

Provision and Utilization of ICT and Internet Services in Science, Technology and Mathematics Education for Effective Teaching and Learning in Nigeria

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***Abstract:** The revolution in information Communication Technology (ICT) has contributed tremendously to better practice in education programme delivery globally. It links different regions on the earth for better interaction. In this paper the researchers discussed basic concepts of ICT, Science and Technology, Need for adequate provision for ICT, The Role of ICT in Education, Challenges of Effective Use of ICT for STM Teaching in Higher Institution, Challenges and problems of ICT use in education in Nigeria, were discussed. In the end, the researchers recommend that there should be enough electricity in order to utilize and access the ICT in the teaching and learning effectively. The NGOs and government from all levels should provide computers and ICT facilities in order to improve teaching and learning on the internet globally.*

Need for adequate Provision for ICT

In 2008, UNESCO emphasized the incorporation of ICT within national education efforts (Castillo, Chen, Gatlin-Watts, & Enriquez de Rivera, 2013; Harasim, Hiltz, Turoff, & Teles, 2000; Hepp, 2003 cited in Cancino & Donoso, 2004). According to Chen, Castillo and Ligon (2015) stated that in addition to being a valid goal for education, ICT is also a means to an end, in as much as it enhances pedagogical effectiveness. When ICT is available to teachers and students, it can enhance learning and teaching experiences (Collins, 1991; David, 1991; Sheingold, Hadley, & Center for Technology in Education, 1990). The effective usage of ICT expands learning and knowledge on local, national and global levels.

Many countries, including the USA, United Kingdom, the Netherlands, South Africa, Chile, India, Czech Republic, Korea and Australia have developed standards and policies to foster and implement ICT in their educational systems (Bose, 2010; Castillo et al, 2013; Dawson, 2008; Driscoll, 2007; Heck, Houwing, & de Beurs, 2009; Jamieson-Proctor, Burnett, Finger, & Watson, 2006; Park, Khan, & Petrina, 2009; UNESCO, 2006; Zounek, 2005). Researches in Mathematics and science education have shown that some national and international ICT affiliated institutions and policies, such as in Chen, Castillo and Ligon (2015), Importance of ICT Globally and Nationally. Region Institution/Organization/Project African Community (Cameroon, Congo, Burkina Faso, Senegal, Angola, Namibia, Mali, Madagascar, Ghana, Guinea) ICT- enhanced Teacher Standards for Africa (ICTeTSA) Australia * Department of Education and Training * Teachers ICT skills Chile * Center of Education and Technologies * The Information and Communication Technology Standards for teacher training, China Educational Technology Standards European Community European Pedagogical ICT European Union * Definition and

Selection of Competencies (DeSeCo) developed by OECD * The project--Tuning Educational Structures in Europe * European e-Competence framework (e-CF) Great Britain Community British Educational Communications and Technology Agency (BECTA) -The E -Learning Nordic project India and South Asia The Little Data Book on Information and Communication Technology, Information and Communication Technology for Education International Community * United Nations Educational Scientific and Cultural Organization (UNESCO) *

International Society for Teacher Education * Organization for Economic Co-operation and Development (OECD) * World Bank (WB) * Inter-American Development Bank (IDB) * Organization for Economic Co-operation and Development (OECD) members: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States –

Technology Use and Educational Performance in PISA (Program for international student assessment) Jordan * Education Reform for the Knowledge economy (ERfKE) * Jordan Education Initiative (JEI) Mexico * National Development Plan and * The State Development Plan for Yucatan * The Mexico with Quality Education Strategy South Africa Foundation for Education, Science and Technology (which has developed the High Performance Leadership Competencies Systems) World Community (Finland, Denmark, the United States, Norway and the UK) The Horizon Report by the New Media Consortium(NMC) United Arab Emirates * National Council for Accreditation of Teacher Education * Vision For Education 2020 * The Ministry of Education and Youth (MOEY) United Kingdom ICT Competency Standards for Teachers developed by UNESCO United Nations Global Alliance Information and Communication Technologies and Development United States * Office of Information and Communication Technology (OICT) of United Nations * The International Society Technology Education * The Society for Information for Technology and Teacher Education (SITE) * The International Education Practice Journal of International Technology and Information Management Volume 24, Number 4 2015 © International Information Management Association, the breadth of the above programs and initiatives is a natural outgrowth of the consensus on the role that technology plays in today's learning environments.

The potential benefits deriving from, and the need for, a well-integrated ICT dimension to teaching rests on extensive and developed literature. According to Duhaney and Zemel (2000), and D'Ignazio (1989), inter alia, today's teachers must incorporate technology in their jobs in order to comply with contemporary learning demands. In the information age, it is impossible to obtain, digest and utilize, all available knowledge. In this environment, ICT plays a role in accessing and managing knowledge, while making learning both easier and engrossing. At the same time, technologies develop "critical thinking, inquiry, and problem solving" (Alghazo, 2006, p. 328) abilities.

Teachers must be proficient in ICT in order to bring available knowledge into their classrooms (Aduwa-Ogiegbaen, 2009; Barbera, 2003; Castillo et al, 2013, González, 2008; Hepp, 2003, Jari, Kalle, Maija, & Veijo, 2006; Peralta & Albuquerque, 2007; UNESCO, 2008; McVay, 2002; Vales, 2009). Mac Calluma, Jeffrey, and Kinshuk (2014) emphasize that teachers' and students' opinion of each other's technological proficiency and competencies diverge

The Role of ICT in Education

The actual roles played by educators in the dissemination and incorporation of ICT were examined by Castillo, Chen, Gatlin-Watts, and Enriquez de Rivera (2013). First, teachers become lifelong learners. Technology is a dynamic area which sees constant flux. In order to stay proficient, teachers have to experiment with new tools and resources which expand their capacity to use different technologies as teaching tools. Second, teachers incorporate inner and outer resources to expand their technological knowledge. Third, teachers convert to “learning facilitators” (Castillo et al., 2013, p. 26).

They design and develop class curriculum to enhance learning outcomes. These new roles are implemented through teachers’ willingness to learn ICT and to share it both with students and with colleagues. Teachers on all levels from an elementary school to high school (and the equivalents of those levels among countries with different nomenclature) need to be comfortable with ICT and to empower their students to use ICT themselves and to learn from it. ICT knowledge is necessary at all educational levels for teachers and students, regardless of subjects taught and degrees obtained.

However, some researchers have indicated that some teachers do not feel that they are adequately prepared to incorporate technology into their teaching (Butter, Pérez, & Quintana, 2014; Grabe & Grabe, 1998; Wetzel, 1993). The potential pitfalls for those teachers, and their students, are obvious: a classroom in which the educator feels uncomfortable with the technology that the students need may prove to rob students of necessary skill development, and fail to impart the knowledge ostensibly delivered there adequately.

It may also well be that ICT attitudes are infectious, and that students are less able to feel comfortable using ICT if their teachers aren’t. In addition, teachers are fearful that they lack ICT competences compared to their students (Butter, et al., 2014). In general, not only competence in ICT, but attitude towards ICT among teachers is also important. Although at both the local and national levels there is a general understanding of the need for improved ICT engagement within classrooms, the attitudes of individual educators will have positive or negative repercussions for the educational attainments of students. Information Communication Technology (ICT) is defined as “skills around computing and communications devices, software that operates them, applications that run on them, and systems that are built with them” (Mid-Pacific ICT Center, 2014). There is as yet no universal or agreed upon definition of what an ICT competency is. However, McLagan (1997) outlined different

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2009). Mac Calluma, Jeffrey, and Kinshuk (2014) emphasize that teachers' and students' opinion of each other's technological proficiency and competencies diverge. The actual roles played by educators in the dissemination and incorporation of ICT were examined by Castillo, Chen, Gatlin-Watts, and Enriquez de Rivera (2013). First, teachers become lifelong learners. Technology is a dynamic area which sees constant flux.

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There is as yet no universal or agreed upon definition of what an ICT competency is. However, McLagan (1997) outlined different foci of the concept, while Castillo et al. (2013) surveyed a number of different approaches that analysts have used. In this paper, we will focus on competency related to both expertise in the abstract and to "bottom line" functional performance (see Diaz Barriga 2006 for a utilitarian application of the term "competence").

As a relevant part of our strategy, we will also incorporate affect, or attitude. Teachers' attitude is crucial towards ICT's incorporation in teaching practices. Hernández-Ramos, Martínez-Abad, Peñalvo, García, & Rodríguez-Conde (2014) analysis showed that "perceived usefulness and the perceived ease of use" (p. 513) directly influence teachers' attitude towards ICT. However, it is important to remember that self-efficacy is more predominant than solely attitude towards ICT (Alshawareb & Majed, 2012; Kreijnsa, et al., 2014). Teachers have to believe in their ability to objectively implement ICT in teaching (Alshawareb & Majed, 2012). Kreijnsa et al. (2014) found that attitude was predominant to self-efficacy towards the intent of applying Digital Learning Materials (DLMs), as a subcategory of ICT.

Challenges of Effective Use of ICT for STM Teaching in Higher Institution

Mathematics education researches have shown that there are different challenges attached to the ICT in teaching and learning of STM ranges from secondary and tertiary institutions. In Nigeria higher institution was not left behind in experiencing the challenges of ICT in teaching and learning in high institutions of learning (HIL) (Flecknoe, 2002). This development could partly be traced to the realization

and acceptance by learning of the significant roles ICTs are capable of playing in the education sector (flecknoe,2002).

In these HIL, the environment has remained almost stagnant due to the slow pace of capacity building mechanisms, poor funding. Inadequate infrastructural provision and development, and until very recently, low wages (flecknoe, 2002). According to Chen, Castillo and Ligon (2015) however, the numbers of both enrolled and aspiring students has been on the increase because of the obvious flood of academic information globally. It has been observed that information and communication technologies (ICTs) are capable of and are playing a number of significant functions in education programme delivery (flecknoe 2002; Mc Cormick and scrimshaw, 2007).

Some of these functions include ICT being employed as catalysis for rethinking and repositioning of learning and teaching practices (flecknoe, 2002; Mc Cormick and scrimshaw,2001). Tuckman (2003) opined that ICT is important in developing the kind of graduates and citizens required in an information society, improving educational outcomes (especially pass rate). ICT is also important in improving the quality of teaching and learning (wagner 2001, garrison & Anderson 2003). The thesis of this paper is that all these potential impact of ICTs in education are largely dependent on factors such as degree of access to the ICTs, proficiency level in the usage of ICTs, administration and management of ICTs during usage among those charged with the responsibilities of dishing out the educational diets (i.e. teachers, lecturers and instructors) according to Mogbo, Gana, Alabi 2015.

Challenges and problems of ICT use in education in Nigeria

Mathematics education researches have shown that there are different challenges attached to the ICT in teaching and learning of STM ranges from secondary and tertiary institutions. In view of this apparent lack of proper implementation of ICTs at various levels of Nigerian education, it is important for all concerned stakeholders to examine barriers militating against effective implementation of ICT in schools and fashion out ways to overcome same (Chen, Castillo and Ligon, 2015).

According to Adeyemi et al. in their 2010 study “Information Communication and Technology (ICT) for the Effective Management of Secondary Schools for Sustainable Development in Ekiti State”, Nigeria stated thus;“ It was found that the level of provision of ICT equipment to secondary schools in the State was low. The level of principals’ management of schools was also low.

The intermittent disruption of electricity and inadequate funding were found as major problem inhibiting the usage of ICT equipment for the management of schools in the State. It was concluded that the State government was not fully ready to imbibe (ICT) for the effective management of secondary schools in the State (Adeyemiet al; 2010: pg 3).”Their findings above reflected the lackadaisical attitude of most state governments in Nigeria towards the adoption and implementation of ICT in their public schools.

Their position concerning the influence of electricity on the implementation of ICT was consistent with those of Hodge-Hardin (1995) and Knupp (1996) which found a significant relationship between non-supply of electricity and the usage of computers in schools. The findings indicating principals’ low level of management of schools might not be unconnected with the problem of shortage of ICT equipment in the schools (Adeyemi and Olaleye, 2010b). Adegun (2002) in his PhD thesis titled “Communication and Administrative Effectiveness of Principals of Secondary schools in South Western, Nigeria” also concluded that communication facilities are deficient in most secondary schools in southwest Nigeria. Iloanusi & Osuagwu (2010) identified

the factors that limit the infusion of ICT in educational institutions in Nigeria. These include paucity of ICT infrastructure and lack of access; high enrolments, inadequate funding and absence of funding allocation to technology; high cost of ownership, unsteady and inadequate electrical power supply and cost to the consumer and policy implications of the mismatch between the advertised capabilities of ICT technology and the aims of individual educational institutions.

Studies have also indicated the academic benefit of ICTs in education. Meta analyses have found consistently positive and moderately high achievement gains at all educational levels from computer mediation in school subjects, particularly mathematics. The computer-assisted instruction was found more effective in all educational levels and with lower achieving students (Kulik, 1983; Kulik, Kulik, & Cohen, 1980).

Information and communication technologies significantly improve students' problem-solving skills, provide opportunities for student-constructed learning, increase students' collaboration on projects, increase mastery of vocational and workforce skills, increase the preparation of students for most careers and vocations, and improve confidence and attitude of students (Cradler & Bridgforth, 2003). Fairle (2008) has highlighted some variables that can be used to measure the penetration rates of internet (ICT) in a society and that these do vary only slightly in developed to developing countries.

They include Income, human capital, the youth dependency ratio, telephone density, legal quality and banking sector development, legal quality and human capital. Ani, Uchendu and Atsey (2006) investigated the prevalence of digital divide in Nigeria, using University of Calabar in the Calabar Metropolis as a case study. The finding of the their survey showed the prevalence of various forms of digital divide such as gender, marital status, age and educational level of the internet users in Nigeria.

Their survey was focused on the part of the general public that patronizes cybercafés. Of much importance in their results are the issues of age and educational level of the respondents. Several studies have shown significant relationships between these two variables and use of ICT resources.

Okebukola (1997), cited by Aduwa-Ogiegbaen and Iyamu (2005), concluded that the computer is not part of classroom technology in more than 90 percent of Nigerian public schools. This implies that the chalkboard and textbook continue to dominate classroom activities in most Nigerian secondary schools. It is important to understand that the majority of Nigerian public schools are situated in towns and villages which constitute the rural part of the nation.

This clearly points to the fact that ICT use in the rural places is almost non-existent. A survey "Indicators of ICT Application in Secondary Education of South-East European Countries" aimed at investigating the main factors, tendencies, problems, and solutions for ICT applications in secondary schools of South-Eastern Europe was conducted by the UNESCO Institute for Information Technologies in Education (UNESCO-IITE).

Nine countries from the region were involved in the project: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, former Yugoslav Republic of Macedonia (FYRO Macedonia), Republic of Moldova, Romania, Serbia and Montenegro, and Turkey. The report presents the specialized comparative research exploring the state-of-art of Informatics/ICTs and ICT

applications. After the analysis of the data collected, the following recommendations, inter alia to the educational policy and decision makers were made:

- 1.To promote national curricula for both Informatics/ICTs and for integration of ICTs in other subjects;
- 2.To support national curricula with a variety of educational software;

Conclusion

Learners are the immediate users of ICT, in fact, students go through institutions of learning by buying scratch cards and use to fill forms through internet. Based on this demand, it is therefore pertinent to provide sufficient internet and ICT materials in place in order to ease difficulties in teaching and learning of STM in Nigeria. Meta analyses have found consistently positive and moderately high achievement gains at all educational levels from computer mediation in school subjects, particularly mathematics. It is important to understand that the majority of Nigerian public schools are situated in towns and villages which constitute the rural part of the nation. This clearly points to the fact that ICT use in the rural places is almost non-existent.

The study identified the factors that limit the infusion of ICT in educational institutions in Nigeria. These include paucity of ICT infrastructure and lack of access; high enrolments, inadequate funding and absence of funding allocation to technology; high cost of ownership, unsteady and inadequate electrical power supply and cost to the consumer and policy implications of the mismatch between the advertised capabilities of ICT technology and the aims of individual educational institutions.

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