REBRANDING THE TEACHING AND LEARNING OF MATHEMATICS IN NIGERIA SECONDARY SCHOOLS THROUGH ICT - DRIVEN INSTRUCTIONAL AIDS

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Abstract
This paper looked into the use of ICT-Driven Instructional Aids as a rebranding approach to the teaching and learning of Mathematics in Nigeria secondary schools. Information Communication Technology (ICT) has no doubt changed the face of teaching and learning globally. Types of ICT-driven instructional aids was also looked into. The gains inherent in ICT-driven instructional aids in Mathematics teaching and learning were also highlighted. The use and requirements of ICT-driven instructional aids were equally examined. The paper also looked at problems associated with the use of ICT-driven instructional aids. Recommendations were made and the paper concluded that for Nigeria as a nation to attain her dream of becoming a global force in science and technology in the year 2020, ICT use in schools for Mathematics teaching and learning should be made mandatory for teachers and students. Mathematicians, technicians, educators in software design, and researchers in the use of technology in Mathematics teaching and learning must establish a continuous collaboration among themselves to make the dream of Nigeria becoming a global force in science and technology by the year 2020 a reality.

Keywords: Rebranding, Information Communication Technology (ICT), ICT-Driven Instructional Aids.

Information Communication Technology (ICT) to a lay man could be referred to as the use of digital tools in communication exchange. ICT can be conceptualized to mean information handling tools that are used to produce, store and process, distribute and exchange information. The various ICT tools are now able to work together, and combine to form a well networked base of learning (United Nations Development Programme UNDP, Evaluation Office, 2001). According to UNDP (2006), ICTS are
increasingly powerful tools for participating in global markets, promoting political accountability, improving the delivery of basic services, and enhancing local development opportunities. Ogunsola (2005) opined that ICT "is an electronic based system of information transmission, reception, processing and retrieval, which has drastically changed the way we think, live and the environment in which we live". Ogunsola further asserted that ICTs can be used to access global knowledge and communication with other people. In mathematics learning, students who use ICTs gain deeper understanding of complex topics and concepts and are more likely to recall information and use it to solve problems outside the classroom (Apple Computers, 2002). In addendum, through ICT-driven learning aids, students extend and deepen their knowledge, investigation and inquiry according to their needs and interest when access to information is available on multiple levels (CEO Forum on Education and Technology, 2001).

Information Communication Technology (IQT) has presented itself a beauty and has no doubt, changed the face of teaching and learning globally. Countries across the world who have understood the usefulness of ICTs are embracing and taking the advantages in ICT to enhance their education sector. ICTs have been extensively used in mathematics in Analysis (Moormam and Grob, 2006) Algebra (Abramorich, 1999; Ainley, Bills and Wilson, 2005), Statistics (Abrahamson and Wilensky, 2007) geometry (Cobo, Fortuny, Puertas and Richard, 2007; Healy and Hoyles, 2001; Laborde, 2001). Internet as an ICT-driven tool has been effectively and efficiently used in collaborative and interactive learning (Resta and Rafferreve, 2007; Cress and Kimmerle, 2008 and Hersant and Vandebrouck, 2006).

ICT - driven teaching and learning aids enhances efficiency of mathematical thoughts, enable learners to make reasonable conjectures and immediately test them in non-threatening environment (Laborde, 2001). Also, ICTs offer multiple mathematical representations that enhance generality of mathematical concepts, and provide opportunities for counter-examples, unlike in paper and pencil environment. Technology driven learning aids enhances curiosity that may drive inventions in computational mathematics (Borwein and Bailey, 2003). Another good example of ICT in mathematics teaching and learning is Abramorich (1999) use of spreadsheets in generalizing Pythagorean Theorem. This demonstrated how computers can be used to teach and learning concepts in geometry and algebra. Loannidou, Repenning, Cherny and Rader (2003) posited that the use of expressive media with computational and visual effects and convenient user interfaces has also advanced the use of technology in mathematics instruction. For example, dynamic geometry software enables construction of accurate diagrams, simulation, drug effects and when, coupled with after-shadows or trace facilities reveal mathematical properties which may be difficult to achieve or paper. These multiple representations in computer applications and its prompt feedback characteristic, illuminates the critical challenge for mathematics educators.
Despite the developments associated with the use of ICT in teaching and learning, formal education in most countries has been slow in adopting technological innovations, notwithstanding decades of INEFFECTIVENESS IN EDUCATION (Torruam and Abur, 2013). Torruam and Abur further stressed that though Nigeria is also making efforts to join the ICT fray, these efforts appear to be ineffective computer laboratories are largely non-existent in many public schools across Nigeria. Experience has shown that where they exist, they are noting to recon with. As a result of thee general neglect, and other factors comprising corruption, outdated curriculum, ill-motivated teachers, materialism and academic laziness on the part of students and teachers, Nigeria as a nation has been reaping mass failure in public examinations especially in mathematics. This moved stakeholders in the sector to call on the government to provide basic facilities including ICT driven teaching aids for Nigeria education system to thrive.

**Types of ICT - Driven Instructional Aids**

Most of the adopted ICT - driven instructional aids by most institutions in Nigeria over the years were in the form of prepared lectures on floppy diskettes, CD-ROMs that can be played as at when the need arises. This has limited advantage because of the number of students per computer system in which most of this facilities are not interactive enough as compared with when the lecture is been received in real time over the internet as is the case with new generation well-meaning institutions especially in the advanced societies (Kamba, 2009). The table below represents some of the ICT - driven instructional aids according to Torruam and Abur (2013).

**Table 1: List of Some Educational Technology and ICT-driven Instructional Aids by Torruan and Abur (2013)**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Flexible</th>
<th>Laboratory</th>
<th>Fixed/mobile</th>
<th>Mobile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Television</td>
<td>Scientific tools</td>
<td>Computers</td>
<td>Mobile</td>
</tr>
<tr>
<td>2</td>
<td>Satellite receivers</td>
<td>Technical instruments</td>
<td>Storage devices</td>
<td>Phones memory</td>
</tr>
<tr>
<td>3</td>
<td>Radio</td>
<td>Medical apparatus</td>
<td>Internet/email/social</td>
<td>Reader Ipod</td>
</tr>
<tr>
<td>4</td>
<td>Recorders</td>
<td>Agricultural implements</td>
<td>Smart boards/touch Screens</td>
<td>I pads</td>
</tr>
<tr>
<td>5</td>
<td>Camera video/picture CCTV</td>
<td>Engineering Facilities</td>
<td>Plain screens</td>
<td>Androids</td>
</tr>
<tr>
<td>6</td>
<td>Projectors /beams</td>
<td>Art costumes</td>
<td>Robots</td>
<td>Iphones</td>
</tr>
<tr>
<td>7</td>
<td>Video games</td>
<td>Language tools</td>
<td>Avatars</td>
<td>Calculators</td>
</tr>
<tr>
<td>8</td>
<td>Mp3-4 players</td>
<td>Books and other devices</td>
<td>Cables</td>
<td>PDAs</td>
</tr>
</tbody>
</table>
In Table one above, Torruam and Abur listed some of the ICT-driven instructional aids that can be sued to learn mathematics. For instances they emphasized that with a DVC player, children can learn recorded mathematics lessons with the use of their television at home. In the laboratory, they can use tools, computers as fixed mobiles they emphasized can be used to teach a large class while mobile phones can be used by individual learners to access and learn mathematical concepts online provided that the said mobile is internet enabled.

**Gains of ICT-Driven Instructional aids in Mathematics Teaching and Learning**

The importance of ICT-driven instructional aids in mathematics teaching and learning can never be over-emphasized as research results by various researchers like Torruam and Abur (2013), Kamba (2009), Ogunsola (2005), Yusuf (2005), Abrahamson and Wilensky (2007) and Cress and Kimmerle (2008) have all added credence to. The use of ICT-driven instructional aids is essential to support teaching and learning of mathematics cannot be easily expressed through graphics, maps, videos, pictures, etc. Worthy of note is that ICT-driven instructional aids media has enhanced the teaching and learning of mathematics through its dynamic, interactive and engaging content. It has equally provided real opportunities for individualized instruction. Also, ICT-driven instructional aids have the potential to accelerate, enrich and deepen (shapen) mathematical skills, motivate and engage students in learning, help to relate school experiences to work practices, help to create economic viability for tomorrow's workers, contribute to positive-radical changes in school, strengthen teaching and provide opportunities for connection between the school and the outside world.

ICTs are capable of making the school more efficient and productive, thereby engendering a variety of tools to enhance and facilitate teachers professional activities (Yusuf, 2005 in Torruam and Abur, 2013). In particular, the gains of ICT-driven instructional aids in mathematics teaching and learning under the following headings:

**i. Simulation of Students Interest:** Research evidences like Samwelsson (2006), Obiyo, Etonyeaku and Ofoegbu (2013) and Joanne (2005) and personal experience have shown that in teaching and learning of mathematical tasks, there is the need to generate, arouse, motivate and sustain students interest. If the learners' interest is built properly, the end result is that effective learning will take place. ICT-driven instructional tools have the potential of guaranteeing this if effectively used for regulating the pace of information flow among different class of learners under the same classroom. This technological aid also addresses learners' individual learning differences.

**ii. Concretizes Perceived Abstract Topics in Mathematics Teaching and Learning:** The use of ICT instructional aids in teaching and learning of mathematical concepts makes learning real, practical and more permanent to the learners. It makes
perceived conceptual abstraction more meaningful. These technological teaching and learning aids equally facilitate revision (recall) activities and provide a unique, opportunity for self and group evaluation for teachers and students. They capture the students intellect and eliminates boredom, make problem-solving easier, neater and boost clarity of understanding.

iii. Creation of Effective Communication: ICT-driven instructional aids when properly used allows for an effective flow and transmission of ideas from the teacher to the students, from students to the teacher or from one group to another. They afford the students opportunity to see, touch, spell what is been talked about by the teacher and exhibit curiosity to ask questions that would be very helpful for effective evaluation.

iv. Used for Mass Instruction and Taking Care of a Wide Audience: Use of ICT-driven instructional aids like projectors and electronic materials such as television overhead transparencies and computers especially, helps in packaging instruction in a very broad manner and thus, takes care of wide range of learners in a classroom with less stress and time. This will help many students to learn faster as the instructional package takes care of various learners interest at the same time. Moreso, teachers can handle a very large class conveniently as the teacher is guiding and displaying the instructional materials on the wall with the use of projector.

v. Provides Meaningful and Useful Sources of Information to Teachers and Learners: ICT-driven instructional tools makes teachers to be up to date and able to provide reliable and useful information to the learners. ICTs are equally used to effectively utilize; shorten information from different sources for the purpose of comparison and contrasting ideas. Also, ICT-driven instructional aids help in perception and retention of information or knowledge in learners.

vi. It Helps in Developing a Continuity of Reasoning and Coherence of Thought: ICT-driven instructional aids or tools helps learners in providing integrated experiences, which may vary from disciplines which makes the end product of education more embracing and productive. Since students are exposed to the real nature of mathematical concepts, they are able to analyze and synthesize those body of knowledge from other mathematically inclined subjects like physics, chemistry, and technical drawing in their daily lives.

vii. It Saves Time, Reduces Verbalism and Repetition of Words: ICT-driven instructional aids help the teacher to be in more than one place at a time (that is, the teacher can attend to several students at a time if the computers are networked wirelessly without the students coming in personal contact with the teacher) and thus, afford the teacher opportunity to address several issues at a time at the classroom without necessarily moving around he class. For example, a video instructional material could be on while the teacher moves around to explain to individual students contents in response to requests based on individual differences on problems. This makes the teacher to become part of the listening audience too. It also reduces verbalism or...
repetition of words by the teacher and in reinforcing verbal messages by providing a multi-media approach, it equally saves time too.

How to Use and what are Required for the use of ICT-Driven Instructional Aids

The efficacy of any instructional aid is judged by its ability to singly or collectively satisfy the stated instructional needs. How to use and what is required to achieve the aim of the instruction with a particular instructional aid is solely the ones of the teacher. The teacher must exercise authority and mastery of the use of the instructional aid. Anyanwu (2003) identified three ways by which the teacher should prepare for the use of ICT - driven instructional aids in classroom. These are as follows:

(a) **By previewing:** before ICT - driven instructional aids are brought to the classroom, the teacher has to possess a first knowledge by using them himself before the class.

(b) **First knowledge:** The teacher should have a full knowledge of the intended names operational level of the intended ICT-driven instructional aids, and

(c) **Actual Presentation**- this is the period the teacher operates and uses these materials in instructing or teaching the students.

However, the following are the basic guidelines and requirement for utilisation of ICT-driven instructional aids according to Torruam and Abur (2013):

**Specific Objectives:** Clear objectives which are behaviorally stated and are user friendly in ICT-driven instructional aids should be stated using processes that direct the sequence, methods, content and techniques of instruction in a subject matter. These objectives provide scientific basis of valid evaluation of instruments construction and administration.

**Maximal fit with Instructional Tasks:** ICT - driven instructional aids must be appropriate, situationally determined and individually responsive.

**Preparation and preview:** To ensure effective and efficient use of ICT -driven instructional aids for proper mathematics teaching-learning situation, the teacher must in advance prepare himself, the learners and the environment, the materials as a matter of importance must be previewed by the teacher in order to follow its process of presentation sequentially.

**Multi-dimensional Presentation:** Creative and proper utilization of variety of ICT -driven instructional aids at different levels of lesson planning can be effective in achieving different instructional objectives, reason being that it will enrich variety of learners mind as they attain better goals more easily than with the use of simple medium.

**Environmental situation:** The environmental variables such as physical, cultural and social which ICT - driven instructional aids are used for learning have remarkable effect on their effectiveness. For example, sound motion films with their attending complex properties can be successfully presented in less quiet environment.
**Measure of outcomes:** Evaluation of ICT-driven instructional aids should be done in terms of their suitability, practicability to the instructional objectives, appealed to the cost effectiveness, learner achievement level, consistency with content call for improvement in utilization technique (Torruam and Abur, 2013).

**Problems Associated with the Use of ICT-Driven Instructional Aids**

Inspite of the numerous benefits that comes with the use of ICT-driven instructional tools in teaching and learning, they are still lacking tremendously in Nigeria let alone its circulation to the secondary schools across the nation (Obiyo, Etonyeaku and Ofoegbu, 2013). Series of problems are confronting the use of ICT-driven instructional aids in secondary schools in Nigeria. Some of them as presented by Obiyo, Etonyeaku and Ofoegbu (2013) include:

**a. Teacher Professional and Technical Know How:** ICT-driven instructional aids are highly technical tools and to understand how they can affect the teaching and learning situation, one must first, have to understand the operational functionality of the materials (Samwelsson, 2006; Joanne, 2005). So many teachers in Nigeria secondary schools are still lacking in basic computer knowledge talk of handling instructional driven software's with the computer (Obiyo, Etonyeaku and Ofoegbu, 2013). This is a serious concern to harnessing the dividends ICT-driven instructional aids can offer. As the relation is re-branding in all its sectors (education inclusive), there is the need to put up a legislation mandating all secondary school teachers and infact teachers at all levels of education in the country to acquire and equip themselves with good computer knowledge and skills so that this all embracing instructional aid (ICTs) for teaching and learning can be effectively and efficiently used during classroom and out of classroom interactions by teachers and students.

**b. Lack of Computers:** ICT-driven instructional aids cannot be meaningfully used in an environment where computers are lacking or grossly adequate (Obiyo, Etonyeaku and Ofoegbu, 2013). They stressed that many secondary schools in Nigeria do not have computer laboratory and those that manage to put up what looks like a computer laboratory do not have enough computers to go round the students during instruction. The computers are still very expensive and inspite of continued efforts of the government agencies, NGOs, and other stakeholders in the education sector, to donate computers to as many schools as possible, there still remains a remarkable percentage of the schools unable to purchase computers for use by their students.

**c. Lack of Electricity:** A lot of schools in Nigeria especially at the rural areas are yet to be connected to the national grid (Obiyo, Etonyeaku and Ofoegbu, 2013). They stressed that in those (schools) that is connected; supply still remains unsteady requiring extra cost for alternative power source. The government has not been able to connect all parts of the country to the national electricity grid and consequently, schools that are yet to be connected are left handicapped and may not be able to offer computer studies (Obiyo, Etonyeaku and Ofoegbu, 2013).
d. **Cost of Computer**: In Nigeria, computers are still expensive and considering the high inflation rate prevalent in the country, majority of individuals and schools still find it difficult to buy computers as they are considered luxury items. For instance, a fairly used (second hand) computer sets still goes for as high as N40,000 and a brand new one goes for J495,000 and above (Ogunsola, 2005).

e. **Lack of Maintenance Culture**: most schools that have computers do not have trained manpower as regards the maintenance and repairs of the systems (Ogunsola, 2005). A common sight in the schools is computer laboratory that is filled with non-functional computer set. Some repairable while some are not. Perhaps, until this ugly scenario is addressed, Nigeria secondary schools will still be eluded of the immense academic benefits use of ICT - driven instructional tools can offer.

Other factors could pose as problems to the use of ICT - driven instructional aids in Nigeria secondary schools according to Torruam and Abur (2013) include: Burglary activities in schools, lack of internet or slow connectivity, increased moral degradation, environmental factors, time constraints and poor maintenance culture.

**Conclusion**

Remarkable affordances of ICT - driven instructional aids in mathematics teaching and learning especially efficiency in computation and geometric constructions, opportunities for multiple representations, prompt feedback during problem-solving and inherent generality of concepts in mathematics has made them a must use in modern day competitive digital world at all levels of education. This calls for an urgent integration of ICTs in mathematics education curricula (that is, the use of ICTs as instructional aids should be included for teachers and students use in the mathematics curricula). To achieve this, a lot of inherent curricula challenges in the education system has to be tackled for optimal technology - enabled education. Until the aforementioned are adequately taken care of, Nigeria's dream of becoming a global force in science and technology by the year 2020 could be a mirage. Hence, Mathematicians, technicians, educators and researchers on the use of technology in mathematics teaching and learning must work harder to making available software that will enhance the teaching and learning of mathematics in Nigerian schools. In particular, mathematics instructors must embrace the gains inherent in technological use in instruction if they are to remain relevant within the ever-increasing revolution in education world over.

**Recommendations**

To ensure that ICT-driven instructional aids are extensively adopted for use in mathematics teaching and learning in Nigeria secondary schools, the following recommendations are made;

a. government and other stakeholders in the education sector should provide all secondary schools across the country with adequate information – technology facilities for teaching and learning,
b. Government should ensure adequate and regular power supply,
c. Teachers should be highly spirited in the use of ICT-driven instructional aids in teaching given the importance of practical knowledge in it,
d. There should be periodic seminars and workshops and in-service training for mathematics on the use of ICT-driven instructional aids.
e. Secondary school administrators should seek for assistance from non-governmental organizations, private sectors, individuals and industries in supplementing and substituting obsolete ICT-driven instructional aids like projectors, functional computer systems and other software packages.
f. Government should ensure that teachers that are well trained on ICTs are deployed to schools to impact ICT skills to the students.
g. Finally, computer learning should be made a compulsory subject of study at all levels of education in Nigeria.

References


