Integrated E-Learning System (IES) for the Nigeria Universities: An Architectural Overview

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Abstract It is no longer news that the standard of education in the third world countries is fast falling. Nigeria is not an exception. This may not be unconnected with human factors, infrastructural decay and government lackadaisical attitude in tackling the problems in the education sector. Many universities especially the recently established ones can boast of very view experienced lecturers. The economic crisis in the country coupled with poor remuneration for teachers has contributed in no small measure to brain drain in the system. The challenge therefore is to optimize the little 'brain' that is left for the benefit of all students across the whole countries as opposed to the current trend of localizing the lecturers. This paper discusses e-learning, it examine the challenges and prospect of e-learning paradigm and propose integrated e-learning system architecture for the purpose of sharing the knowledge of few experts and professional still remaining in the universities system.

Keywords Knowledge, E-Learning, Database, Networking

1. Introduction

Knowledge is wealth. No meaningful development takes place without application of knowledge. One of the widely circulated books in the world, the Holy Bible, attests to it that man perishes for lack of knowledge[1]. The ancient pyramid of Egypt, the world trade center tower, the US independent tower as well as the world tallest hotel in UAE were all constructed as a result of man possessing a body of knowledge. Knowledge about diseases and control is essential for survival in the planetary earth. Specific knowledge about a particular disease is needed by doctors to treat a patient. In fact[2], contends that there is a continual survival struggle between Insect and Man. Man is able to survive till this moment because of continual studies about insects. The construction engineer needs a body of knowledge to build or construct a road. The lecturers in schools need a formal training before he can impact knowledge. Education on the other hand is the acquisition of knowledge through training. Without education man is not refined and could not attain his potentials. The major difference between primordial man and the modern man is that the latter posses a body of knowledge through education which the former lacks[3]. observed that no nation on earth that climbed the ladder from underdeveloped (e.g. Nigeria, Ghana, Bangladesh) to developing and developing (e.g.

Korea, Singapore, Malaysia) to developed (e.g USA, UK, Germany, Russia) nation ever did so without starting by streamlining and improving their technology. Improving technology necessarily means improving the quality of education.

In Nigeria majority of the populace are not educated.

This is because a good percentage of the populace lives in rural community with little access to education[4]. In recent times, however, parents and the whole populace are increasingly aware of the role of education in the building a vibrant society. It is in realization of this that we now have millions of our teaming youth seeking for admission into higher institution yearly. Going by Joint Admission and Matriculation Board (JAMB), this year alone, thousands of candidates applied for admission into our Universities. The Federal University of Technology Akure recorded about 1034 candidates seeking admission into probably less than 100 position in the department of computer science alone. Similar situation abounds in other department in the university and indeed other universities across the country. This has invariably put maximum pressure on the universities to admit more students than the facilities in the system can accommodate. There are only few hands available for teaching and inadequate laboratory resources to cater for the teaming students. The direct consequence of this is lack of qualitative education for the students. The immediate solution should be the introduction of means of sharing these limited professionals in order to maximize the limited resources we have. It becomes pertinent, therefore, that a new scheme be evolved where the remaining number of experts and professionals in the university system could

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be retained and their potential optimized. To arrest these ugly trends in our educational system, Technology immediately becomes reference point.

The advent of technology has changed the way things are been done.[5] describes ICT as a generic term referring to technologies which are being used for collecting, storing, editing and passing information in various forms.[6] views technology as the mean or activity by which man seeks change or manipulate his environment. The development of network technologies, couple with advancement in Information and Communication Technologies provide a framework for which we build a solid foundation for e-learning. It consists of internet and other materials that make the content delivery as easy as possible. Other areas of advancement include image processing, multimedia software system. Technology has revolutionalised business. It has turned the world into a global village. Nations used technology for individual growth, advancement and prosperity. In fact it is a common knowledge that no nation on earth that climbed the ladder of underdeveloped to developing and develop nation (Korea, Singapore, Malaysia, Indonesia etc) ever did so without starting by strengthen and improving the infrastructure for basic science and Technology. Thus it is now possible to transmit live digital contents from and to different parts of the planetary earth through network facilities and satellite transmission.

The concept of e-learning brought a convenient marriage of information and communication technology and revolutionalises the way we learn. E-learning is technology-based learning such as computer-based learning, virtual classroom and digital collaboration. It is the general terms used to refer to computer enhance learning. e-learning, technology is the main knowledge carrier between teacher and learners. The knowledge of an expert is transfer into e-learning technology as information. It may encompass the use of mobile technology such as personal digital assistance and MP3/MP4 player. It may also involve a web-based teaching materials, hypermedia in general, multimedia CE-ROMs or web sites, discussion boards, collaboration software, e-mail, blogs, wikis, text chat, computer aided assessment, educational animation, simulations, games, learning management software, electronic voting and other audio-visual materials. Here, more than one of the methods may be combined together to form a learning model. E-learning can be self-paced in which case the individual can learn at his or her own free period. The class can be communicated virtually. Instruction can be communicated virtually. Instructors and students are located in different part of the Globe and take part in class wherever it is convenient for them. The flexibility of e-learning makes it the moist suitable means of education in this part of the Globe. E-learning can be synchronous or asynchronous. In synchronous e-learning classes take place in real-time. Instructions are communicated to the students at real time through audio or video or through a chat room. Asynchronous e-learning allow the students to access prepackage training material at real time.[7] identifies the fact that a new didactic concept emerge in which student works more individually and independently. The use if ICT cannot be separated from this fact.

2. Justification for the Research

Nigeria is the largest black Africa nation with about one hundred and seventy millions people. The country is full of abundant natural resources and has a divergent cultural heritage. The large proportion of the population is living in the rural areas[8] and has little access to education. In fact[9] reported that 70 percent of Nigeria as been uneducated. As a result of perpetual mismanagement of her resources, many sectors of the nation political and socio-economy have been affected.

The education sector is one of the sectors that are seriously affected. For example,[9] repots the shortage of lecturer with PhDs to manage the University system. Also the number of professors is not enough to service the Universities. The other professionals in the system prefer private sector employment for obvious economic and work environment reasons. There are not enough man resources to manage the university system thereby leading to drop in the standard of education in Nigeria. It is therefore imperative to seek for ways of sharing the knowledge of few professionals in the Universities.

3. Method Adopted

The methodology adopted is precipitated on the need to allow the Universities to share resources with each other and to motivate adaptive learning within the Universities communities in Nigeria. We research in the different materials in use and sharable materials among different Universities in Nigeria in term of human and materials resources. The database is design is such a way that student with and outside the Universities would have access to the course contents, researches, Tutorial, Journals and instructional materials within and outside the system. Also multimedia components are included to provide multimedia streaming in which case the use of Audio-Video educational materials would be address.

4. Current State of Teaching and Research in Nigeria Universities

The Nigeria university system practices a course unit system. Under course unit system students are required to take specific number of units of courses per week or per semester; and the course are, ideally, suppose to be run throughout the year. The course unit system is particularly interesting in the sense that students have the flexibility of choosing a course of their choice for a particular semester. The courses are designed in a stepwise manner so as to allow graduation from lower level to higher level. The science

related courses are designed to allow for laboratory works. Consequently all departments are assumed to consist of professional experts in deferent area of choices. These professionals and experts are limited in number. Also, many of them prefer private sector where the working environment and remuneration is better. Also it is no news that many have left the shore of this country as a result of frustration occasioned by poor remuneration and adverse condition of service.

Each university in Nigeria is autonomous in areas of teaching and research. Research articles, field notes, lecture material, monographs, tutorial and other training materials are disjointed with each of the University maintaining her own repositories. Data and knowledge are not shared. Even within the same university, different repositories exist for different departments. This makes knowledge sharing difficult.[10] observed, and rightly too, that the whole power of science is in the power of share ideas and not the power of hidden ideas. He further opines that science advances where there is free exchange of ideas and that the advancement is more visible by operating open system. The Nigeria university system is not open. Students project, thesis, research outputs and other relevant materials are locked up in libraries and achieves that are hardly referenced. The mode of learning is one to many; in most cases students do not benefits enough from this learning paradigm. The class is sometimes overcrowded in not so conducive environments. There is a rigid timetable and any student that misses the time table could not have another opportunity other than to wait for another year if he is so desire to get that portion of the class. Also the curriculum is developed by the school and training is delivered by the lecturers. Often students are left at the mercy of a teacher who has the ultimate power to design and implement any approach for his teaching. Many times the ratio of students to lecturers is too high to provide for any meaningful way to impact knowledge.

Another area which cannot be ignored is the lack of training infrastructures in Nigeria schools. In some cases where these infrastructures exist it is overstressed as a result of excessive usage due to too much students who depend on the infrastructure. The state of the classroom in government owned institutions is so bad that sometimes lecturers and students alike suffer from heat and too much of humidity in the classroom. Imagine a class of three thousand students crowding to listen to a lecturer who does not use radio material to teach and in dark environment.

Libraries in Nigeria higher institution particularly the universities consist of audio-visual learning materials which include tape and audio recording of education materials that are hardly utilized. In most cases students are no even aware of the existence of such facilities. This is because the power holding company responsible for generation and distribution of electricity is not functional. Also, the students are not sensitized enough. Traditionally the main learning approach centers on teachers rather than the students. A teacher determines what to teach, how to teach and he is less concern about the students he teaches. Various learning approach has been put in place to compensate for the problems occasioned by this traditional learning paradigm. For example online instruction has the potential to provide opportunities for reflective and integrating learning approach. This could offer students adaptive personalized e-learning, which could be of better alternative to one size all approach of the online learning. E-learning is a general term used to refer to computer-enhanced learning. It may involves the use of mobile technologies such as personal digital assistants and MP3/MP4 player and includes the use of web-based teaching materials and hypermedia in general, as rooms or web-sites, discussion boards, collaborative software, e-mail, blogs, wikis, text chart, computer aided assistant, educational animation, simulation, games, learning management software et cetera.

5. Trends in E-Learning System in Nigeria

The development of Information and Communication Technology has pave way for improvement in the way we learn and ease of impacting knowledge. The traditional chalk and black board system has gradually give way to sophisticated e-learning. The current education is characterized by teacher eventually deciding on the education practiced in his classroom. He is responsible for his performance, as long as the result is satisfactory to teach the way he pleases. This teaching method is determinative and limits the teacher in his possibilities. Education and the teacher are compelled to a certain/specific content of education, time tables, face-to-face instruction, instruction time, class rooms and etcetera. The status of teacher is laid down just as it in[11]. In future ICT will be used for communication between students and teachers; internet, laptops and simulations would be used. Consequently different learning environments would be possible. Teacher-centered and whole-class instruction would no longer be the dominant teaching method. There would be large amount of information and less time in passing this information across. The role of teacher would soon shift to guiding the process of students getting information themselves. In their scenario-studies and constructive learning theories conducted by[12] and[13]. It was concluded that the profession of the teacher will shift from transferring knowledge to guiding the process of learning. This is merely so because information is dating so rapidly that education cannot keep on focusing on the transfer of knowledge anymore.

The Nigeria university system is still far from ICT compliance. It looks incredible that many universities are still using of traditional black-board and chalk teaching method in Nigeria. The closest to e-learning is the case of Nigeria Open University. The Nigeria Open University combined traditional learning paradigm with visual assisted tools and teaching materials in form of video and projectors. These complimented with web-based instruction materials. This mode of learning ensures the students obtain maximum knowledge from the facilitators.

The conventional universities in Nigeria are still far behind in taking advantage of huge opportunities in e-learning. Most of the Universities are still lagging behind in taking advantage of the recent revolution in Information and Communicating Technology. They are still using the traditional mode of chalk and black board approach of teaching. Most of the school libraries are full of outdated books. Sometimes the books would have been stored for more than two years before it is made available for students use. Also the libraries are not computerized. In most cases when they are computerized, it is only restricted to searching of materials on the shelf. Also most of the library has no direct link with the subject lecturers in the acquisition of books. As a result a tangible percentage of the books are outdated and irrelevant.

Another major problem we have in the nation University system is the brain drain experience as a result of economic hardship. Many of the professionals and experts in many core areas of teaching and research have left the University system to seek for greener pasture elsewhere outside the country. For instance, Nigeria is said to have the highest number of medical Doctors in United State of America[14]. A tangible number of our professors and intellectuals work outside the country. For example[15] and[16] report lack of enough lecturers in Nigeria Universities. The remaining experts in the teaching and research here are too meager to cater for the teaming population of our students. Already we have some of them ageing. The fact is that most of these expert here are duplicated in other institutions just to set get accredited by the relevant agencies vis-à-vis Nigeria University Commission, different accreditation bodies). Their knowledge is not actually shared but assumed to be shared. The immediate consequence of this is low quality of education as most of the core courses are being thought by junior lecturers in the institution who are supposed to be taking tutorials pending the time they get mature in the system. Therefore there is an urgent means to devise some means of making use of limited number of these core academicians outside the confine of their environment.

There is a huge advantage in online learning which is believed to have the potential of providing opportunities to provide reflective thought and deep learning through realistically integrating and apply the principle to learn[17]. Also online learning could offer student adaptive personalized e-learning as an important alternative to the one size fit all approach of online learning[18]. It also offers a feedback mechanism that facilitates improvement in teaching methodology.[9] gives some distinctive advantages of personalized learning in contract with traditional approach. These are giving as follows:

i) while traditional leaning environment adopt one-to-many learning mode, personalized learning environment usually is based on one-to-one, many-to-one learning concept

ii) Traditional learning environments are usually been de sign for the average learner, while in personalized e-learning environments the learning material and sequencing, learning style, learning media etc depends on the individual learner's characteristics, that is background, interests, skills, preferences etc.

iii) In traditional learning environments, the curriculum, learning units etc are determined by lecturers while in personalized settings, they are based on the learners' requirements (i.e. self directed learning).

However, despite all these advantages some factors have been identified as potential disadvantages of e-learning. These include but not limited to learner isolation[19], [20],[21]; Also the need for greater discipline, writing skills and self motivation, the need for online users to make a time commitment to learning[22],[23].

In view of all these disadvantages a blended learning approach was devised. This is achieved by combining traditional classroom environment with online learning paradigm. Sometimes, students are required to complete online test prior to taking a class in order to ensure that they share common foundation of knowledge. Also, e-learning can be used after class to maintain on ongoing dialogue around a community of participants. Thus we have various discussions boards or chats groups. It is possible to combine pre-class and post-class learning components.

6. The need for University Teachers Training Institute

For the university teacher to be proactive and professional in his daily dissemination of knowledge, he has to continuously and aggressively pursue the acts of acquiring more knowledge. Not this alone, apart from vocational training there should be avenue for formal training and upgrading of his professional knowledge. The training institute would serve as a place where professional from different universities could rub mind. As of present there is no formal professional training institute for university teachers. This is necessary as it will cater for the need to constantly update the universities teachers with current trends in teaching and research. Also, it will formally educate the teachers on workplace ethics and how to uphold the integrity of the systems.

Teacher would be made to be abreast of the latest application of technologies in teaching and research. It was observed in[12] that teachers must as of necessity knows how to use ICT in an innovative manner.[7] is of the opinion that education designing skills form the core of the future teaching profession. In future teacher would not only be solely responsible for quardance of learning process[7]. Different member of school organization would each take care of a specific part of the teaching-learning process. It is outdated to expect teacher to be the sole guide of learning processes, there is always need for people who are able to prepare the curriculum properly and who can prepare learning environment. Teaching and learning no longer are function, but roles which pass to others. Each time the teacher has a different part, and sometimes he actually is a

student. School becomes learning communities in which students becomes teacher and teachers take place in the school desk. In all these teachers role would still be very important. In fact, should be noted that an appropriate knowledge base is essential for creating powerful learning environments and for adequate provision of supporting instructional material. Also, in the process of transferring information to knowledge, the teacher plays an important part as well.

The teachers are hardly prepared for new didactical teaching methods and are not in the least prepared for the use of ICT. The learning process is organized based on the subject matter. Even if we assume these teacher training institute are well-equipped and students are educated properly, we cannot expect inexperienced young teachers to act as agent of change. They have to adjust to situation particularly the peculiarity of the organization they found themselves. They have to familiarize themselves with new concept and new application.[7] suggested that in order to enlarge the role of teacher training institute in the process of implementing ICT, it is suggested to stimulate a collective approach (teachers, schools, teachers training institutes and teachers in training) of solving problems in concrete teaching and learning situation. The following arguments were suggested to support such an approach.

Richly ICT-designed learning situations are created and are needed for both vocational education and training of future teachers (in teachers training institute). The more the university teachers training institutes develop their curriculum using up-to-date application, the greater the risk of educating students for unrealistic situation. Teacher could learn from each other. Teachers learn most from their own networks (exchanging ideas from one another). University training institute can play a great role in this by facilitating a means of networking among the teachers. They could also provide knowledge from which people could learn. School and teacher training institutes experience a comparable process. Schools and teacher training institutes can learn from each other's experiences and expertise as well. They experience the same process in designing new education. They have similar question and experiences similar challenges. The cooperation between the teachers and the institute on share responsibility requires a search for as many ways as possible to fulfill this ambition. All these point to the fact that professional training in the subject matter remains important.

7. Components of the Proposed System

The propose system consist of the backend and front-end. The backend of the prototype was developed using Oracle database. The front-end was developed using visual basic and some other third parties application tools to enhance the interface.

7.1. Architecture of the System

In fig 1, i is incremented from 0 to the maximum number of users of the IES whereas n is total number of users of the system i.e. $n = i_{max}$. Access is gained into the main server through the user authentication server. Request is made into the authentication server. The server authenticate the user and if permission is granted by on the predefine level of privileges assigned then the user can used the facility of the server.
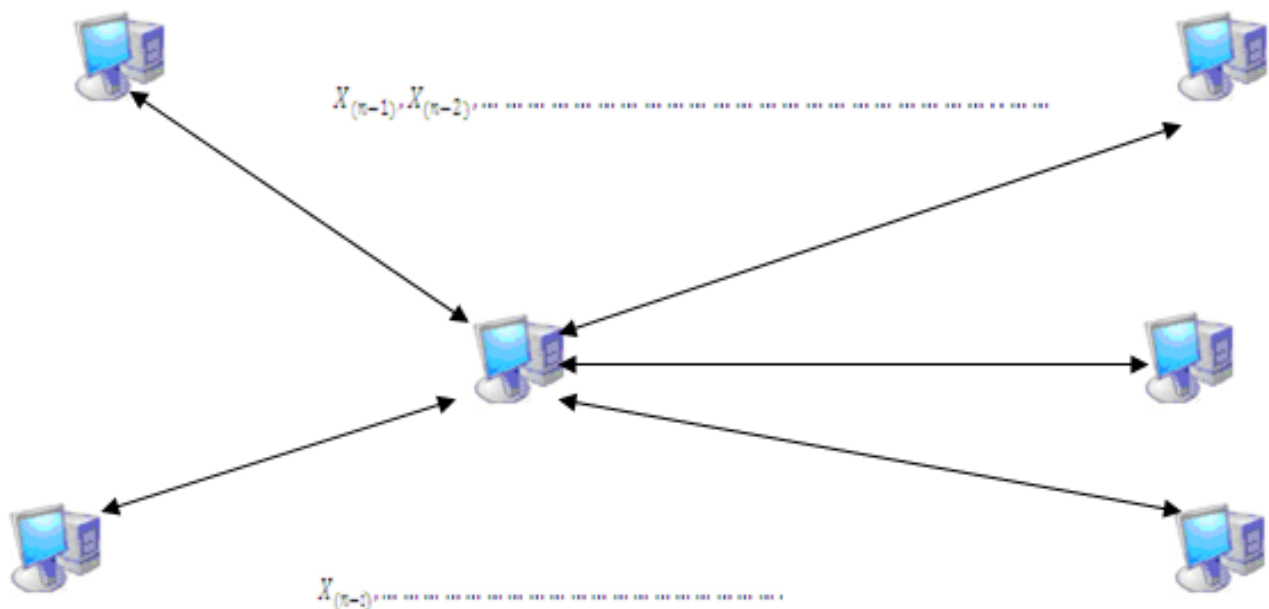

$X_{(n-1)}, X_{(n-2)}$

$X_{(n-2)}$

Figure 1.   Architecture of IES System

7.2. The Backend

The proposed database would consists of some elements of the three broad classes elements given in[6] which consists of data, metadata and processes. Each of the components would, however, be injected with some new classes of sub-elements to make the contents rich and exhaustive for the type of usage we propose. The data elements will typically consist of data elements which include research articles, data set fields, notes, images, lecture materials, monographs, books and link to authors and publishers, Journal addresses and ratings, research(es) in progress, tutorials, experts in different areas, areas open for collaborative studies, etc. Also the data contents in the repositories would be rich enough to act as a reference point for all level of researchers and research institutions around the country and beyond. Also, the data elements in the database would consist of the sources of grants and application areas of the grants. The multimedia components of the database will consists of information about the library itself and the individual components of the library. The third components process will be the function perform over the different types of library.

This component would necessarily include searching, retrieving and adding of information to the database.

7.2.1. Content of the Database

As stated earlier the database consists of latest research in different fields of endeavor across the country and related research in progress. It also consists of monographs, articles, Digital Images, source of grants and other useful materials share in the University System. To compliments those teaching materials and additional module are provided to stimulate testing of students in different topic they learn. This is adaptive learning module.

The following gives some value of the fields and their corresponding attributes:

   i) Security(userid, username, password)

   ii) Current Research(research type, title, keywords, Rtrust, publication details, comments)

   iii) Tutorial (Tutorial Id, Subject Id, module, Contents)

   iv) Research Materials (Material ID, Type, subjects, Content)

   v) Journals (journal Id, author, university Publication Details, related research, comments)

   vi) Journals (journal id, research)

   vii) Research in Progress (Research ID, type, keyword, Expected contribution, comments)

7.3. Design of the Front-end

The design of the database consists of two phases. The first phase consists of the backend which is made up of Oracle database. The use of Oracle offers a distinctive advantage in term of robustness, security, resilient to attack, bug and user level authentication. The relations of the database were normalized to reduce redundancy.

The second component consists of the front-end which is made up of Vb.net environment. The interface should build so as to make way for easy interaction. Thus a user-friendly menu-based interface was design to help access the database.

A typical user of the system is expected to register online in which case a userid is issued to him after he supplied all the necessary details. Each of the research material is assign a unique Id.

The user is expected to enter a unique Id for the research materials which should also be pre-display in a module of the Database. The current research consists of the research Keywords, Research trust, publications details and comments. Similarly research Id, Type, Keyword, expected contribution and comments if any. The database is packed with research materials which consist of known research Id, Type (monograph, journal), subject module and contents which are downloadable. Research journal and link to different research journal sites are previewed.

8. Challenges and Prospects of UEL System

The challenges face here would be of two folds vis-à-vis the human factors and the institutional factors.

From human factor point of view, though the students need

to work independently as far as possible, but the major concerns are as follows:

   i) How would the teacher intervene in the learning process?

   ii) How much ICT knowledge would the teachers needed?

   iii) Whether the teachers should design the teaching material himself or let someone else do it

   iv) How the learning-teaching process would be formed to establish best learning environments?

Teachers require skills like:
   • Creativity
   • Flexibility
   • Logistic skills(e.g. for assigning work and study places and grouping students)
   • Skills for working in projects
   • Administrative and organizational skills
   • Co laboratory skills

A teacher has to posses a specific amount of knowledge if he is to be useful in the modern dispensation. It should be noted that instruction is compulsory if a teacher lacks this knowledge.

The main challenge of this new concept is that the ICT changes fast and teacher need to be continuously acquainted with the latest development and constantly apply it in his teaching.

Also it will be expedient to mention other counter - arguments

   • A variety of learning situations will (continue to) exist in the future. There will be schools and teachers who will hardly use ICT in education.

• Teachers have their own responsibility to acquire some ICT-skills. It is part of their professionalism.

For the successful implementation of the modern concept of training other factors within the school system would be necessary. This has to do with the following:

• Organizational preconditions(vision, policy and culture)

• Personnel support(knowledge, attitude, skills)

• Technical preconditions(infrastructure)

The teacher depends on the specific situation in the school and therefore cannot act autonomously.

In addition to the human factors discussed above the infrastructural decay in Nigeria over the year has compounded the problems associated with this new learning paradigm.

The epilepsy power supply we have in Nigeria is a major impediment to business growth, economic developments and research initiatives of the universities and research institutions. For the e-learning to work there must be streamless supply of electricity. The server which is expected to be distributed needs constants supply of electricity. The students need to browse all the time. As the uploading and downloading of all the material on the system is continuous we need constant source of electricity from the Power Holding Company (PHCN).

Another major challenge is lack of physical infrastructure in most of the universities where this system would be use. We need buildings, computers, internet and software research where the system would be build upon. Also manpower is very essential in the implementation of the system. There should be training and retraining for those who would manage the system. Also students and staff would need to be trained on the usage of the system.

In addition for the system to work there must be systematic appraisal of all the research and research related activities on all the Nigeria Universities and integration of the leaning modes.

Another challenge is the political will from the state, federal and the private institutions/university authorities to cooperate in forming formidable units to implement the model.

The ever decreasing budget and sometimes late release of grants to the universities is one of the greatest impediment to many developmental project in the Nigeria University system This could be a decisive factor as to if the program would be successful or not.

The proposed system offers a unique opportunity for the knowledge of a staff in one university to be shared across the whole nation. Instead of limiting the knowledge of a particular lecturer to a particular university the knowledge is shared across different universities throughout the nation.

Another prospect is the ability to share resources that are hitherto hidden from the research communities. Articles from research findings are readily made available for both student and lecturer digest. You can download lecture material from other Universities. You can get tutorial on the different subjects in diverse field from the database. The system allows you to browse for information about difference topic through the share resources.

The system is particularly useful for students and researchers alike in the area of liberalized study. Students as well as researchers can access the system anywhere and anytime provided there is a network connection. This offer extra advantage over traditional teaching methods where student only rely on what it is taught in class and scanty material available in the library.

Apart from allowing the sharing of knowledge of few scholars in Nigeria Universities, it allows for the preservation of the knowledge. Here the knowledge is preserved and could be used by the coming generation.

The combination of digital contents and Audio stream make virtual learning environment possible. This also will facilitate enhancement in classroom experience and learning process.

9. Conclusions

In this paper we have examined the concept of e-learning in Nigeria university educational system. The huge opportunities are available from e-learning as well as the challenges were discussed. The introduction of IES paradigm as a way of arresting the vastly declining education standard in Nigeria was suggested. We design a conceptual database for the system. We therefore conclude the introduction of e-learning would not only arrest declining standard of education in Nigeria, improve the quality of our students, restore the lost glory of Nigeria educational system, stimulate economic growth, it will also guarantee that our best brain are shared within the nation universities. remain in this country to propel us to attain the elusive millennium goals and endless 'visions'.

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