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# Application of information and communication technology to the teaching and learning of mathematics towards millennium development goals realization in Nigeria

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**ABSTRACT**

All the nations of the world are embracing technological innovations and integrating them into their educational systems for advancement and development. The use of Information and Communication Technology (ICT) in mathematics teachers' training has been verified to ascertain if it will serve as a catalyst for change in the teaching and learning of mathematics. In this study, relevant and related literatures were reviewed. The study population was sampled mathematics teachers from fifty schools in Ondo West and Ondo East Local Governments Areas of Ondo State, Nigeria. The selected respondents were trained on Autograph and Cabri3D software while questionnaires were respectively responded to by the trained teachers. Chi-square and simple percentages were used to analyze the data received. Results of this study show that there is significant effect of ICT usage on students' performance. Also, a significant relationship exists between the school location and respondents' perception of ICT utilization for teaching and learning of mathematics. Necessary and useful recommendations were given to relevant stakeholders to improve performances on the part of the teachers and the students for the teaching-learning process in mathematics.

**Keywords:** Information and communication technology, mathematics, autograph, millennium development goals.

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## INTRODUCTION

Life without the knowledge of mathematics would have been very difficult because mathematics is an important subject for the aspiration of scientific and technological development. No nation in the world has ever developed technologically without putting mathematics in the appropriate position. "Most advances in science and technology owe their origin to mathematics which is often referred to as the language of science and technology. For example, the computer which is the greatest discovery of the last century owes its origin to mathematics theories. Whatever problem is solved today by applying computer technology has been solved by mathematics in the past. No wonder, the place of Mathematics amongst the subjects taught in Nigerian schools is well recognized" (Adenegan, 2007). With the current need for science and technology in a developing nation like Nigeria, the teaching and learning of mathematics need to be improved.

Our immediate society cannot afford to lag behind in the scheme of development. Hence, the need to update ourselves so as to bridge up with the trend of development as it obtains in the other parts of the world.

Globally, every society sets some goals for her to achieve in this new millennium into which almost one and half decades have been spent. These goals have been termed as Millennium Development Goals (MDGs). The conception of Millennium Development Goals is based on the United Nation's Declaration which arose from the consensus of experts set up by the United Nations and World Bank on a frame work to be adopted to achieve greater benefit for all human beings in the world in this current millennium.

The target date is between 1990 to 2015, thus it has been a 25 years development programme that had been for-seen to help governments all over the world, especially in the developing world to start some planned process that will help them to catch up with the concept. The document was actually adopted with a target of 2015.

**Millennium Development Goals, ICT and Mathematics**

The United Nations Millennium Development Goals as stated by Awe and Akintade (2007) are to: eradicate extreme poverty and hunger, achieve Universal Primary Education, promote gender equity and empowerment of women, reduce child mortality, improve maternity health, combat HIV/AID, malaria and other diseases, ensure environmental sustainability and lastly develop a global partnership for development.

Incidentally, as it obtains round the world, these goals revolve round technological advancement, which is itself not achievable without proper understanding of Mathematics, as no achievement can be made in any field, irrespective of the orientation, if the society is not mathematically well-groomed. Information in any of its form is a basic tool in the performance of management functions and it is equally desirable in the day-to-day activities. The applicability of information has greatly increased in spheres and scope than hitherto as the various agents of changes in the use. The applications of ICT are advancing in the technologies of computer and internet that these have revolutionized all spheres of human endeavours is no news. In Nigeria, most banks and industries are presently tapping from the obvious advantages of these versatile machines through E-banking, E-communication, E-commerce, E-mail etc.

Educational system needs to wake up and join the trends. The use of sophisticated electronic tools can allow the educationist to explore and organize new ways of teaching and learning. These tools include radio, television, calculator, computers and mobile phones. The most important of these is the computer. This is because it is capable of solving complex problems quickly and accurately. Hence, among other ways of applying ICT to teach and learn mathematics; E-teaching and E-learning, Computer Assisted Instruction, Mathematics by Radio and Television, Classroom Teaching with Multimedia System, Autograph and Cabri3D.

According to Douglas (2005), autograph uses the standard conventions of Windows applications with regard to multiple windows (called ‘pages' in Autograph), the loading and saving of pages as files and the copying and pasting of text, data and graphics.

Communication is defined as a source and extension of imagination in forms that can be learned and shared. It is the production, perception and understanding of messages that bear man's notion of what is important, what is right and what is related to something else (Lampard, 2005).

According to Lampard (2005), information technology is seen as the acquisition, processing, storage and distribution of vocal, pictorial, textual and numeric information by means of computers and telecommunication networks. Simply, communication is the exchange of information between people by means of speaking, writing or using a common system of signs or behaviours. In the light of this, we can see that we are in an information age where ICT has gained a lot of grounds in the world's educational development. The ICT tools or components, which are computers, telephones, radio, communication networks and know-how, have a lot of influence in enhancing the effectiveness of instructional techniques. The use of the internet and other products of telecommunications industry looms large in computer science, computer engineering and information systems interactively together for efficient and effective gathering, processing, dissemination and maintenance of information.

In a nutshell, "Mathematics is now an enormously useful science which, in order to attain this status, has had to cross a desert of usefulness where Mathematics was nursed tenderly as a science of mind" (Balogun et al., 2002)". Astronomy is a practical science of Mathematics. It is used to foretell the calendar, feast, eclipses, wars, pestilence, whirlwinds, storms and the future of nation and even of individuals. It is a useful application of Mathematics would linger on for at least the next two millennia.

The diverse applications of mathematics abundantly establish that mathematics, as a discipline, is fit for purpose, as mathematics continually drives the expansion of the frontiers of other disciplines through their progressive formalization and symbolization and the building of mathematical paradigms of real world systems.

In Nigeria, a credit in mathematics is required for admission to countless programmes of study at the tertiary level of education. Ekhaguere (2010) asserted that in view of this fate-determining place of mathematics in the nation's educational system, a policy must be

formulated and implemented toward ensuring that no child is left behind in mathematics at the pre-tertiary level of education.

According to Oyekan (2000), "instructional materials are those things that can facilitate effective teaching and pleasant learning that is teaching aids through which learning process may be encouraged and motivated under the classroom situation". These enhance the teaching learning process when adequately and appropriately used.

Mathematics as a Core Subject in Nigeria Secondary Schools is a model for thinking, for developing scientific structure, for drawing conclusions and for solving problems. It is a subject that deals with facts. As a result, Olademo (1990) opined, "this subject-mathematics should be given much consideration and let no man think of it as abstract or as untrue". As posited by Balogun et al. (2002), "Mathematics instruction is a training of logical thinking. It is a means of solving many problems. It is confronted with finding solutions to problems that have not been provided by a similar type. Its greatest virtue is its flexibility and the high esteem at which it is held as a tending discipline is partly due to its illustrious pedigree".

As readily asserted by Adenegan and Akinremi (2014) and Adenegan and Lawal (2014), the concerted efforts of mathematicians in the field of financial mathematics on risk measurements is a welcomed development in this millennium as the concept of value at risk used in the 21st century global market has gained popular attention of researchers which has considerably helped many investors. This consequently is an added advantage to boost the technological and economic stability and development of any nation.

## Statement of problem

Despite the place of mathematics in Universal Basic Education (UBE) programme which is one of the objectives of MDG, little or no attention had been given to the realization of Education for All (EFA) as stated in MDG document. The general poor performance of students in both internal and external Mathematics examinations had attracted the attention of individuals, parents, school administrators and government at various levels thereby expressing deep concern over their low understanding and shallow knowledge. The invention of ICT as one of the foremost discovery of our time had not being patronized in educational sector for its usefulness and advantages. Hence, this project examines and investigates application of ICT in teaching and learning of Mathematics towards achieving the MDG by introducing the newest ICT software application in Mathematics: Autographs and Cabri3D.

## Purpose of the study

The purposes of this study include:

1. Finding out whether ICT truly has a positive impact on the teaching and learning of Mathematics.
2. Finding out whether ICT is at the reach of the secondary school students and Mathematics teachers for use.
3. Discovering the importance of ICT Strategies by the school administrators and government in the teaching and learning of Mathematics towards achieving MDGs by introducing teachers to the use of Autograph and Cabri3D in teaching Mathematics.
4. Discovering the contribution of the government and NGOs to the improvisation of ICT in the schools.

## Research questions

The following questions are answered during the course of this research:

i) Does ICT improve learning and teaching of Mathematics in secondary schools towards achieving MDGs?
ii) Can application of ICT reduce mass failure in Mathematics?
iii) Do the students of the secondary school which adopt the use of ICT perform better in mathematics than those who do not adopt it?
iv) Are there ICT facilities available in the schools in Ondo-East and Ondo-West Local Governments of Ondo State?
v) Are the students exposed to ICT in teaching and learning of Mathematics?

## Hypotheses

$Ho_1$: There is no significant relationship between ICT knowledge and student performance.
$Ho_2$: There is no significant effect of ICT Usage on student performance.
$Ho_3$: There is no significant relationship between the school location and respondents' perception of ICT utilization for mathematics teaching in schools.

## METHODOLOGY

### Sampling techniques

In choosing the mathematics teachers involved in this study, a random sampling technique was used. The researchers met the Principals of the randomly selected schools and at least a

**Table 1.** Responses on ICT awareness level in the schools.

| SN | Items | Yes | % | No | % |
|---|---|---|---|---|---|
| 1. | Are you a computer literate mathematics teacher? | 49 | 98 | 01 | 02 |
| 2. | Do you use computer or browse on the internet to teach your Mathematics student? | 12 | 24 | 38 | 76 |
| 3. | Do you have internet services in your school? | 22 | 44 | 28 | 56 |
| 4. | Are you aware of any ICT package in teaching of Mathematics? | 41 | 82 | 09 | 18 |
| 5. | Do you want ICT to be introduced in your school? | 48 | 96 | 02 | 04 |
| 6. | Do you have Mathematics laboratory in your school? | 11 | 22 | 39 | 78 |
| 7. | Have you used or heard about Autograph or Cabri3D before? | 11 | 22 | 39 | 78 |
| 8. | Have you ever used any software to teach Mathematics before? | 06 | 12 | 44 | 88 |
| 9. | Does your School have any software for teaching Mathematics? | 05 | 10 | 45 | 90 |
| 10. | Have you attended any workshop/training on ICT for Mathematics before? | 11 | 22 | 39 | 78 |

Mathematics teacher was nominated from the selected Secondary Schools in Ondo-East and Ondo-West Local Governments of Ondo State giving a total of 50 Mathematics teachers who attended the ICT workshop.

#### Research instrument

Questionnaire was used as the basic instrument for data collection which was designed for the Secondary Schools Mathematics teachers only. The items of the questionnaire cover the perception of the teachers as regards the use of ICT, its awareness, as well as availability in their respective schools. The questionnaire was administered to the mathematics teachers after the workshop training.

#### Procedure for data collection

The researchers administered the questionnaire personally to the Mathematics teachers immediately after the training workshop and monitored the proper filling as appropriate. After the completion of the questionnaire as required, the researchers ensured all questionnaires were collected.

#### Procedure for data analysis

The collected questionnaires were analyzed using frequencies and percentages. This was carried out converting the frequencies of the respondents into percentages. The results are discussed in descriptive analysis in relation to the research questions after which inferences were drawn and necessary recommendations were made.

#### Data analysis

The data collected from the selected mathematics teachers are analyzed as shown in Table 1.

In Table 1, it was discovered that almost all the mathematics teachers used are computer literate. However, it was discouraging to realize in SN 2 of table that only 24% of the respondents do browse on internet in order to update their knowledge to teach their students. The implication is that this attitude has drastically reduced the level of application of ICT in teaching and learning of mathematics in many schools in the state. In the same manner, the mathematics teachers' responses on item 3 analyzed, revealed that most schools do not have internet services. Item 4 showed that a good number of the teachers are aware of the ICT packages in teaching of mathematics.

However, owing to that fact that the respondents in items 3 and 2 respectively responded that they do not have internet services and facilities in their schools, and that they do not use computer or browse on the internet to teach their students, the response on items 7, 8 and 9 of not having heard about Autograph or Cabri3D not to talk of using it and other software to teach mathematics are not surprising.

Item 10 showed that 78% of the respondents have not attended any workshop or training on ICT for teaching and learning of Mathematics before. However, item 5 revealed that 96% of the respondents want ICT to be introduced to their schools.

## RESULTS AND DISCUSSION

The chi-square formula is shown as follows:

$$\chi^2_{cal} = \frac{\sum (O_{ij} - E_{ij})}{E_{ij}}$$

where *O* = Observed value; *E*= Expected value.

### Hypothesis 1

$Ho_1$: There is no significant relationship between ICT knowledge responses and its application to Mathematics learning.

Reject $Ho_1$ if $\chi^2_{cal} > \chi^2_{tab}$ but as we can see in Table 2 0.3404 < 16 therefore the decision taken is that we accept the null hypothesis and conclude that there is no significant relationship between ICT knowledge responses and its application to mathematics learning, this implies that the mathematics teachers only have ICT

**Table 2.** Result of $Ho_1$ analysis.

| Responses | | | d.f | Level of sig. | Remarks |
|---|---|---|---|---|---|
| Relationship between ICT knowledge responses and student performance | 0.3404 | 16 | 7 | 0.05 | Not significant |

**Table 3.** Result of $Ho_2$ analysis.

| Responses | | | d.f. | Level of sig. | Remarks |
|---|---|---|---|---|---|
| Effect of ICT usage on students' performance | 18.3237 | 16.343 | 6 | 0.05 | Not significant |

**Table 4.** Result of $Ho_3$ analysis.

| Responses | $\chi^2_{cal}$ | $\chi^2_{tab}$ | d.f. | Level of sig. | Remarks |
|---|---|---|---|---|---|
| Perception of ICT utilization for mathematics teaching in schools. | 161.816 | 76.343 | 9 | 0.02 | significant |

knowledge but did not apply it to the teaching of mathematics hence, their knowledge did not have effect on the students' performance because the students are well used to the old methods of teaching.

### Hypothesis 2

$Ho_2$: There is no significant effect of ICT Usage on student performance.

Reject $Ho_2$ if $\chi^2_{cal} > \chi^2_{tab}$ but as we can see in Table 3 18.3237 > 16.343, therefore the decision taken is that we reject the null hypothesis and conclude that there is significant effect of ICT usage on students' performance, in the sense that if the mathematics teachers can use ICT knowledge to teach mathematics concept, it will have considerable effect on the students' performance.

### Hypothesis 3

$Ho_3$: There is no significant relationship between the school location and respondents' perception of ICT utilization for mathematics teaching in schools.

From the responses in Table 4 as subjected to chi-square analysis at 0.02 level of significant with 9 degree of freedom, the critical value from the table is $\chi^2_{tab}$ = 76.348 and $\chi^2_{cal}$ = 161.816.

The null hypothesis $Ho_2$ is rejected since $\chi^2_{cal} > \chi^2_{tab}$ therefore the decision taken is that we reject the null hypothesis and conclude that there is significant relationship between the school location and respondents' perception of ICT utilization for mathematics teaching in schools.

The results obtained from the analysis revealed that the teachers in the selected secondary schools have certificates, good qualifications, and knowledge about the use of computer and some other technologies, but they were not professionally trained to use the ICT for teaching. Instead they preferred to use ICT for social networking. Also, little or no attention was given by both the government and management of secondary schools to the technological improvement of their schools. The following reasons were observed to be responsible for non-application of ICT to teaching and learning of Mathematics:

i) Lack of awareness, introduction and the usage of ICT package in teaching of Mathematics
ii) Unavailability of computer systems, ICT resource centers and probably lack of internet service when needed.

## CONCLUSION

The findings of this study revealed clearly that the application of ICT would have enhanced teaching and learning of mathematics but most mathematics teachers in secondary school have shallow knowledge of ICT for instructional use. The importance of ICT in mathematics

teacher training cannot be overemphasized. As the world becomes a global village, mathematics teachers should not be left behind in the use and application of ICT to enhance teaching and learning. This implies that the training and retraining of mathematics teachers on the use and application of ICT could go a long way in achieving the Millennium Development Goal (MDG) in mathematics education and bring about enduring consolidation of mathematics education in Nigeria.

## RECOMMENDATIONS

Since ICT is a paradigm of representation of 21st century, if the following recommendations are well implemented, they will go a long way in solving the problems associated with slow pace in mathematics education for national development. Based on the results of the research, the following recommendations were made:

i) The curriculum experts and planners in teacher education should include ICT training so as to produce ICT competent graduates for effective teaching of mathematics in secondary school.
ii) Periodic ICT training should be organized forthwith for the in-service secondary school teachers for proper knowledge of the latest software.
iii) There should be review of secondary school curriculum for proper integration of computer education and ICT related contents in secondary school curriculum.
iv) In-service training programmes on ICT should be adopted for all mathematics education teachers to acquaint them with the knowledge of ICT and stimulate their interest for professional competence.
v) Internet facilities must be made available in all schools to facilitate effective use of ICT in mathematics teaching and learning.
vi) ICT resource-centers should be established in varying capacities in various secondary schools both in rural and urban centers and this should be equipped with highly sophisticated equipment as well as competent and disciplined computer technologists.
vii) Government should release adequate funds to the schools for the maintenance of these ICT facilities so as to promote their usage.
viii) NGOs should be encouraged to invest in the provision and improvisations of ICT facilities in the schools.
ix) Provision of electricity power, security and the technical experts for ICT resources in secondary schools should be ensured.
x) Government should liaise with international bodies like World Bank and others to invest in provision of ICT resources in secondary schools.
xi) Mathematics education teachers must have the knowledge and skills in using the new sophisticated digital tools and resources to help the learners to achieve high level of performance.
xii) A policy should be put in place to enable teachers undergo compulsory training in the effective use of ICT.

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## REFERENCES

**Adenegan**, K. E. (**2007**). Teaching methodologies: Issues, challenges and implications on the teaching and learning of Mathematics in primary schools. Nigerian Journal of Research in Primary Education, 1(1):29-35.

**Adenegan**, K. E., and **Akinremi**, O. V. (**2014**). Mathematics Education and the 21st Century Global Market Challenges: Implications for National Stability and Development. In: Aremu, O. A. and Ayodele, A. I. (Ed). Repositioning Nigeria's Tertiary Education for the 21st Century Global Market. Akure: Internitina Gim Publishers.

**Adenegan**, K. E., and **Lawal**, M. O. (**2014**): Science Education: A Roadmap to Economic and Technological Development. In: The Management of Tertiary Institutions for Qualitative and Functional Education in Nigeria. A Festschrift in Honour of Prof. Adeyemi Idowu. Atoyebi et al. (Ed). Ibadan, Spectrum Books Ltd. pp 567- 577.

**Awe**, I. A., and **Akintade**, C. A. (**2007**). Millennium development goals for national development: Mathematical implications. Journal of School of Science, 1(1):71-75.

**Balogun**, F. O., Fakunle, I., Olagunju S. O., Akinnodi, P. O., Ganiyu, A. A., Olademo J.O.A. and Adewumi, J. A. (**2002**). Mathematics Methodology in Approaches to Science Techniques, Yinka Ogunlade and R. O. Oloyede (Ed).

**Douglas**, B. (**2005**). Autograph version 3: Getting Going with Autograph 3. UK: Desmond Publishing Ltd.

**Ekhaguere**, G. O. S. (**2010**). Proofs and Paradigms: a Mathematical Journey into the Real World. Inaugural lecture, Ibadan University Press, Ibadan. pp: 1-30.

**Lampard**, C. C. (**2005**). A careat to researchers on the implementation of information technology. Educational Research Journal, 3(2).

**Olademo**, J. O. (**1990**). Mathematics and Universe. Journal of NAMSN ACE, Ondo Ifeoluwa (NOD), Ent. Ltd. Pp 30.

**Oyekan**, S. O. (**2000**). Foundation of teachers education. Ondo: Ebunoluwa Printers (Nig.) Ltd. pp. 17, 240.

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