

PREREQUISITES FOR EFFECTIVE INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN THE TEACHING OF BASIC SCIENCE AND TECHNOLOGY IN PRIMARY SCHOOLS IN NIGERIA.

By

Olofu, Martin Afen Ph.D, Daniel, Katen & Kinsley Charles Edet Ph.D

Department of Curriculum and Teaching, Faculty of Educational Foundation Studies,
University of Calabar, Calabar.

ABSTRACT

Much emphasis has been placed on the use of ICT in teaching and learning for the attainment of the goals of education. This is as a result of the enormous roles ICT plays in facilitating teaching and learning. These roles have become more glaring in the 21st century where ICT facilities have permeated every aspect of human endeavours. In the era of Covid-19, ICT facilities have played critical roles in bridging the gap created by physical and social distancing within and outside the classroom. Despite these benefits, availability and utilization of ICT in teaching and learning in most institutions of learning in Nigeria particularly primary schools have remained a mirage. This paper discusses the basic prerequisites that need to be met if the gains of ICT will be achieved in primary schools with particular focus on the teaching of Basic Science and Technology. These are categorized into institutional, teacher, learner and government related requisites or factors. The paper concludes that except these prerequisites are fulfilled, issues of effective gains of ICT in Nigerian primary schools will remain mere wish. The paper recommends among others government commitment to adequate funding of education through provision of infrastructure and ICT equipment, teachers positive attitude to application of innovative ICT facilities in teaching and learning as well as redirecting learners' focus in the use of ICT for fun and entertainment to education-oriented activities.

Key words: ICT, facilities, prerequisites, institutional, teacher, government, learner, Basic Science and Technology.

INTRODUCTION

Primary education is the foundation of education until the formal introduction early childhood education in Nigeria. It provides the basic education those individuals who have the opportunity of passing through it become literate and functional members of their society and useful to themselves. In some cases, it is the only educational opportunity some people have in their life. It is therefore, pertinent that this vital level of education should be adequately equipped for the recipients.

One of the important areas of studies that prepare the child for future career is science and technology. The global importance of Science and Technology cannot be over emphasized. It, therefore, implies that this all important area of knowledge should be adequately inculcated in the learners at the primary school level in the introductory subject, Basic Science and Technology. It is necessary to remove all impediments to the teaching and learning of this subject by meeting every prerequisite variable that will enhance its teaching and learning. Information and Communication Technology (ICT) is an integral part of Basic Science and Technology at the primary school level. According to Federal Ministry of Education in Nigeria,

ICT refers to the art and applied sciences that deal with data and information. It encompasses all (equipment including computational machinery - computers, hardware, software, firmware etc., tools, methods, practices, processes, procedures, concepts, principles and the sciences) that come into play in the conduct of the information activities: acquisition, representation, processing, presentation, security, interchange, transfer, management, organization, storage and retrieval of data and information(Federal Ministry of Education, 2019).

In the contemporary world, Information and Communication Technology has remained a critical part of human activities. There is hardly any part of human endeavours today that ICT facilities are not employed. It is a veritable tool in the field of education, health, agriculture, entertainment industry, politics/ governance, security, etc. Through ICT, the world has become a global village. In any form of discourse on issues related to ICT, there is overwhelming evidence that technology has impacted heavily on human life in diverse forms. Olofu and Olofu (2021) observed that technological innovation has created great impact on every level of education; as online courses, teaching aids, educational software, social networking tools and other emerging technologies are disrupting and almost taking over the traditional physical classroom environment.

Education as an instrument for national development relies heavily on ICT facilities. The essence of education in Nigeria is captured in Nigerian philosophy of education which holds that education is an instrument for national development and social development, a measure of maximizing the creative potentials and skills of the individual for self-fulfillment and general development of the society, among others (Federal Republic of Nigeria, (FRN) 2014).In education, both human and material resources are deployed to attain its objectives. In this direction, the teacher (as human resource) and Information and Communication Technology (as material resource) are key resources in instructional planning and delivery. ICT has been deployed to facilitate educational planning and management, classroom engagements, instruction and social interactions. ICT is an important tool in assessment and evaluation of educational engagements. The use of ICT is gradually removing physical walls of the classroom and the

confines of school location. Today, millions of learners can be reached effectively from one source of instruction. Effective communication and interactions between learners and teachers, among teachers and among learners is greatly enhanced when ICT is applied.

Despite these general expected massive gains associated with the deployment of ICT, the actual benefits in Nigerian primary schools are yet to be derived, not because the values are unknown but because of some critical challenges. This is essentially as a result of the challenges bedeviling the availability, access and effective use of ICT facilities in primary schools. Having competent instructors at the front line of e-learning education is still a prerequisite to successful education programme (McMahon, 2015)

The perspective of this paper is that there are basic factors for the use of ICT in Nigerian primary schools for education sector to flourish or benefit maximally from the tremendous opportunities ICT has provided. These basics, in this paper, are tagged the prerequisites for effective deployment of ICT in primary schools. They are the basic requirements that need to be met if education is to benefit from the use of ICT. They are examined under four major categories. These include institutional factors such as adequate provision of ICT related infrastructural facilities such laboratories, ICT centres; government related requirements such as adequate funding of education generally and ICT facilities in particular, the will power to implement educational policies and programmes as planned, providing and enabling environment for effective teaching and learning; the teacher related requisites which comprised developing the right attitude towards ICT, readiness to improvise and willingness to use the available ICT facilities; and learners related factors such as willingness to use ICT more for education than for fun or entertainment.

Importance of ICT in attaining the goals of Basic Science and Technology in primary education in Nigeria

Primary Education in the Universal Basic Education (UBE) programme is the third level of the UBE programme after Early Child Care Development and Education (ECCDE) for children 0-4 years and one year Pre- Primary Education for children aged 5 years prior to their entering primary school. According to the National Policy on Education (FRN, 2014), Primary Education is introduced to attain the following objectives:

- a. inculcate permanent literacy, numeracy and the ability to communicate effectively;
- b. lay a sound foundation for scientific, critical and reflective thinking;
- c. promote patriotism, fairness, understanding and national unity;
- d. instill social, moral norms and values in the child;
- e. develop in the child the ability to adapt to the changing environment; and
- f. provide opportunities for the child to develop life manipulative skills that will enable the child function effectively in the society within the limits of the child's capability (p10).

These are very noble intentions such that if they are vigorously pursued with relevant ICT facilities it potent progressive development in the area of science technology for Nigeria as a nation. However, these objectives have not been adequately achieved.

To achieve these objectives, the policy document specifies that “teaching shall be practical, activity-based, experimental and Information Technology (IT) supported” p3. It is further stated therein that

in recognition of the prominent role of Information Technology in advancing knowledge and skills necessary for effective functioning in a knowledge driven world, government shall provide adequate infrastructure and develop capacity for effective utilization of IT to enhance the delivery of Basic Education in Nigeria(p15).

Government is also expected to provide among other educational services, educational resource centers as well as laboratories and workshops to facilitate teaching and learning. This highlights the relevance of instructional technology in teaching and learning.

A broader perspective of government's roles in ICT development and utilization in school is contained in The National Implementation Guidelines for Education in Nigeria which clearly indicated that, to enhance the use of ICT in Education at all levels, government shall:

- (I) build and encourage the development, utilization and sustenance of the ICT manpower required to achieve an ICT-enhanced Education;
- (ii) establish and sustain a common ICT infrastructure platform for education at all levels;
- (iii) ensure and encourage Research and Development (R&D) in ICT generally and ICT in Education in particular;
- (iv) engage in and encourage regular stakeholder consultations (including the Private Sector), sensitization of the learning community, public awareness and inter-governmental relations to achieve a broad-based consensus on ICT in education;
- (v) provide appropriate legal, regulatory and security framework to ensure that ICT in Education and the conduct of related activities are focused on achieving ICT-enhanced Education; and
- (vi) adopt innovative and creative financing models for ICT in Education.
- (vii) Use measurement and evaluation as a veritable tool in ICT in Education for tracking policy implementation, efficient service delivery and compliance. (Federal Ministry of Education, 2019)

Basic Science and Technology is one of the subjects being taught in the primary schools. It is an integrated subject made up of Basic Science, Basic Technology, Information Technology and Physical and Health Education. It is taught from Primary 1-6. According to Yusuf and Alabi (2015), the goals of Basic Science and Technology are to enable the learners to: develop interest in science and technology; acquire basic skills in science and technology; apply scientific and technological knowledge and skills to meet societal needs; take advantage of the numerous career opportunities offered by science and technology; avoid drug abuse and related vices, be safety and security conscious and finally become prepared for further studies in science and technology.

Laudable as these objectives are, the reality on ground after many years of implementing the Basic Science and Technology is that much is yet to be achieved. Less attention is given to the practical aspect of science and technology development, the society is battling with drug abuse, safety and security is far from being achieved. These stem from lack of proper funding, poor teaching due to lack of relevant teaching facilities, lack of learners interest and social and moral decay in Nigeria.

Information and Communication Technology is very central in the content of Basic Science and Technology education. The relevance of ICT in the achievement of the overall goal of education

and that of Basic Science and Technology has been widely acknowledged. ICT helps facilitate the interaction between teachers and learners by keeping the students updated and enhancing teachers' capacity and ability, fostering a live contact between the teacher and the student through e-mail, chalk session, e-learning, web-based learning including internet, intranet, extranet, CD-ROM, TV audio-videotape. Educational technology has become very powerful media for interactive participation of experts and learners and it reaches the unreachable (Sharma, Gaudhar, [Sharma](#) and [Seema](#), 2011). In modern science and technological era, education demands more knowledge of from the teacher regarding ICT and skills to use ICT in teaching –learning process. The knowledge of ICT is also required for pre-service teachers during their training programme, because this integrated technological knowledge helps a prospective teacher to know the world of technology in a better way through which it can be applied in future for the betterment of the students (Bbattacharjee and Deb, 2016). According to Federal Ministry of Education (2019)

The objectives of ICT in Education are: (i) To facilitate the teaching and learning processes. (ii) To promote problem-solving, critical thinking and innovative skills. (iii) To promote life-long learning and advance knowledge. (iv) To enhance the various teaching/learning strategies required to meet the needs of the population. (v) To foster research and development. (vi) To support effective and efficient education administration. (vii) To enhance universal access to information. (viii) To widen access to education and the range of instructional options and opportunities for any-where, any-time, any-pace and any-path learning. (ix) To promote commercialization of ICT in Education. (x) To develop and support technical infrastructure that maximizes digital creativity, sharing and innovation.

Prerequisite for effective integration of ICT in the teaching and learning of Basic Science and Technology.

These are the basic conditions that need to be met if ICT has to be effectively deployed in teaching and learning. These are categorized into institutional, government, teacher, learner related requisites.

Institutional related factors

Institutional requirements are school based factors that need to be met if the benefits of ICT are to be enjoyed. The 21st century classroom need to take a multimedia approach to learning core content, promote essential learning and innovation skills, build information, media, and technology skills in context and, advance life and career skills. (Tech4learning (nd). ICT facilities do not operate in a vacuum. Institutional requirements are the basic issues which the school needs to address. It is the duty of institutions of learning to provide internet services, infrastructure and access to ICT facilities. Institutional variables that are necessary for effective deployment of ICT in primary schools in Nigeria include adequate provision of ICT related infrastructural facilities such as ICT centers, laboratories and workshops, capacity building of teachers and support staff, and provision of classrooms. However, the extent to which institutional requirements are met depends on government funding. The school as an agent of government is expected to provide or

facilitate their provision. In terms of access, this will include providing access to where facilities exit. Some restrictions to access involve creating certain conditions to be met before usage, restriction due to location and time. Unnecessary barriers to access should be removed.

Government related factors

The ICT related requirements that the government need to provide include adequate funding of education generally and adequate provision of ICT facilities in particular, the will power to implement educational policies and programmes as planned, providing an enabling environment for effective teaching and learning, providing enabling environment for service providers such as internet services. Government has the primary duty to provide for the education of her citizens as it is the fundamental right of the Nigerian child to be given opportunity to be educated, not just to be educated but given qualitative education. In the contemporary time, deployment of information communication and technology is an important component of quality education. Government is expected to fund education adequately according to international best practices. The critical role of government in this regard is clearly enunciated in National Policy on Education, that government should provide among other educational services, educational resource centres as well as laboratories and workshops to facilitate teaching and learning. Government shall also provide adequate infrastructure and develop capacity for effective utilization of IT to enhance the delivery of Basic Education in Nigeria (FRN, 2014:15).

These are achieved through provision of infrastructural facilities, instructional facilities, teacher training, providing enabling environment for education to thrive, work through its relevant agencies to implement educational policies and programme as planned. It is also expected of government to put in place and enforce quality assurance through monitoring and evaluation mechanisms and the feedback ploughed back into the system to realize expected goals of education.

The poor funding of education in Nigeria at all levels by the government revealed that the budget for education based on United Nation standard is abysmal. This low budgetary allocation and other forms of neglects in education sector have caused the dearth in providing quality education.

Teacher related requisites

The teacher related requisites comprise developing the right attitude towards ICT, readiness to improvise and willingness to use the available ICT facilities, etc. The teacher occupies a central position in the implementation of the curriculum. The success or failure of educational programme depends to a large extent on the teacher. Generally, the teacher has many variables that influence the attainment of educational goals. His attitude, knowledge and skills which are determined to some extent by his training, his readiness to accept and apply changes in education, his interest and commitment to the success of the learner among others are some of such determinants. The 21st century education and perhaps the pandemic era demand specific skills from educators. The 21st century teacher should prepare students for a rapid change of technology and incorporate technology in studies (Sinha, 2018), be forward thinking, be able to embrace change and be able to implement technology (Cox, 2016). Mishra & Mehta, 2017 as cited by Izar, Na and Na (2021) noted that teachers constitute one of the most important pillars in an education system. Their knowledge and experience will influence the delivery of their lessons and the use of pedagogies in their instructional Teaching and learning. The first prerequisite is to deal with the

attitude of the teacher to technology application generally and specifically in teaching and learning. Attitude determines the disposition to like or hate, accept or reject, use or abandon. In this case primary school teachers need to be persuaded on the need to accept, embrace and use ICT in teaching because of the benefits accruing from its usage.

Another foundation that should be laid for achieving the objectives of using ICT is the training of teachers in practical skills on how to access and use ICT facilities as it affects life generally and in teaching and learning. Having competent instructors at the front line of e-learning education is still a prerequisite to successful education programme (McMahon, 2015). In-service training, seminar and workshops are key means by which teachers' attitude, knowledge and skills can be improved. The teacher on his part should be willing to accept opportunity for improvement when provided. The zeal for self-development can also help individual teacher embark on educational programmes for professional development.

The end product of teacher training is better knowledge, better skill and better values to equip teachers for effective instructional delivery. This also will at the end eliminate the instructional inadequacy that affect learners

The learner factors and effective use of ICT

The learner is the focal point in teaching and learning situation. That is why all classroom interactions and by extension school activities are made to be learner centered. Therefore, the learners have critical roles to play in the attainment of educational goals and effective use of ICT facilities in this regard. The roles of the learners are so vital that the efforts of the government, school and teachers will be in vain if the learners fail in their responsibilities. In the curriculum, special provision is made for learners' activities because of the importance of learner in any teaching/learning situation.

In respect to ICT usage, the learners of this generation are pro-technology driven. They are so engrossed in technology usage that it has become a major concern to stakeholders in the educational sector. Some have considered their attitude to technology as a distraction because of the number of hours learners commit to ICT usage, the kind of activities they engage in while using ICT facilities and the overall impact these activities have on them. Some other educators admire the extent ICT learners' interest, exploration and use of ICT has brought to bear in improving their educational activities. Both of these divides have implication for learners' roles. Adequate focus on school related ICT based activities is key here especially while in school.

Challenges of adopting ICT in Nigeria for effective teaching and learning

Despite the very significant roles ICT plays in education generally and at the primary school level in particular, it is bedeviled by numerous challenges. There are so many impediments to effective deployment of ICT usage in teaching generally and in the teaching of Basic Science and Technology in particular. These problems may be associated with the institution, the teacher, the learners or the government. These are in the areas of poor or lack of infrastructural facilities, power supply, access, lack of competent teachers, poor or total absence of basic facilities that enhance ICT operations. Izar, Na and Na (2021) have argued that despite different initiatives that may be introduced, nevertheless, they will not be successful if there are any barriers in the process of implementation.

The extent to which primary schools can deploy ICT facilities in attaining the objectives of Basic Science and Technology depends on government funding. Even in the era of Covid-19 where social and physical distance globally became the order of the day and the use of ICT in teaching and learning a norm rather than an option, these basic requirements are far from being addressed. These challenges are not peculiar to any level of education in Nigeria; however, the primary school level is worst hit because most of the schools are in the rural areas. According to Malhotra (2021), ICT deployment in this era of the pandemic comes with its challenges. There has been so much emphasis on the role of ICT in salvaging education during the pandemic with little discourse on the technical know-how, access and availability of facilities especially in developing world noted the author. There are also challenges such as unreliable telecommunication network, epileptic power supply, unreliable internet and high cost of ICT hardware/software were identified as major challenges of availability and utilization of ICT in school academic library (Agim, Iroeze, Osuji, Obasi-Haco, 2018). These are challenges arising sometimes from government lack of commitment to adequate funding of education and strong will to mediate between end users of telecom and the service providers. Some others are inadequate assistance from staff, epileptic power supply and irregular internet connectivity (Osuchukwu, Obuezie and Ogwuche, 2017).

So much has been revealed in literature on the inadequacy of the Nigerian teacher at different levels as it relates to ICT usage in instructional delivery. Michika and Manabete (2019) in a survey found that teachers lack competencies. In the area of ICT utilization, most Nigerian primary school teachers despite their training are still novice and alien to contemporary educational technology facilities. Some reasons may account for this. Some of these technologies were not there or they were never exposed to them while they were in training, their resistant to adapt to technology or lack of availability and access to the facilities as well as the environment the teachers operate (rural or urban, ICT stimulating or ICT inhibiting environment). Research findings revealed that even before the pandemic, Nigerian teachers were ill equipped for ICT usage and there is inadequacy of facilities (Archibong and Effiom, 2009, Nanjwan, James, Daniel & Udoh, 2019). Chris, Aguinaga, Hines and Hartshorne (2011), lamented that although, web-based instruction, streaming video, podcasting, video-conferencing, use of wikis and blogs to creating learning community have substantial impact on distance education, teacher educators are reluctant to break away from traditional methods. From the simple phone that almost every Nigerian has to many complex technology gadgets, most teachers are not ready to explore their relevance in teaching and learning. All these pose serious challenges to effective deployment of ICT in teaching in primary school. It becomes imperative, then that if the purpose of ICT usage is to be accomplished; these teachers related factors must be addressed.

Conclusion

Basic science and Technology as a school subject is meant to help learners understand their environment and lay a sound foundation to scientific and technological advancement as pupils prepare for their future career. This can only be made possible if the necessary instructional facilities, ICT inclusive are made available in schools. The use of ICT facilities in teaching and learning globally has become a *sin qua non*. The teachers, institutional, government and learners barriers should be removed through deliberate efforts.

Recommendations

Teachers must become proactive and receptive of various initiatives and changes in technology that influence educational development. Self-development is recommended.

Government needs to demonstrate high interest in education and show adequate commitment through proper funding, provision of instructional infrastructure and facilities and motivate teachers through adequate remuneration, regular training and promotion as at when due.

The learners should channel their technology driven attitude to education related and productive activities. Where facilities exist in schools, pupils should be properly guided to utilize them to enhance maximum benefits; through these approaches the goals of teaching and learning Basic Science and Technology in primary school will be achieved.

REFERENCES

- Agim, N. C, Iroeze, P. C, Osuji, C. E and Obasi-Haco, C. (2018). Level of availability and utilization of information and communication technology facilities by students: a case study of Federal Polytechnic, Nekede, Owerri, Imo State, Nigeria. *European Centre for Research Training and Development*. (4)3, 26-39.
- Archibong, I. A. and Effiom, D. O. (2009). ICT in University Education: Usage and Challenges among Academic Staff. <https://www.researchgate.net>
- Bhattacharjee, B. and Deb, K. (2016). Role of ICT in 21st Century's Teacher Education. <https://www.ripublication.com>
- Chris, O. Aguinaga, N. Hines, R. and Hartshorne, R (2011). Using Contemporary Technology Tools to Improve the Effectiveness of Teacher Educators in Special Education. <https://www.researchgate.net>
- Cox, J. (2016). 5 Essential 21st Century Teaching Strategies. www.teachhub.com
- Federal Ministry of Education (2019). National implementation guidelines for ICT in education. <https://education.gov.ng/wp-content/uploads/2019/07/>
- Federal Republic of Nigeria (2014). 6th edition. *National Policy on Education*. Lagos: NERDC press.
- Izar, N. A., Na, Y. M. A., & Na, K. S. (2021). Teaching in the Time of Covid-19: The Challenges Faced By Teachers in Initiating Online Class Sessions. *International Journal of Academic Research in Business and Social Sciences*. 11(2), 1294-1306.
- Malhotra, S, (2021). The effect of covid-19 in the international education industry. <https://www.researchgate.net>.
- Mahon, R, (2015). The Challenges of Information and Communications Technology Education in Sub-Saharan Africa. <https://www.researchgate.net/publication/285576627>
- Michika, M.U. and Manabete, S.S. (2019). Lecturers' ICT competency needs in the use of peripheral equipment for teaching in polytechnics in Northeast Zone of Nigeria. <http://www.scirj.org>
- Nanjwan, J. James, D., Daniel, D. & Udoh, M (2019). Problems of Utilization of Information and Communication Technology Devices for Education of Students with Visual. <https://www.researchgate.net>.
- Olofu, M. & Olofu, P. (2021). Edmodo as an Online Instructional Delivery Technique for Sustaining Teaching and Learning Activities in Covid-19 Era in Public Universities in North-Central, Nigeria. <https://www.researchgate.net>
- Osuchukwu, N., Obuezie, A. and Ogwuche, G. (2017). Availability and utilization of information communication technology facilities in a private university library in Nigeria. <https://www.ajol.info>
- Sharma, K., Gaudhar, K., Sharma, S. and Seema, S. (2011). Role of ICT in the Process of Teaching and Learning. <https://www.researchgate.net>
- Tech4learning (nd) Build a 21st century classroom! <https://www.tech4learning.com>
- Yusuf, A. and Alabi, B. (2015). Basic Science and Technology curriculum contents; Antidote to functional Universal Basic Education for sustainable development. <https://www.academia.edu>