a supermarket is retagged by a thieve and its identified as similar but fake product. Basically, student/staff may lose vital information such as security number, address and in the event of such situation the rogue is capable of operating in the society with privileges of a rightful owner (Garfinkel &Rosenberg, 2005). However, some countermeasures can be used to mitigate this kinds of threat by adopting some security policies alongside with the RFID technology by providing second form of authentication such as password, Personal Identification Number (PIN) or biometric. In other words, data retrieved by rogue receivers on campus could lead to some threats to personal privacy which will be discussed in the next chapter.

Fig4: Relay Attack in the context of building access **(**Garfinkel &Rosenberg, 2005)

Furthermore, rogue access that result into personal privacy threats include:

Sniffing**:** this form of privacy threat allows unauthorized readers to scan tags unknown to the owner, Knight (2006).Data collected by rogue may be joined together to create a picture of the tag owner that an individual tag may not provide and this may result into medical predisposition and unusual personal inclination.

Denial of Service: it is known that a system can only work when RFID tags and back-end database are available Weis et al. (2003). However, rogue access such as flooding can block readers' request by using physical barriers for example faraday cage. Blocking may be disastrous incase of medical emergencies and recovery operations.

Replay of Attack: according to (Garfinkel & Rosenberg, 2005)in figure 4 above, attackers can intercept and retransmit RFID queries using relay devices and this retransmission may deceive building access control systems.

Standard Query Language Injection**:** RFID databases also known as the back-end system that stores different information about individuals may respond to hidden commands embedded in the SQL. Moreover, data from the tag passing to the back-end database might include unexpected commands for the database application to reveal sensitive data of people.

Electronic Impersonation**:** in a situation where someone is in possession of your digital identification, this kind of threat will not only violate only the integrity policies but also confidentiality policies. Similarly, crime committed by the attack could be linked to the legitimate owner of the tag.

Tracking**:** although, tracking in RFID technology is a legitimate application however involuntary tracking is an invasion of privacy.

Generally, the degree of harm caused by rogue access can only be measured by how sensitive the information on tag (Knight, 2006). Therefore it is more cost effective to building in the appropriate measures from the start.

Security Issues of RFID Identified and possible solutions

GAO report (2005) identified a number of security issues that are implicated by commercial use of RFID technology. It was stated, that, without effective security measures, information on the tag, can be read by any compliant reader. Also, data transmitted through the air can be intercepted and read by unauthorized devices; and data stored in the databases can be accessed by unauthorized users. GAO report (2005) suggested that RFID systems should be designed in such a way that, only legitimate readers can read the tags, and only authorized personnel should have access to the readers. It should also, be designed in a way that the integrity of the data on the chip and the one stored in the database is maintained. The report added that, from the design stage on, care must be taken to ensure that the tag and reader communication is adequately encapsulated and shielded to avoid attacks such as counterfeiting or cloning and denial of service due to flooding of electromagnetic field, in order to make available, critical data when necessary. The report further suggested that the risk of various attacks, such as replay attack and eavesdropping can also be mitigated by educating the users on how to use their personal data on the RFID based cards and how to prevent third party from accessing system data which could have a serious implications on individual privacy. The design should also consider avoiding electronic collisions when multiple tags and/or readers are present. Lastly, GAO report (2005).maintains that many security risks can be mitigated through compliance with the Federal Information Security Management Act (FISMA), which requires each agency to develop, implement and document information security programs for personnel and users of RFID.

Conclusion

It is clear, therefore, that whether the university is deploying RFID-based card today, in the nearest future, or has concluded that RFID-based card is not suitable for students and staff; it will certainly continue to replace the barcodes in the retail supply chain. In addition, another thing about RFID technology is that, it is not a single technology and there are numerous RFID products in the market. Similarly, it has contributed to the general speeding up of the world. However, In light of the concerns associated with the individual privacy of information gathered by means of an RFID based system, and overall aspect of security, various researches have shown how effective this technology is, as a security mechanism and as an identification method. Moreover, security can only be guaranteed when security objectives such as confidentiality, availability, integrity, authentication and anonymity are achieved. Above all, a security program needs to be put in place before the RFID-based card is fully implemented. The program should include security policies, procedures, standards, guidelines. Also, security awareness and incident handling, a risk assessment, types of attacks against RFID technology and most importantly the control management that link to the corporate strategy to ensure laws and regulations are followed. This will guide the university with some clearly stated goals for the decision that will unavoidably have to be made as RFID technology becomes a common technology. However, further studies to identify

potential problems and solutions of RFID technology, as well as workshops should result in much more effective technology.

Recommendation

The use of RFID based cards by the university to identify and verify the identity of staff and students is a great idea to be considered. Moreover, various researches have shown its great capabilities as well as functionalities and can offer unique solutions that cannot be provided by other technologies. RFID based ID cards are thereby recommended to replace the conventional ID cards that are in use today in almost all the universities, especially in underdeveloped and developing countries. Reason being that, RFID is capable of solving the problem of students and staff having multiple cards such as school ID cards, library cards, hospital cards and so on. All these could be incorporated on a single RFID based card. However, concerns raised by users in association with security and privacy of data gathered by RFID technology require careful analysis. Analysis which involves goals to achieve, its cost effectiveness, alternative technologies available and the feasibility of employing safeguards that can protect the security and privacy of data collected about the users. Lastly, more research is also needed into this technology before it can concluded that the benefits actually outweigh the disadvantages and/ or vice versa.

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Example: In most organizations, data resources are considered to be a major resource (Brown, 2008; Kroll & Johnson, 2009; Smith, 2010).

- Citing author within sentence if author's name is mentioned directly within the manuscript text:

Example: Bade (2002) states that the value of data is recognized by most organizations.

- Direct quote in-text citations:

Example: "In most organizations, data resources are considered to be a major organization asset" (Smith, 2001: 35-36) and must be carefully monitored by the senior management.

Example: Bade (2002) states that "the value of data is realized by most organizations" (p. 45).

- In-text citations should not appear numbered:

Incorrect: In most organizations, data resources are considered to be a major resource [15; 30; 84].

Correct: In most organizations, data resources are considered to be a major resource (Bade, 2002; Johnson & Johnson, 2005; Smith, 2001).

- For quotes exceeding 40 words, quotes should be formatted as a block quote (a block quote uses no quotation marks, and its margins are indented from the left; a period is placed before the parenthetical in-text citation):

Example: As an ever-growing number of people around the world have gained access to e-mail and Internet facilities, it has become clear that the communicative environment provided by these tools can foster language learning. E-mail facilitates access to speakers of one's target language. (Vinagre & Lera, 2007:35)

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