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A review on Implementation of ICT-Based Education in Nigeria: Limitation and Challenges

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Abstract—Information and Communication Technologies (ICTs) have become commonplace entities in all aspect of life. ICT has fundamentally changed the practices and procedures of nearly all forms of human endeavour and they are playing major roles in work places, business, education, and entertainment. Moreover, many people recognize ICTs as catalysts for change; change in working conditions, handling and exchanging information, teaching methods, learning approaches, scientific research and accessing information. The aim of this study is to explore the concept of ICT, the limitations and challenges of integrating ICTs to education systems. Though within the education system, ICT has begun to have a presence but the impact has not been as extensive as in other fields.

Index Terms—Information and Communication Technology (ICT), Education, school, pedagogy Teachers and Students.

1 Introduction

Information Communication Technologies (ICT) refers to computers and internet connections used to handle and communicate information for learning purpose. In other words, ICTs is a technology that supports activities involving the creation, storage, manipulation and communication of information. ICT enables us to record, store, process, retrieve and transmit information. It encompasses modern technologies such as computers, telecommunications, internet, facsimile and microelectronics, this include older technologies such as mechanical accounting machines, printer, etc.

Information and Communication Technology (ICT) are making dynamic changes in the society. They are influencing all aspects of life. The influences are felt more and more at schools, because ICTs provide both students and teachers with more opportunities in adopting learning and teaching methods that have greatly improve the education sector, just as ICTs are transforming service delivery in other sectors (e.g. banking, health services etc.) [17]. Education is one of the main keys to economic development and improvements in human welfare. As global economic competition grows sharper, education becomes an important source of competitive advantage, closely linked to economic growth, and a way for countries to attract jobs and investment. In addition, education appears to be one of the key determinants of lifetime earnings. Countries therefore frequently see raising educational attainment as a way of tackling poverty and deprivation.

There are however, many constraints on delivering education to the right people at the right time. In developing countries (like Nigeria), there is frequently a shortage of qualified school teachers, money for books and teaching materials may be scarce for people living in dispersed communities in the rural areas. In developed countries (like United Kingdom), money is also a problem because the cost of university education has risen sharply and students are expected to meet all or part of the cost directly. Students who are already in full-time employment find it hard to take part in a university course offered at conventional times of the day, while employers willing to train staff are often conscious of the costs of taking people away from their main job in order to attend training courses. They are therefore eager for more efficient and flexible ways to train their employees [4]. All these factors have encouraged an interest in the use of ICTs to deliver education and training in a convenient ways. Computers began to appear in schools and universities classrooms in the advanced countries around 1980s. Broadband connections to schools and universities became common things in developed countries in the second half of the 1990s. In developing countries like Nigeria, computers and internet connections are very expensive and limited. This is not necessarily a bad thing, as it allows the developing countries to learn from the investments of the developed countries.

Initially, educators saw the use of ICTs in the classroom mainly as a way to teach computer literacy. Most now see a broader role in the use of ICTs in delivering many kinds of learning at lower cost and with higher quality than traditional methods of teaching. In addition, schools and universities increasingly use ICTs, as do other large organizations, to reduce the costs and improve the efficiency of administration [12]. Information and Communication Technology in today's world refers to those technologies that determine the efficiency and effectiveness with which we communicate and the devices that allow us to handle information, Tinio [13], states that the potentials of ICTs is to increase access and improve relevance and quality of education in developed and developing countries. ICTs greatly facilitate the acquisition and accumulation of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policies formulation and execution, and widen the range of opportunities for students and the teachers [8].

ICTs have revolutionized the way people work today and it is now transforming education systems. Jegede [6], state that the trainings in ICT that teachers received had similar contents irrespective of the training provided, the trainings had not impacted on classroom practices as mere word and data processing skills have been the major emphasis but a more focused and teacher-targeted ICT training content freely

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delivered is what is need now in Nigeria Universities in order to compete well with the developed countries. As a result, if schools train students in yesterday's skills and technologies they may not be effective and fit in tomorrow's world [18]. This is a sufficient reason for ICTs to win global recognition and attention. For instance, ICTs are dependable tools in facilitating the attainment of one of the Millennium Development Goals (MDGs), which would be the achievement of universal primary education by the year 2015. Kofi Anan, the former United Nations Secretary General, points out that in order to attain the goal of Universal Primary Education by the year 2015, we must ensure that Information and Communication Technologies unlock the door of education systems [14]. This indicates the growing demand and increasingly important place that ICTs could receive in education.

2 THE CONCEPT OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

The term information and communications technology was introduced in the early 1990s to replace that of Information Technology (IT) in recognition of the communicating abilities and facilities offered by the computer. However, while most people adopted the term ICT, people in higher education used the term Communication and Information Technology (C & IT) to refer to the same concept. Akudolu [1] clearly opines that ICT "refers to a broad field encompassing computers, communications equipment and the services associated with them." ICT is not just considered as applications and systems but also as skill for life. In this sense it is regarded in line with literacy and numeracy as a fundamental skill which every individual needs so as to live confidently, effectively and independently in a modern society [3]. This identification of ICT as a skill for life informed its introduction in the school curriculum in the developed nations. ICT has three positions in the education curriculum:

i. learning about ICT,
ii. learning with ICT and
iii. learning through ICT,

learning about ICT refers to ICT concept as a subject of learning in the school curriculum while learning with ICT is concerned with the use of ICT as a medium to facilitate instruction and learning through ICT refers to the integration of ICT as an essential tool into a course/curriculum, such that the teaching and learning of that course/curriculum is no longer possible without it" [11].

This implies that ICT can be learnt as any other subject in the curriculum. It can be an instructional medium or a source of learning. It can also be integrated in the learning process so that learning takes place through the learner's interaction with the facilities. Therefore ICT in education is considered as discipline, resource and key skill. Within these three broad areas, ICT offers enormous benefits to the society.

It is in this regard that current reform programmes being implemented in different parts of the world such as the NEEDS' Education Reform Programme (NERP) and Millennium Development Goals (MDGs) recognize the place of ICT in the overall strategies for achieving stable economic development [1].

The chat shown in figure 1.1 is the order in which ICT flow in Nigeria Educational System especial within the two Universities used as a case study (Ekiti State University, Ado - Ekiti and Federal University of Technology, Akure). ICT has changed the way learning is being imparted in educational institutions. The key stakeholders of ICT in educational institutions include students, teachers, administrator, regulatory authority (State/Federal Government or Private organizations) and Parents or Guidance. Students and teachers benefit from anywhere and anytime learning, while ICT enable effective management of data resulting in increased transparency and easier management of data at low cost. With the aid of ICT, virtual universities offer opportunities to students in distant areas to gain education and disseminate information across the rural parts of the country. The virtual class consists of interactive multimedia modules on the internet, which helps in standardizing the distribution of education, irrespective of the teacher availability [9].

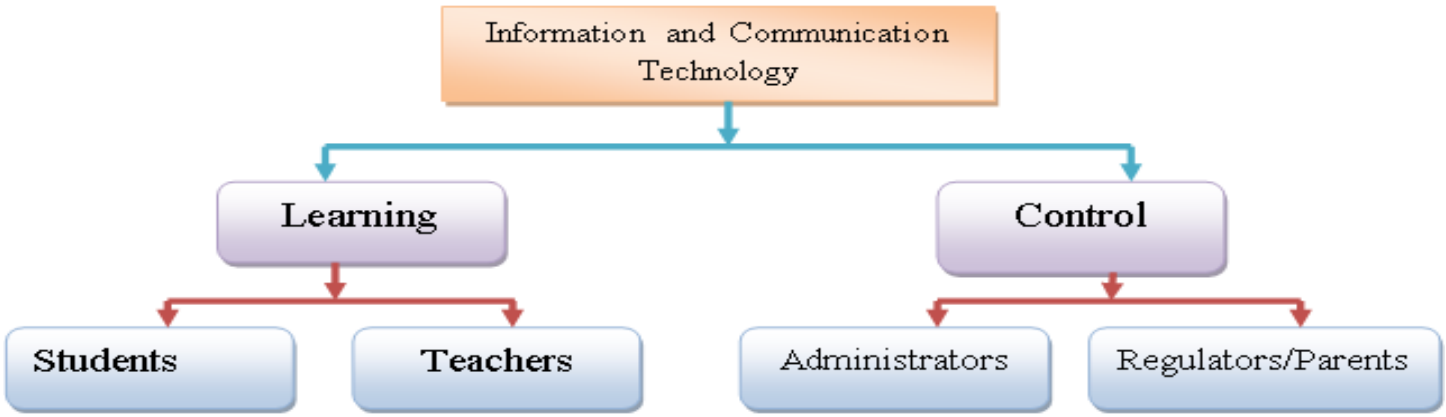

Fig. 1. Information and Communication Technology Educational chart

The potential for using ICTs well in education sector depends on a number of factors that differ from one country to another, and especially between developed and developing countries. It is important for countries to bear these differences in mind when making decision and planning investments on ICT. What works in a country like USA with high levels of

computer access and low telephone and Internet connection costs will not necessarily transfer to somewhere like Nigeria with few computers and expensive connection charges. One of the most important differences between countries is the availability of Hardware and Software. Pelgrum and Law [11] claim that the issue of 'computers in education' started to become popular in educational policy-making in the late 1980s, when relatively cheap microcomputers became available for the consumer market. Computers are spreading rapidly in schools not just in developed countries, but also in developing ones as well. However, schools have been using computers in classrooms for almost two decades but, ways to use them effectively have evolved slowly and patchily. Schools use ICTs in two ways:

i. for administration and routine tasks of classroom management, and
ii. for instruction

In the classroom, they have two main instructional roles: for teaching ICT skills and as a tool for teaching other subjects. Probably the most incontrovertible benefit of computers in schools has been in easing administrative chores. For example, teachers no longer need to pass round bundles of end-of-term reports in paper envelopes, but can fill them in on screen(through the school portal) and often deliver them safely to parents online. Data on students' attendance and performance can be more easily recorded and analysed. The use of ICTs for administration and routine tasks for classroom management seems to have developed just as quickly, or quicker, than their use of ICT for instruction in most of the developing countries like Nigeria [4]. The use of ICTs to make administration more efficient may also raise the overall quality of education. For instance, if teachers spend less time on administrative tasks, they will have more time for teaching and for preparing materials. So using ICTs to improve administration will save the time academic staff spend on administrative matter and be able to increase time spend on teaching. This is a gain that evaluators rarely consider, however it may be the area on which schools should concentrate on, rather than chasing the more elusive benefits of ICTs in teaching. Teachers can download material created by other teachers and made it available to students, for instance finding material in different languages for language classes and for student to get research materials online. Schools also use classroom management software, through which the teacher controls the computers on which students work: teachers can give students assignments to work on, and at the same time see what they are doing, which is important when class sizes grow.

3 THE ROLES AND BENEFITS OF ICT IN EDUCATION

ICT is making major differences in the learning and teaching approaches. Schools in the Western World invested a lot for ICT infrastructures over the last 20 years, and students use computers more often and for a much larger range of applications [15]. Several studies reveal that students using ICT facilities mostly show higher learning gains than those who do not use. For instance, Mikre [8] finding across 75 studies in the United States showed the following:

Students who used computer tutorials in mathematics, natural science, and social science score significantly higher on tests in these subjects. Students who used simulation software in science also scored higher. The findings also indicated that primary school students who used tutorial software in reading scored significantly higher on reading. Very young students who used computers to write their own stories scored significantly higher on measures of reading skill. Moreover, students who used word processors or otherwise used the computer for writing, scored higher on measures of writing skill.

Furthermore, the use of ICTs in education also shifts the learning approaches, there is a common belief that the use of ICTs in education contributes to a more constructivist learning and an increase in activity and greater responsibility of students. This limits the role of teachers to support, advice, and coaching students rather than merely transmitting knowledge. The gradual progress in using computers changes from learning about computers, to learning computers, and finally to learning with computers [15].With respect to introduction of ICT technologies in schools, teachers' reluctance to adopt the innovations in developing countries, need to be encourage to see the context of the new technology and show more commitments on how it will improve their teaching methods. Watson [18], states that change or improvement can happen at schools if teachers understand themselves and understood by others. For instance, many teachers are currently not in a position to make informed judgements on ICTs to support their teaching goals. Jegede [5], investigated on the relationship between ICT attitudes, attitudinal constructs and competence of some selected Nigerian teachers, the study reviewed that there is a significant relationship between attitudes toward ICT and competence. The research also showed that the attitudinal constructs that would predict ICT competence include perceived control factor as well as affective component.

In recent years however, there has been a growing interest to know how computers and internet can best utilized to improve effectiveness and efficiency of education at all levels and in both formal and non-formal settings. As there is a shift of theories explaining learning processes and ICTs become handmaiden for learning activities. The major roles that distinguished ICTs as an object for study, an aspect of a discipline or a profession is the medium in which the instruction is been disseminate [10]. Mikre [8] differentiated between traditional learning setting and constructivist approaches. The former considers learning as transmission of knowledge to students, which is the sole responsibility of the teacher. On the other hand, the constructivist approach considers learning as authentic and learner centred. ICT (computer for example) is a greater help in the constructivist approach, where one can design simulated and individualized learning environments to students. ICTs are exerting impacts on pedagogical approaches in the classrooms. Their contribution to changes in teaching practices, school innovation, and community services is considerable. A research review by Kozma [7], suggests three significant concerns for consideration regarding ICTs impact on

education:

Firstly, student outcomes such as higher scores in school subjects or the learning of entirely new skills needed for a developing economy. Secondly, we should consider teacher and classroom outcomes such as development of teachers' technology skills and knowledge of new pedagogic approaches as well as improved attitudes toward teaching.

TABLE 1
OVERVIEW OF PEDAGOGY IN THE TRADITIONAL METHOD VERSUS INFORMATION TECHNOLOGY METHOD

Aspect	Traditional pedagogy	Emerging pedagogy for the information technology
Active learning	Activities prescribed by teacher	Activities determined by learners
	Whole class instruction	Small group involved
	Little variation activities	Many different activities
	Students have direct contact with Teachers	Students may not see the Teachers
	Pace determined by the programme	Pace determined by learners
Collaborative	Individual	Working in teams
	Homogenous groups	Heterogeneous groups
	Limited Information available	Unlimited Information available for learner
	Every one for him/herself	Supporting each other
Creative	Reproductive learning	Productive learning
	Low creative skills	High creative skill
	Apply known solutions to problems	Find new solutions to problems
Integrative	No link between theory and practice	Integrating theory and practice
	Separate subjects	integration between subjects
	Discipline based	Thematic
	Individual teachers	Teams of teachers
Evaluative	Traditional pedagogy	Emerging pedagogy for the information society

Finally, one has to consider other outcomes such as increased innovativeness in schools and access of community members to adult education and literacy.

The table below presents comparison of the traditional pedagogy era and the emerging pedagogy of Information Technology era that fits to the use of ICT (particularly computers and internet) to increase student involvement in learning. This was based on observation and interaction with both staff and students in the universities selected for this research. Emerging pedagogy is the name given to the new view of constructivist learning when compared to the relatively long existing behaviourist view of learning. This also clearly elaborates the role of ICTs in facilitating the developing countries schools in on information Technology era.

Active learning: - ICT-enhanced learning mobilizes tools for examination, calculation and analysis of information in order to provide a platform for student inquiry and construction of new information. The learners therefore, learn as they do and whenever appropriate, work on real-life problems in-depth. Moreover, ICT makes the learning less abstract and more relevant to their life situations. In contrast to memorization-based or rote learning, which is the feature of traditional pedagogy; ICT-enhanced learning can also be 'just-in-time' learning that the learners choose what to learn when they need.

Collaborative learning: - ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modeling real world interactions, ICT-supported learning provides opportunity to work with students from different cultures, includes learning done throughout the learner's lifetime by expanding the learning pace to include not just peers but also mentors and experts from different fields.

Creative learning: - ICT-supported learning promotes the manipulation of existing information and the creation of real-world products rather than the duplication of received information.

Integrative learning: - ICT-enhanced learning promotes a thematic integrative approach to teaching and learning. This approach eliminates the artificial separation between the different disciplines and between theory and practice, which characterizes the traditional approach.

Evaluative learning: - ICT-enhanced learning is directly to students and the teachers. Unlike static, text or print-based education, it recognizes the presence of different learning pathways to explore and discover rather than merely listen and remember.

ICT is becoming more fitting to realize and implement the emerging pedagogy of constructivism. Nevertheless, an International study by Voogt and Pelgrum [15] shows a major obstacle for ICT integration in education and the difficulty of integrating computers and internet into classroom practices. The teachers' lack of competence and enthusiasms to use computers in the instructional processes also contribute for the difficulty. However, in order to improve, and make optimal use of ICTs, changes in the pedagogic approaches and classroom strategies as well as integrating ICT in teacher training and staff development practices accompanied by

teacher motivation schemes are imperative.

However, the benefits of ICTs in the classroom and educations process are:

i. Offer the opportunity for more student centred teaching,
ii. Provide greater opportunity for teacher-to-teacher and student-to-student communication and collaboration,
iii. Give greater exposure to vocational and workforce skills for students,
iv. Provide opportunities for multiple technologies delivered by teachers,
iv. Create greater enthusiasm for learning amongst students,
v. Provide teachers with new sources of information and knowledge,
vi. Prepare learners for the real world,
vii. Provide distance learners country-wide with online educational materials
ix. Provide learners with additional resources to assist resource-based learning
x. Producing people capable of working and participating in the new economies and societies arising from ICTs and related developments,
xi. Leveraging ICT to assist and facilitate learning for the benefit of all learners and teachers across the curriculum,
xii. Improving the efficiency of educational administration and management at every level from the classroom, school library, through the school and on to the entire sector as a whole,
xiii. Broadening access to quality educational services for learners at all levels of the education system.

4 LIMITATIONS OF ICT IN EDUCATION

ICT as a modern technology that simplifies and facilitates human activities is not only advantageous in many respects, but also has many limitations. Many people from inside and outside the education system, think of ICT as "Panacea" or the most important solution to school problems and improvements. However, many conditions can be considered as limitations of using ICT in education. The limitations discovered from two school used for this research can be categorized as teacher related, student related, and technology related. All of them potentially limit the benefits and positive impact of ICT on education.

1. Teachers' attitude plays an important role in the teaching-learning process that utilizes computers and internet connections. Although teachers' attitude towards the use of these technologies is vital, many observations reveal that most of teachers do not have clarity about how far the technology can be beneficial for the facilitation and enhancement of learning. Of course, some teachers may have positive attitudes to the technology, but refrain from using it in teaching due to low self-efficacy, tendency to consider themselves not qualified to teach with the technology. Moreover, as identified by Brosnan [2] attitude, motivation, computer anxiety, and computer self-efficacy are factors affecting teachers' to make use of computers in their lessons. Teacher resistance and lack of enthusiasm to use ICT in education may also be another limitation. Furthermore, many teachers may not have the required IT skills and feel uncomfortable, nor do they have trainings needed to use the technology in their teaching. Unless teachers develop some basic skills and willingness to experiment with students, the use of ICT in education is in a disadvantage.

2. The limitation of using ICT in education is also related to student behaviour. Appropriately, the use of computer and the internet by students have significant positive effects on students' attitude and their achievement. Nonetheless, it is very common to observe limitations related to student behaviour. Students tend to misuse the technology for leisure time activities and have less time to learn and study. The use of online gaming, Facebook, Skype, chatting and other communication channels drawbacks the use of ICT in education, because students easily switch to these sites at the expense of their study. Internet access at home, for instance, may be a distraction because of chat and online games, reducing the time spent in doing assignments and learning. Therefore, the impact of availability of ICT on student learning strongly depends on its specific uses. If ICT is not properly used by the students, the disadvantage will overweight the advantage. For example, while students use the internet, it may confuse them by the multiplicity of information to choose from. As a result, the teacher spends much time to control students from websites unrelated to the learning content. Then, for caution, it is important to identify the major limitations of using ICT in education as related to student behaviour [12]. Most literatures in Information Technology (IT) identify the following limitations of ICT used in education as related to student behaviour:

i. Computers limit some students imaginations,
ii. Over-reliance on ICT limits students critical thinking and analytical skills,
iii. Students often have only a superficial understanding of the information they download,
iv. Computer-based learning has negative physical side-effects such as vision problem,
iv. Students may be easily distracted from their learning by visit uneducated sites,
vi. Students tend to neglect other learning resources and focus mainly on computer and internet,
viii. Students focus on superficial presentations and copied information from the internet,
ix. Students may have less opportunity to use oral skills and hand writing,
ix. The use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher.

3. The other limitation of ICT in education is technology related, this is the major challenges facing developing countries. High cost of the technology and maintenance of the computer and internet facilities, high cost of spare parts, virus attack of the software, interruptions of internet connections, high cost of bandwidth and poor supply of electric power in developing country like Nigeria are among the technology related limitations of using ICT in education [13].

5 Challenges of ICTs Integration in Education

Integration of ICTs into the education systems in developing countries may face various challenges with respect to different policies introduce by different governments, planning, infrastructure, learning content and language, capacity building and financing [17]. The most common challenges of ICT integration are:

1. The infrastructure challenges that may exist are the absence of appropriate buildings and rooms to house the technology, shortage of electric power supply, telephone lines, bandwidth, network devices, and lack of the different types of ICTs equipment's. Due to all these, one need to deal with infrastructure related challenges before planning of ICTs integration into education systems.
2. Lack of the ICT knowledge by Policy makers, they need to know the potentials of ICTs by applying different contexts for different purposes. Other challenging points at the level of policy and planning are identification of stakeholders and harmonization of efforts across different interest groups, the piloting of chosen ICT-based model, and specification of existing sources of financing and the development of strategies for generating financial resources to support ICT over the long term.
3. With respect to challenges of capacity building, we have to develop competencies of teachers and school administrators for the successful integration of ICT in the education system. In fact, one impeding factor of ICTs integration in education systems is the skill gap of people implementing it (Tinio, 2003). For instance, teachers need professional development to gain skills with particular applications of ICT, integration into existing curricula, curricular changes related to the use of Information Technology (IT), changes in teacher role, and on underpinning educational theories such as constructivism or student-centred learning. Because of this, any attempt of ICT integration in education must be parallel with teachers' professional development.
4. Education administrators also play a key role in the integration of ICT in education. Lack of support from the school administration is also a big challenge. Thus, for the effectiveness of ICT integration, administrators must be competent and have a broad understanding of the technical, curricular, administrative, financial aspect, and social dimensions of using ICT in education because Leadership plays a key role in ICT integration in education. For ICT integration programs to be effective and sustainable, administrators themselves must be competent in the use of the technology.
5. Furthermore, learning content and language also challenge the integration of ICT into educational system in developing countries because of different dialect for each ethnics group. We have to care for the relevance of the learning content to the target groups, with respect to language, English is the dominant language in many of educational software, while English language proficiency is not high in many of the developing countries, and this is one barrier in the integration of ICT to education (Mikre, 2011).
6. The greatest challenge of integrating ICT into education system is the finance, ICTs in education programs require large capital investment and developing countries need to predict the benefit of using ICT and balance the cost relative to the existing alternatives. In most developed and some developing countries, the potential sources of money and resources for ICT are grants, public subsidies, fund-raising for ICT programme, kind support from volunteers, community support, revenues earned from core business, and revenues earned from ancillary activities.

6 Conclusion and Recommendation

Education provides an opportunity to improve the lives of the people. The need to use new technologies to raise the quality and efficiency of education cannot be overemphasized. It is imperative that we expose students, teachers and school administrators to ICT in order to improve the quality of education and technical proficiency, thus leading to increased productivity and accelerated development. ICT technologies are influencing all aspects of life including education. They are promoting changes in working conditions, handling and exchanging of information, teaching-learning approaches and so on.

ICTs are making major differences in the teaching approaches and the ways students are learning. ICT enhanced learning environment that facilitates active, collaborative, creative, integrative, and evaluative learning as an advantage over the traditional method. In other words, ICT is becoming more appropriate in the realization and implementation of the emerging pedagogy of constructivism that gives greater responsibility of learning for students. ICT use in education systems of developed nations has comparatively advanced than ICT use in education systems of developing nations. This paper strongly recommends the mainstreaming of ICT utilization (particularly the computer and internet) in education systems at all levels, for they benefit curriculum implementation and enhanced student learning. Therefore, education policy makers, educators and all concerned should evaluate and recognize the benefits, limitation and challenges of ICT in education in order to work for the effective functioning of this technology in educational systems. To promote the development and implementation of ICT in Nigeria educational system, the following recommendations are made:

i. ICT Education should be compulsory in all schools, from nursery to tertiary institutions.
ii. Serving teachers and school administrators should be given the opportunity within a specific period to become ICT literate through in service education.
iii. The State and Federal Ministries of Education should ensure the provision of electricity in every school.
iv. The over-dependence of educational institutions on government for everything has limited institutions' ability to partner with the private sector or seek alternative funding sources for ICT educational initiatives.
iv. Resistance to change from traditional pedagogical methods to more innovative, technology-based teaching and learning methods, by both students and lecturers is another area that needs to be corrected.
v. Inadequate ICT infrastructure including computer hardware and software, and bandwidth/access, in order to overcome these challenges, government should

ensure the provision of basic ICT facilities in all schools.

vi. Skilled manpower in computer need to be employed, to manage available systems and ensure frequent training of teachers, students and school administrators on how to apply ICT in teaching, learning and management process in the schools.

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