



The Role of Information and Communication Technology (ICT) in Teachers Education for Sustainable Development in Nigeria

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Abstract. This paper discussed the place of Information Communication Technology (ICT) in teacher education for sustainable development in Nigeria. The main argument here is that the ICT environment in Nigeria needs to be enriched to ensure the training and development of teachers that are able to blend with the changing demands of teaching in the present era of globalisation with its emphasis on Information Communication Technology (ICT). The main critical issues identified as needing policy intervention here are teacher Information Communication Technology (ICT) access and competence. Some of the advantages of Information Communication Technology (ICT) on education for sustainable development are highly spelt out. The paper recommends enhancement of teacher access and competence through curriculum adaptation that will involve theoretical and practical exposures in Information Communication Technology (ICT) as part of teacher education programme and provision of access to computer and other ICT infrastructure to teachers on the field.

Keywords: Information and Communication Technology, Teacher Education, Sustainable Development, Globalisation.

1. Introduction

Information and Communication Technology (ICT) has become a house-hold concept all over the world. In Nigeria, under star, ling and mastering of basic

skills and concepts of ICT form part of the core of schools at various levels. It might be construed that ICT generally refers to computers and computing related activities. This is, however, not the case because even for the fact that computer and their applications play important role in modern information management, other technologies or system also comprises the phenomenon that is commonly regarded as ICT.

UNESCO (2017) regards Information and Communication Technology (ICT) as the combination of information technology with other related technology, specifically communication technology. Informatics refers to the science dealing with the design, realisation. Evaluation, use and maintenance of information process systems which include hardware, software organisational and human aspect. An implication of this information technology on the other hand is defined as the technological application (artefacts) of informatics in society. This paper is aimed at examining the role of ICT in Nigeria teacher education system, advantages of ICT in education for sustainable development, teacher's education and ICT., the impact of ICT on teachers/students, the use of E-learning in education, challenges it also discuss in ICT in education, recommendations and conclusion. Information Communication Technology highly depends on manpower training, instruments, power supply/energy. Utilization which will lead to sustainable development.

2. The Relevance of ICT in Education

The communication revolution has had tremendous implications for education because education involves both medium and message of the communication process. ICT in education means the use of computer and different applications of ICT in instruction as well as information transmission and exchange via the World Wide Web to enhance cognitive development. Through the application of information and communication technology in education, motivation is ensured because it helps in the recall of previous learning, providing new instructional stimuli and activating the learner's response like power point presentation in seminars. This also provides systematic and steady feedback. ICT facilitates appropriate practice sequencing learning and acts as a viable source of information for enhanced learning. As people become aware of the development around them, there is every tendency to improve the same in Nigeria. By using this innovative, instructional strategy, learners would be able to nurture and sustain desirable attitude towards information technology tools in their entire life. The chosen medium of communication influences the distribution of knowledge over time and space. The technology involved in communicating has been linked to learning throughout history.

The uses of information and communication technologies in the education process are divided into categories. According to Okebukola (2016), the categories are ICT for education and ICT in education. By ICT for education, he means the development of information and communication technologies in the teaching-learning process, and by I.C.T. in education he means the utilization of information and communication technology in teaching-learning process.

Thomas and Raga (2014) classify the application of computers and other communication technologies in education into three categories: Pedagogy: Training and: Continuing education. Pedagogical application of ICT is concerned with the more effective learning with the aid of various components of ICT. Explaining further on this concept or classification, the authors express optimism that almost all subjects ranging from the most structured Mathematics to the least structured music can be taught and learnt with the help of computers. It means that the application involves effective learning with the aid of computers and other information technologies serving the purpose of learning aids that play contemporary roles in teaching/learning situations rather than supplementary to the teacher/instruction/facilitator. Most people refer

to computers as add-on rather than replacing device. Training refers to the development of skills. A skilled person is one who is well coordinated in psychomotor activity. In a simpler term, it refers to programmes that are concerned with improved ways of doing things, of carrying out various activities in a professional manner. Information communication and technology can be used to develop skill since it can provide programme that manifests its capacity for simulation model building and interactive adaptation. This usage cuts across all courses and professions including administrative skills related to student management, tutoring, course writing and seminars.

The concept of continuing education is linked to society that is willing to learn but has been hampered by one factor or another which necessitates a break or gap in education not necessary as a result of mental incapability. By the dynamic nature of the contemporary society the end of formal education does not mean the end of learning. The rate at which changes come in the world demands the actualisation of the adage that learning is a continuous process which continues throughout one's life. One of the best tools to keep abreast with the world and sustain life long education is the use and application of information and telecommunication technology. Continuing education is based on past formal education and it assumes learner's to be adult or near adult who can manage their learning on their own. Apart from traditional technologies such as print, broadcast, television and radio, some other sophisticated new technologies provide opportunities for enhancing quality of teaching. These are audio tape, video tapes, computer-based planning packages, interactive video, CD, TV, audio teleconference and video conferencing. These technologies have been recently supplemented by the advent of opportunities for interactivity and access to instructional resources provided by the computer telecommunication network popularly known as internet. The delivery technologies package information and instruction to give student access to educational experiences.

According to UNESCO. (2013): The relevance of Information and Communication Technology (ICT) in education can be seen in various ways:

Improved access to information: With the internet and digital resources, students have access to a vast amount of information at their fingertips. This allows them to research and learn about topics in depth, beyond what is covered in textbooks. By using search engines and online databases, students can find up-to-date and reliable information to supplement their learning.

Enhancing communication and collaboration: ICT tools such as email, video conferencing, and messaging apps facilitate communication between students, teachers, and parents. Students can collaborate on projects with classmates in different locations, and teachers can provide feedback and support remotely. This improves the overall learning experience and fosters a sense of community among students and educators.

Personalized learning: ICT allows for personalized learning experiences tailored to individual student needs and learning styles. Educational software and platforms can adapt to each student's pace and level of understanding, providing targeted support and resources. This helps students to learn at their own pace and focus on areas where they need more help.

Engaging and interactive learning: ICT tools such as interactive whiteboards, educational apps, and simulations make learning more engaging and interactive for students. These tools can help students visualize complex concepts, conduct virtual experiments, and participate in virtual field trips. By making learning fun and interactive, ICT can improve student motivation and retention of information.

Global Perspectives: ICT enables students to connect with peers and experts from around the world, allowing them to gain global perspectives and cultural awareness. Through online collaborations and exchanges, students can learn about different cultures, languages, and viewpoints, enriching their educational experience and preparing them for a globalized world.

The relevance of ICT in education lies in its ability to enhance learning outcomes, improve access to information, facilitate communication and collaboration, personalize learning experiences, engage students, and provide global perspectives. By integrating ICT into the education system, teachers can create a more dynamic and student-centered learning environment that prepares students for the challenges of the 21st century.

3. Advantages of ICT in Education for Sustainable Development

With the integration of ICT in education there is every hope of industrial growth in the country, Industrialisation provides high output per man. This enhances growth of the economy and improves the living standard of the citizen (Okebukola, 2016). The idea of depending on the national government for white collar job will be reduced with the introduction of information and communication technology in our educational system. This implies that information and

communication technologies create opportunities for many enterprising individuals, firms and countries globally. The army of youths roaming the streets with all related criminal activities will be employed and crime waves will also be reduced. The emergence of GSM, commercial business centres, and cyber cafes, in the country has enhanced the economic fortune of families. The wasted human resources have been engaged in one form or the other, thereby encouraging research into the areas that can encourage foreign reserve.

Outside the socio-economic prosperity through ICT integration in education, teaching and learning will be improved in terms of their outcomes. It is, however, important to state that the use of this technology does not automatically enhance the quality of teaching and learning. Wali. (2018) asserts that in a situation where information and communication technology are efficient and effective and functional, they will relatively be used as teaching materials, easy data storage and processing as well as trial and simulation, easy documentation and follow up. It also provides easy access to information and external programmes as well as facilitate distance education. He stressed that when used and developed efficiently, it helps teachers teach more and better integrate learning. It brings together a large number of professionals who were apart in time and space. Despite the litany of the advantages of ICT in education for sustainable development, there are bound to be some shortcomings, such as low electricity supply, insufficient manpower, and insufficient computer instruments e.t.c.

Information and Communication Technology (ICT) plays a significant role in promoting sustainable development in education. By leveraging ICT tools and resources, educational institutions can address key challenges related to access to quality education, environmental sustainability, and social equity. The following advantages of using ICT in education for sustainable development:

Access to quality education: ICT provides students with access to digital learning resources, online courses, and educational platforms, regardless of their location. This helps bridge the gap between urban and rural areas, ensuring that all students have access to quality education and learning opportunities. For example, the use of online learning platforms such as Khan Academy and Coursers allows students to access high-quality educational content for free.

Environmental sustainability: ICT can contribute to environmental sustainability by reducing the need for

paper-based resources and minimizing the carbon footprint associated with traditional education practices. Digital textbooks, online assignments, and e-learning platforms help reduce paper waste and energy consumption, making education more eco-friendly. Additionally, virtual classrooms and webinars reduce the need for physical travel, thus reducing carbon emissions.

Enhancing teacher training and professional development: ICT tools can support teacher training and professional development by providing access to online courses, webinars, and resources. Teachers can expand their knowledge and skills in areas such as digital literacy, online teaching methods, and educational technology, empowering them to deliver high-quality instruction that promotes sustainability and environmental awareness.

Fostering collaboration and networking: ICT enables collaboration and networking among students, teachers, and educational institutions, fostering a culture of knowledge sharing and innovation. Online platforms, social media, and virtual communities allow stakeholders to connect, share resources, and collaborate on projects that promote sustainable development in education. For example, the Global Education Innovation Initiative (GEII) encourages collaboration among educators worldwide to promote sustainable development goals.

Promoting lifelong learning and continuous improvement: ICT supports lifelong learning and continuous improvement by providing access to online courses, webinars, and resources that help individuals enhance their knowledge and skills. By embracing digital learning opportunities, students and educators can stay current with evolving educational trends, technologies, and practices, thus contributing to sustainable development in education.

The advantages of using ICT in education for sustainable development are evident in its ability to provide access to quality education, promote environmental sustainability, enhance teacher training, foster collaboration, and support lifelong learning. By integrating ICT tools and resources into educational practices, institutions can create a more sustainable and inclusive learning environment that empowers students and educators to make positive contributions to society.

4. Teacher Education and ICT

ICT has changed the practice and philosophy of education, particularly teacher education and it is a powerful tool for the development of quality teaching

and learning (Wali,2018).If the impact of ICT is to be felt in the lives of learners and the society at large, then teachers who are supposed to be "advocates of change" in the society must first be recipients of the current ICT revolution. According to Asuquo (2018), the environment in which the instruction is given simulates the working environment to the maximum possible degree. Teachers should be acquainted with technology (ICT) replica of the ones in the world of works and the ability to manipulate the ones in the world of works is a reflection of the skills acquired during training. The need to organise and manage content and teach it properly puts the teachers at the forefront of those that need ICT, because this is basically what ICT in education represents. For teachers to be very relevant and successful with respect to changing educational goals, then they must be abreast with proper means of disseminating and communicating with their students.

Basically, one of the goals of teacher education as contained in the National Policy for Education (2004) is to provide teachers with the intellectual and professional background adequate for their assignment and make them adaptable to any changing situations. But this is not the case, for instance, Iroha and Ekwueme (2004) observed that the extent of science teachers' awareness of ICT and utilisation are low, while Rubinson B. (2016) found that, majority of mathematics teachers are not computer skilled and may not be ready to use computer in implementation of mathematics curriculum. These findings reflect the level of inadequacy or lack of exposure to ICT in teacher training institutions. Teachers should therefore, be exposed to ICT in the course of their training in order to enhance productivity for quality education.

Ertmer, P. A. (2005). Enumerates some key aspects to consider when discussing teachers' education and ICT: Professional development for teachers: Teacher education programs should provide professional development opportunities for educators to enhance their ICT skills and digital literacy. Training workshops, online courses, and mentorship programs can help teachers develop proficiency in using educational technology tools, digital resources, and online platforms to support teaching and learning.

Integration of ICT in curriculum and pedagogy: Teacher education programs should emphasize the integration of ICT in curriculum design, lesson planning, and instructional strategies. Educators need to understand how to effectively incorporate digital tools, multimedia resources, and online activities to

enhance student engagement, foster critical thinking skills, and facilitate collaborative learning.

Digital assessment and feedback: Teachers should be trained in using ICT for assessment and feedback purposes, such as online quizzes, digital portfolios, and virtual assessments. By leveraging digital tools for assessment, teachers can gather and analyze student data, provide timely feedback, and track learning progress effectively.

Ethical and safe use of ICT: Teacher education programs should address ethical considerations, digital citizenship, and online safety guidelines to ensure that educators promote responsible and safe use of ICT in the classroom. Teachers need to understand the importance of protecting student privacy, preventing cyber bullying, and promoting digital literacy skills among their students.

5. The Impact of ICT on Teachers/Students

Information and Communication Technology (ICT) has a profound impact on both teachers and students in education. The integration of ICT tools and resources in teaching and learning can transform the way educators deliver instruction, engage students, and enhance learning outcomes. The impact of ICT on teachers and students can be seen in various aspects, including teaching effectiveness, student engagement, and skill development. According to Law, N., & Yuen, A. (2016). When discussing the impact of ICT on teachers and students:

Impact of ICT on Teachers: Professional development: ICT provides opportunities for continuous professional development for teachers, allowing them to enhance their digital literacy skills, learn new teaching strategies, and stay current with educational technology trends. Training workshops, online courses, and peer collaboration can help teachers improve their ICT competencies and integrate technology effectively in their teaching practices.

Instructional Support: ICT tools offer teachers valuable resources and support to design engaging and interactive lessons, create multimedia presentations, and deliver personalized instruction to meet the diverse learning needs of students. Digital platforms, educational software, and online resources enable teachers to provide differentiated instruction and address individual student interests and strengths.

Collaboration and Communication: ICT facilitates collaboration among teachers through online platforms, virtual communities, and professional

networks, enabling them to share resources, exchange ideas, and collaborate on instructional projects. Communication tools such as email, messaging apps, and video conferencing enhance communication between teachers, students, and parents, fostering a collaborative learning environment.

6. Impact of ICT on Students

Engagement and motivation: ICT enhances student engagement and motivation by providing interactive learning experiences, multimedia content, and real-world applications of concepts. Digital tools such as educational apps, virtual simulations, and gamified learning platforms make learning fun and engaging, encouraging students to actively participate in their learning process.

Personalized learning: ICT enables personalized learning experiences tailored to students' individual needs, learning styles, and interests. Adaptive learning software, online assessments, and virtual tutoring programs help students progress at their own pace, receive targeted support, and explore areas of interest in depth.

Critical thinking and creativity: ICT fosters the development of critical thinking, problem-solving, and creative skills among students. By using digital tools to research, analyze information, and collaborate on projects, students develop analytical and creative thinking abilities that are essential for success in the digital age.

Digital literacy and 21st-century skills: ICT equips students with digital literacy skills, technological proficiency, and 21st-century competencies that are essential for their future success. By using ICT tools in their learning activities, students learn how to navigate digital resources, evaluate information sources, and communicate effectively in a digital world.

The use of ICT has had impact on the roles of both students and teachers. The teacher is no longer the dominant figure to teaching and learning process and the gap between teaching and learning is narrow and more precise. According to Voogt, J. (2017). These are some of the realities as a result of ICTs in education:

- Teachers will no longer be masters but colleagues.
- They are no longer custodians of knowledge and culture but guides and helpers.
- They help manage learning not "give rules" on how to learn.

- The interactive nature of internet and the World Wide Web allows teachers and students to share knowledge and ideas. Thus, teachers and students become partners and learn from each other.
- Students will operate mostly independently.
- They will no longer be passive recipients of knowledge but active participants in what and how they learn.
- Students do not have to go to a classroom to learn. Instead, classroom learning will come to them in richer and better ways.

7. Use of E-Learning in Education

E-learning, also known as online learning or digital learning, has emerged as a popular and effective method of delivering education through digital technologies. E-learning offers students and educators the flexibility to access educational content and resources anytime, anywhere, using computers, mobile devices, and the internet. The use of e-learning in education has several advantages, including increased access to quality education, personalized learning experiences, and enhanced student engagement. According to Picciano, A. G. (2017). Here are some key points to consider when discussing the use of e-learning in education:

Access to quality education: E-learning provides students with access to high-quality educational content, online courses, and learning resources that may not be available in traditional classroom settings. By removing geographical barriers and time constraints, e-learning enables students to access educational opportunities from top institutions and experts worldwide, expanding their learning possibilities.

Personalized learning experiences: E-learning platforms allow for personalized learning experiences tailored to students' individual needs, interests, and learning styles. Adaptive learning algorithms, interactive multimedia content, and self-paced modules enable students to learn at their own pace, receive immediate feedback, and engage with content that aligns with their learning preferences.

Flexibility and convenience: E-learning offers flexible learning options that accommodate busy schedules, diverse learning styles, and varied commitments. Students can access course materials, participate in discussions, and complete assignments at their convenience, allowing for greater control over their learning process and promoting self-directed learning habits.

Enhanced student engagement: E-learning platforms enhance student engagement through interactive multimedia content, gamified learning activities, and collaborative online discussions. Features such as video lectures, virtual simulations, and online assessments make learning more engaging, interactive, and participatory, leading to increased student motivation and retention of course material.

E-Learning, according to Walli (2018), is the main ICT new education tool. E-learning or electronic learning is a new tool or instrument of teaching and learning. Wali (2018) opines that, e-learning is a form of learning that is provided electronically. It comprises the use of computers, telephones, satellites, internet and the World Wide Web. It could be provided partially or wholly via a web browser or through the internet or an intranet or through multimedia platforms such as CD-ROM or DVD. Waller and Wilson (2014) in their views, posited that e-learning is the effective learning process created by combining digitally delivered content with learning support and services. The use of e-learning in education has a great impact on teachers/students. Harmonising these definitions and views, e-learning could be seen as a technology-based process/method of teaching and learning that involves the effective delivery of instruction through the use of ICT facilities, computers, telephones, multimedia internet, intranet and the World Wide Web; that is, an electronic means of delivering curriculum-based instructions which is comprehensive in content, presentation and purpose.

8. Challenges in ICT Education

The success of any educational programme depends on the calibre of teachers available to handle such programmes. According to Ebitimi (2016), our teachers did not have adequate training to the concept of pedagogy. The new learning technology and their uses. There is shortage of manpower for effective utilisation of software and their maintenance. This is to say that there are not enough qualified programme engineers and technicians and they are equally difficult to fund. When they are found, the (public) education cannot afford to retain as competition from the private sector is fierce.

Inyang- Abia (2017) enumerates some constraints facing ICT education to include the following:

- Dearth of qualified human resources
- Lack of enough political will and support by the government
- Lack of technical knowhow
- Inadequate supply of ICT equipment and devices
- Lack of constant energy or power supply;

- Lack of integration of ICT into education mainstream.

The epileptic nature of power supply in the country is another inhibition to effective use of technology in education. All information and communication technology are power driven. So, unless the bodies concern with power supply wake up from their slumber, the dream of information and communication technology will remain on paper and unfulfilled dream which is bad for the country. The information and communication technology equipment is costly implying that the electronic materials are not at the reach of many families in Nigeria. It means they require a hundred percent input of government at all levels ie. Federal. State and Local Governments to make the programme a reality. Also, identified as a shortcoming, is the problem of diversion of equipment. This is the manifestation of the indiscipline in our society. It is common knowledge that there was a lot of vandalisation, diversion and stealing of introductory technology equipment imported to this country at the wake of 6-3-3-4 system of education in the 1990s.

Nigeria as a nation is working towards belonging to the comity of nations that embrace ICT literacy. In view of this new dimension, it is a new experience for both teachers and students who are all going into the information communication technology as co-learners. The first challenge for the teachers in this circumstance is that they are faced with idea of creating a school or learning and teaching environment that is fundamentally different from what they experienced.

Information and Communication Technology (ICT) has transformed education by providing new tools and resources to enhance teaching and learning. However, the integration of ICT in education also poses several challenges that educators and institutions need to address. Understanding these challenges is essential to developing effective strategies for maximizing the benefits of ICT in educational settings. Here are some key challenges of ICT in education:

Inyang- Abia (2017) enumerates some challenges facing ICT in education to include the following:

Access and infrastructure: One of the primary challenges of ICT in education is the unequal access to technology and reliable internet connectivity among students and schools. Disparities in access to digital devices, software programs, and high-speed internet may limit students' ability to fully engage with online resources and participate in digital learning activities.

Digital literacy and training: Many educators may lack the necessary digital literacy skills and training to effectively integrate ICT tools into their teaching practices. Without sufficient training and professional development opportunities, teachers may struggle to incorporate technology into their lessons, assess digital resources, and provide meaningful support to students in using digital tools.

Technological barriers and compatibility issues: Educational institutions often face challenges related to the compatibility of ICT systems, software applications, and digital resources. Inconsistent technology standards, interoperability issues, and software incompatibilities may hinder the seamless integration of ICT in curriculum delivery and communication between stakeholders.

Digital divide and equity concerns: The digital divide refers to the gap between individuals and communities who have access to technology and those who do not. In educational settings, the digital divide can exacerbate existing inequities in access to educational opportunities, resources, and learning outcomes, particularly for underserved populations and marginalized groups.

In addressing these challenges, educators, policymakers, and technology providers need to collaborate to develop comprehensive strategies for promoting equitable access to ICT, enhancing digital literacy skills, ensuring data security, and mitigating the impact of the digital divide on educational outcomes.

9. Recommendations

ICT education should be included in teacher education curricula at various teachers training institutions with qualitative programmes that will address ICT knowhow.

Provision of necessary infrastructural support: power supply, internet facilities and others. Also, massive training and deployment of skilled manpower to the various teacher education institutions should be encouraged.

Teacher education curriculum should be reformed or re-structured to accommodate ICT education in order to meet new educational challenges.

Adequate funding by relevant bodies: Government, international donors etc: should be provided for the entire educational sector. Particularly teacher training institutions with emphasis on ICT development.

Teacher training institutions should design and deliver in-service and pre-service training programmes for teachers.

10. Conclusion

Just as education is important to the overall development of the society, it is much more important to note here that, qualitative teacher education through the introduction of ICT in teacher education is a sine qua non for the country's educational and national development, because no education system might rise above the quality of teachers. The need to integrate ICT into teacher education is right now inescapable in order to meet the changing global and national educational goals, which are designed for the nation's sustainable development.

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