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**The Role of Engineering and  
Technology Research in the  
Realization of the MDG's**

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### **Abstract**

*The Millennium Development Goals (MDGs) are broad statements of socio-economic development targets that were adopted by member countries of the United Nations (UN) at its General Assembly in the year 2000. By their adoption of the MDGs, the governments of the signatory countries, of which Nigeria is one, are committed to achieving by 2015 eight specified goals. The focus of this paper is to generate recommendations for making ICT contribute maximally to the fulfillment of the Millennium Development goals in Nigeria in the area of education. In this paper comparative analysis was done between the use of the traditional method of teaching and knowledge impartation in primary and post-primary schools and the deployment of ICT facilities for the same purpose. It was observed that pupils taught using ICT facilities had quick understanding and performed better than pupils taught using the traditional teaching method. We therefore recommend from our findings that, there should be mass deployment of ICT facilities in schools in order to fast-track the attainment of MDGs in the area of education.*

*Keywords: Education, ICT, MDGs, Development, Teaching.*

## **1 Introduction**

Education for all by the year 2015 is a slogan we are all used to; Universal basic education (UBE) is one of the measures the present government of Nigeria intends to utilize in accomplishing the millennium goal of education. UBE stresses the inclusion of girls and women and a number of underserved groups: the poor, street and working children, rural and remote populations, nomads, migrant workers, indigenous peoples, minorities, refugees, and the disabled. It is worthy to note that the progress of any country depends upon the quality of education offered and its practices. Recent developments in technology have changed the world outside the classroom; it is more eye-catching and interesting for a student than the classroom setting. As a result, students find the traditional classroom instructions as dull and devoid of life and do not interest them for learning. The second goal of MDG cannot be realized if the students are not interested, integration of ICT in education will bring about the realization of this goal.

## **2. Information and communication technologies (ICT)**

ICT is a diverse set of technological tools and resources used to communicate, to create, disseminate, store, and manage information (Blurton, 2002). These technological tools and resources include computers, the Internet, broadcasting technologies (radio and television), and telephony as well as newer digital technologies such as computers and the Internet. ICT tools and resources have been touted as potentially powerful enabling tools for educational change and reform. When used appropriately, different ICTs are said to help expand access to education, strengthen the relevance of education to the



increasingly digital workplace, and raise educational quality by, among others, helping make teaching and learning into an engaging, active process connected to real life (Jung, 2002).

The present society is increasingly dependent on electronic information and communications. Large quantities of information are available and transaction can take place remotely. ICT has become part of the society for communication between people, searching for entertainment and education, virtual meeting place, shopping and many more. Thus ICTs in education plays a very important role to provide the platform and strong foundation to people.

ICTs in education can be considered in three key ways: ICT Integration, ICT Equipment, and ICT Foundation Skills (Victoria, 2010). ICT Integration should be the main goal of any ICTs in education intervention. When we know our goals, we can then consider what type of equipment would be most appropriate for these goals. And when we know what equipment will be utilized, we can determine the basic skills which teachers and students require to work with these tools towards the integration and achieving the set goals.

### 3. The Millennium Development Goals (MGDs)

The Millennium Development Goals (MGDs) is a broad statements of socio-economic development targets that were adopted by member countries of the United Nations (UN) at its general Assembly in the year 2000 (United Nations Organisation, 2010). By their adoption of MDGs, the governments of the signatory countries of which Nigeria is one are committed to achieving by 2015 eight specified goals which include:

1. Eradicate extreme poverty and hunger
2. Achieve universal basic education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDs, malaria and other disease
7. Ensure environmental sustainability and
8. Develop a global partnership for sustainable development.

The progress of any country depends upon the quality of education offered and its practices, the recent developments in technology have changed the world outside the classroom; it is more eye-catching and interesting for a student than the classroom setting. As a result, students find the traditional classroom instructions as dull and devoid of life and do not interest them for learning. The second goal of MDG cannot be realized if the students are not interested, integration of ICT in education will make realization of the goals a reality.

### 4. Comparative analysis Between ICT based Education and Traditional Method of Education

The millennium development goal on education aims to achieve universal basic education by the year 2015. The degree to which ICT have helped expand access to basic education since the intervention have been under reported. Some of the comparative advantages of ICT use in education include;

1. Project CHILD (Computers Helping Instruction and Learning Development) is a computer-integrated instruction programme developed in 1988 by the University of Florida for grades K-5 (pre-school and primary school). The programme focuses on three subject areas—reading, writing and mathematics. Each Project CHILD classroom has a learning station with between three to six computers. Over a decade's worth of research on Project CHILD students have shown that they have scored consistently higher on standardized tests than their counterparts in traditional classrooms, and that the positive effects of the programme have increased over time.
2. In higher education and adult training, there is evidence that educational opportunities are being opened to individuals and groups who are constrained from attending traditional universities. Report from the world mega universities i.e, the Open University of the United Kingdom, the Indra Gandhi National Open University of India, the China TV University System, the Universities Terbuka of Indonesia, and the University of South Africa, among others) has an annual enrollment of more than 100,000, and together they serve approximately 2.8 million. Compare



- that with the 14 million combined enrollment of the 3,500 colleges and universities in the United States (Potashnik, 2002).
- Of the many educational broadcast projects in the US, the Interactive Radio Instruction project has been the most comprehensively analyzed. Findings provide strong evidence of the project's effectiveness in raising the quality of education as demonstrated by increased scores on standardized tests as well as improved attendance. (Perraton, 2002). Barney and friends have been known to keep our children indoors and educated.
  - Fouts, (2002) in his research work proved that Students learn more quickly, demonstrate greater retention, and are better motivated to learn when they work with computers.

Table 1. Overview of Pedagogy in the Industrial (Traditional) versus the Information Society

Aspect	Less (‘traditional pedagogy’)	More (‘emerging pedagogy’ for the information society)
Active determined by learners	<ul style="list-style-type: none"> <li>• Activities prescribed by teacher</li> <li>• Whole class instruction</li> <li>• Little variation in activities</li> <li>• Pace determined by the programme learners</li> </ul>	<ul style="list-style-type: none"> <li>• Activities</li> <li>• Small groups</li> <li>• Many different activities</li> <li>• Pace determined by</li> </ul>
Collaborative	<ul style="list-style-type: none"> <li>• Individual</li> <li>• Homogenous groups</li> <li>• Everyone for him/herself</li> </ul>	<ul style="list-style-type: none"> <li>• Working in teams</li> <li>• Heterogeneous groups</li> <li>• Supporting each other</li> </ul>
Creative	<ul style="list-style-type: none"> <li>• Reproductive learning</li> <li>• Apply known solutions to problems problems</li> </ul>	<ul style="list-style-type: none"> <li>• Productive learning</li> <li>• Find new solutions to</li> </ul>
Integrative practice	<ul style="list-style-type: none"> <li>• No link between theory and practice</li> <li>• Separate subjects</li> <li>• Discipline-based</li> <li>• Individual teachers</li> </ul>	<ul style="list-style-type: none"> <li>• Integrating theory and</li> <li>• Relations between subjects</li> <li>• Thematic</li> <li>• Teams of teachers</li> </ul>
Evaluative	<ul style="list-style-type: none"> <li>• Teacher-directed</li> <li>• Summative</li> </ul>	<ul style="list-style-type: none"> <li>• Student-directed</li> <li>• Diagnostic</li> </ul>

Source: Thijs, A., et al. learning through the Web (Victoria, 2010)

### 5. The Benefits Derivable in use of ICT in Education

ICTs have the potential for increasing access to and improving the relevance and quality of education. It represents a potentially equalizing strategy for developing countries. The benefits in enhanced learning, perceived relevance and enriched education experiences are enormous.

#### 1. Renewed interest in Education:

Students are increasingly using digital media. The reality is that in many countries use of digital media take up many hours in a student's day. In order to reach them, it will be increasingly important for education to find ways to convert as many of those hours as possible into teaching and learning opportunities. The interactive whiteboards are replacing blackboards, electronic pens replace chalk, digital books and documents are replacing print, and literacy now embraces the ability to create and respond to video, music and art as well as text. ICTs such as videos,



television and multimedia computer software that combine text, sound, and colorful, moving images can be used to provide challenging and authentic content that will engage the student in the learning process. Interactive radio likewise makes use of sound effects, songs, dramatizations, comic skits, and other performance conventions to compel the students to listen and become involved in the lessons being delivered.

2. **Personalized learning:**  
ICT based education systems are increasingly investigating the use of technology to better understand a student's knowledge base from prior learning and to tailor teaching to both address learning gaps as well as learning styles. This focus has helped to adjust content and pedagogy based on individual student needs – both strong and weak.
3. **Teacher manager/mentors:**  
Through introduction and adoption of ICT tools and resources, the role of the teacher in the classroom will be transformed from that of the font of knowledge to an instructional manager helping to guide students through individualized learning pathways, identifying relevant learning resources, creating collaborative learning opportunities, and providing insight and support both during formal class time and outside of the designated 40 minute instruction period.
4. **Expand Access to Education:**  
ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus. With eLearning, qualified students in developing countries who can't get a third level qualification because of limited physical infrastructure might join extra-mural programs and further their educations. One defining feature of ICTs is their ability to transcend time and space. ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners. Online course materials, for example, may be accessed 24 hours a day, 7 days a week.
5. **Access to Learning Materials:**  
With the deployment of ICT tools and resources, both teachers and students no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at anytime of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries, and even some in developed countries, that have limited and outdated library resources. ICTs also facilitate access to resource persons— mentors, experts, researchers, professionals, business leaders, and peers—all over the world.
6. **Prepare Students for the Work place:**  
One of the most commonly benefits to be derived from the use of ICTs in the classroom is to better prepare the current generation of students for a workplace where ICTs, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus representing a competitive edge in an increasingly globalizing job market. Technological literacy, however, is not the only skill well-paying job in the new global economy will require. EnGauge of the North Central Regional Educational Laboratory (U.S.) has identified what it calls "21st Century Skills," which includes digital age literacy (consisting of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy, and global awareness), inventive thinking, higher-order thinking and sound reason



Table 2. Skills Needed in the Workplace of the Future

Digital Age Literacy

Functional literacy	Ability to decipher meaning and express ideas in a range of media; this includes the use of images, graphics, video, charts and graphs or visual literacy
Scientific literacy	Understanding of both the theoretical and applied aspects of science and mathematics
Technological literacy	Competence in the use of information and communication technologies
Information literacy	Ability to find, evaluate and make appropriate use of information, including via the use of ICTs
Global awareness	Cultural literacy Appreciation of the diversity of cultures Understanding of how nations, corporations, and communities all over the world are interrelated
<b>Inventive Thinking</b>	
Adaptability	Ability to adapt and manage in a complex, interdependent world
Curiosity	Desire to know
Creativity	Ability to use imagination to create new things
Risk-taking	Ability to take risks
<b>Higher-Order Thinking</b>	Creative problem-solving and logical thinking that result in sound judgments
<b>Effective Communication</b>	
Teaming	Ability to work in a team
Collaboration and interpersonal skills	Ability to interact smoothly and work effectively with others
Personal and social responsibility	Be accountable for the way they use ICTs and to learn to use ICTs for the public good
Interactive communication information	Competence in conveying, transmitting, accessing and understanding information
High Productivity desired	Ability to prioritize, plan, and manage programs and projects to achieve the results Ability to apply what they learn in the classroom to real-life contexts to create relevant

Source: Adapted from EnGauge. North Central Regional Educational Laboratory. (Victoria, 2010)

7. Enhanced Teacher Training:  
ICTs have also been used to improve access to and the quality of teacher training. For example, institutions like the Cyber Teacher Training Center (CTTC) in South Korea are taking advantage of the Internet to provide better teacher professional development opportunities to in service teachers. The government-funded CTTC, established in 1997, offers self-directed, self-paced Web-based courses for primary and secondary school teachers. Courses include "Computers in the Information Society," "Education Reform," and "Future Society and Education." Online tutorials are also offered, with some courses requiring occasional face-to-face meetings (Thornburg, 2000). In China, large-scale radio and television-based teacher education has for many years been conducted by the China Central Radio and TV University, the Shanghai Radio and TV University and many other RTVUs in the country. At Indira Gandhi National Open University, satellite-based one-way video- and two-way audio-conferencing was held in 1996, supplemented by print-materials and recorded video, to train 910 primary school teachers and facilitators from 20 district training institutes in Karnataka State. The reports are enormous.

6. Infrastructure and Instruments, Prima Facie to Education Development Goals

There are basic Infrastructures that have to be put in place by any nation that desires to meet the millennium goals in Education, the key infrastructures and instruments required include;

- (i) **Energy:**  
Adequate power supply is a major infrastructure that holds the life line to technological and industrial breakthrough. Best practices cannot be implemented without this vital resource. The Government while working on meeting the energy needs of this nation can also look at the means of providing this infrastructure by use of renewable sources of energy; this include small solar energy plants for educational institutions (primary to tertiary)
- (ii) **Collaboration:**  
Development of collaboration between ICT industry and educational institutions through training research development and capacity building is of vital importance. This collaboration should involve universities and research institutions where challenges are collectively resolved and update done for sustainable development.
- (iii) **ICT Based Curricula:**  
There is the need to develop and implement an ICT based curricula in our educational institutions, with measures put in place for continuous review and update. ICT has to be an essential part of the curricula and well as learning tools, this will improve the quality of learning process to meet with international standards and modern challenges.
- (iv) **Qualified Personnel:**  
Development of qualified teachers is paramount to attaining the millennium goals in education. The relevant bodies should focus on providing qualified teachers in material/substantial mastery of instructional methodology in the field of ICT. We are in a knowledge era, where knowledge is money and the key to knowledge lies today in Information. Great efforts should be made to train and retrain interested individual so as to have qualified hands in our educational institutions.
- (v) **Networking:**  
There is the need to create an information network throughout the educational institutions and centres and also establish links with other bodies and institution within the continent and globally in order to share resources and up-date knowledge.
- (vi) **Infrastructural Building:**  
Provision of an ICT infrastructural building is paramount to industrial development. The vocational school that proposes to have an ICT centre should meet the following basic requirements;
- Have 3 rooms, 2 rooms computer library and 1 room will be a digital library.
  - Have capable resources in ICT field with international certification; and
  - Have the experience to manage school information networking, and active in some activities related to Information Technology

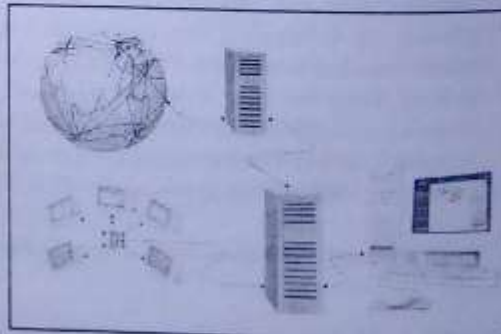
(Based on recommendations given at the 10<sup>th</sup> SEAMEO INNOTECH International Conference, November 2006)

### 7. Pictorial Illustration on the Use of ICT in Education

The benefits derivable from the use of ICT in education cannot be over emphasized as we live in an information age, following illustration give some of the prima facie to MDG -2

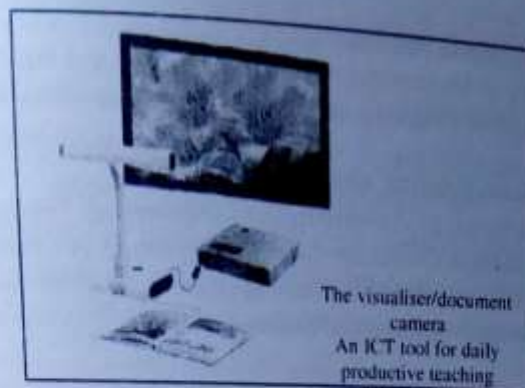


Use of multimedia projector in the classroom to enhance teaching and learning



The internet allows for resource sharing and knowledge up-date





## 8. Conclusion

The millennium development goals are attainable and not beyond the reach of a developing nation as Nigeria. ICT integration means applying computer and Internet technology to enhance the quality of teaching and learning objectives. It is the end goal of ICT in education interventions. Kinds of benefits that are expected to be gained in the use of ICT cannot be fully explained, but it is clear that its use will be beneficial to the attainment of education for all in the nearest future. The educational effectiveness of ICTs depends on how they are used and for what purpose. Like any other educational tool or mode of educational delivery, ICTs do not work for everyone, everywhere in the same way.

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