ISSN-L: 2223-9553, ISSN: 2223-9944
Vol. 2, No. 2, March 2012

ADDRESSING CHALLENGES OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) IN TEACHER EDUCATION: - A CASE FOR DEVELOPING NATIONS

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ABSTRACT

The education sector all over the world is under increasing pressure to use the new information and communication technologies (ICTs) for teaching and learning This is an innovation and no innovation and change in history come without challenges, so ICTs in education is no exception. Cognizant of this obvious fact, the paper presents and analyzes the current definition of educational technology by the Association of Educational Communication and Technology (AECT) which highlights current trends in education focusing on ICTs with implications for teacher education. The paper also presents key principles for effective ICTs integration in teacher education and a review of challenges and enablers of ICTs in education. Both challenges and enablers based on the reviews were rated and offers on implementation options for schools and teachers in the quest to making ICTs integration a huge success through continuing professional development for teachers.

Keywords: Innovation, resources, and enablers

INTRODUCTION

Information and Communication Technology (ICTs) is making a serious demand on education, more specifically in teacher education. This is so because a teacher cannot teach what he/she does not know, neither can he /she teach with tools that he/she cannot manipulate and use. Embracing the age of information and knowledge society is a must for all teachers and learners, as it is widely recognized that education in formal and non-formal setting is the cornerstones of social –economic development. Studies have shown that education contributes to poverty reduction and increased economic growth, which in turn leads to an increase in the individual's standard of livings. It also enables an individual to participate in wealth generation activities, creation of employment and the overall development of society. The traditional role of education to promote, socio-economic development is placed on access to education, quality and outcomes of the education system.

The education sector is seen as the source for the acquisition of technological literacy and the development of new technological skills and other skills necessary for achieving the eight time-bound Millennium Development Goals (MDGs) (Obanya, 2007). Kainth & Kaur (2010), posit that basic literacy of reading, writing and mathematics are no longer sufficient; students have to read critically, write persuasively, think and reason logically, and solve complex problems. To achieve these, teachers and students need to acquire technological competencies and information processing skills for knowledge-building in all domains.

With ICTs, the focus is shifting from teacher-centre to student-centre interactive and engaging learning environment which has given rise to the change in the role of both teachers and learners. The role of the teacher has changed from knowledge transmitter to that of learning facilitator,

ISSN-L: 2223-9553, ISSN: 2223-9944
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guide, navigator and co-learner with the students. Teachers will have to use authentic teaching / learning strategies such as contextual, collaborative, co-operative, blended, self-directed, mastery, programmed teaching/learning, among others, based on situational analysis. On the other hand, learners will take greater responsibilities for their own learning in the fantasy interactive learning environment that evokes mental images of physical and social situation not actually present or in some cases not possible (Wang & Reeves, 2007). Such is the bane on teacher education–to produce and retrain teachers that are capable of using technological processes and resources in flexible and effective ways, connecting peers and experts in other countries (Siddiqui, 2008).

Knowledge-based economy is unique in the sense that it transforms, as it is development oriented-creates an enabling environment that leads to wealth creation and job generation for the overall development of the society. The century requires knowledgeable people who are creative and innovative, and will be able to use their knowledge and skills to stimulate and nurture innovations. This requires structural, human resources, and cultural variables (Robbins & Coulter, 2005).

Bansel (2007:80), points out that 'teaching is becoming one of the most challenging professions in our society'. The fact remains that the educational system designed to prepare learners for an agrarian or industrially-based economy will not provide students and teachers with the knowledge and skills they need to survive in knowledge-based economy and society, which integrate the three ages of agriculture, industries and information.

Knowledge-based information society is new, and as such requires new skills and strategies, and Price (2006:62) captures it this way:

"… to prosper in this new economy and exploit these newly vital assets, we need new vocabularies, new management techniques, new technologies, and new strategies".

The teaching and learning of new ways of doing things are in the frontiers of educational institutions. Teachers have to be exposed to the newer theories of learning, and use the principles derived from these theories in the classroom for enhanced instructional methods, instructional techniques, and instructional activities.

Resta (2002) and Hepp, Hinostraza & Rebbe (2004) present the key operating practices for teacher educators as follows:

- Leadership and support from educational policy makers and planners,
- Strategic planning
- Ongoing commitment to training and development of in-service teachers.
- A focus on the students
- A focus on quality
- Empowering teachers and emphasizing on team work
- Developing measures of progress.

All the key operational practices according to the reports of Presidential Task Team on Education (PTTE) (March, 2011:72) should be summarized as follows:

> *"… beyond teaching ICT as a subject in schools. It is also a lot more than having a computer laboratory. It is a combination of these and ICT- backed school management system, with school communication, teacher activities in preparing and delivering lessons, as well as in monitoring students learning and keeping records and in communicating with parents and all other stakeholders. It also mean ICT backed learning tools for students at all levels of education. Above all, it is anchored on strong foundation of ICT-versatility in teachers and learners.*

Current Definition of Educational Technology

The need for ICTs backed schools is captured most succinctly by the International Association of Educational Communication and Technology (AECT) current re-definition of educational technology as:

ISSN-L: 2223-9553, ISSN: 2223-9944
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> *"The study of ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources.*
>
> (Januszewski & Molenda, 2008 :49).

This definition becomes the latest beacon to guide our thinking about education in the 21st century using technology as a springboard. The focus is on 'facilitating learning and improving performance' by the use of 'appropriate technological processes and resources'. Hence, Peeraer & Petergen (2010) posit that integrating ICTs into teaching and learning is highly an educational reform agendum for all nations.

Bransford, Brown & Cocking (2000) have shown that several studies have reviewed the literature of ICTs in teaching / learning and have concluded that ICTs owe a great potential. In addition, Tinio (2003) argues that conventional institutions settings can use ICTs to enhance quality assurance in education through blended learning model. This model combines traditional classroom practices with ICTs resource and processes. Hargreaves (1999:123) however points out that:

"It is plain that if teachers do not acquire and display this capacity to re-define their skills for the task of teaching, and if they do not model in their own conduct the very qualities of –flexibility, networking, creativity … then the challenge of schools in the next millennium will not be met".

Key Principles for Effective ICTs Development in Teacher Education

The UNESCO Planning guide for ICTs in teacher education (Resta 2002:32-33) cites three key principles for effective ICTs development in teacher education that were put forward by the Society of Information Technology and Teacher Education (SITE). They are:

a. Technology must be infused into the entire teacher education implying that it should permeate all courses;
b. Technology should be introduced in context. ICT applications like word processing, database, spreadsheets and telecommunications should not be taught as separate topics but rather encountered as the need arises in all courses of the teacher education programme;
c. Students should experience innovative technology learning environment in their teacher education programmes. This implies that students should see their lecturers engaging in technology to present their subjects, for example, utilizing PowerPoint or simulations in lectures and demonstrations. Students should also have the opportunity to use such applications in practical classes, seminars and assignments.

Pre-service Teacher Education Institutions, therefore have a key role to play in training teachers in the use of ICTs by providing opportunities not only to just learn about technology but learning with or through technology. To be able to use technology in education; teachers need visions of the technology, potentials, opportunities to apply them, adequate training in their use and time for experiment and practice. To achieve this, teachers should understand how ICT can be used generally and how they can be used in specific subjects.

Challenges and Enablers of ICTs in Education

Ertmer (as in Goktas, Yildirim & Yildrim, 2009) classified the challenges of ICT in education into two primary categories: extrinsic and intrinsic. Extrinsic challenges refer to those that are beyond teachers, they include lack of infrastructure / resources, inadequate training, lack of training opportunity, lack of technical assistance and lack of time; intrinsic challenges, is referred to as those within the scope of the teacher, they include: resistance to change, attitude and practice.

To Tinio (2003), these challenges are facilities and resources, capacity-building, language and culture, and finance / cost of ICT. Anderson (1997) reports of the following barriers to implementing information technology programmes: physical barriers such as remoteness, and an unreliable electricity supply; scarcity of funds; lack of staff development; insufficient and inappropriate software,

ISSN-L: 2223-9553, ISSN: 2223-9944
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and speed of technological development. To advance the depth of these challenges, Goktas, Yildirim & Yildirim (2009:194-195) present a summary of several researchers view of barriers and enablers that affect ICTs integration in teacher education programmes as follows:

Table 1: Summary List of the Challenges Facing ICTs Integration in Teacher Education.

S/N	Challenges	Beggs (2000)	Brush, Glazewski, Rutowski, Berg, Stromfors, Van-Nest, .	Bullock (2004)	Mehlinger & Powers (2002)	Moursund & Bielefeldt (1999)	Mumtaz (2000)	Nantz & Lundgren (1998)	Schoep (2004)	Shool Net Africa (2004)	Williams, Wilson, Richardson, Tuson, & Coles (1998)
1	Lack of in-service training.	√	-	-	√	-	-	-	√	-	-
2	Lack of appropriate software / material.	-	√	√	-	√	√	√	-	-	√
3	Lack of basic knowledge / skills of ICTs.	-	√	-	√	√	√	-	√	√	√
4	Lack of hardware.	√	√	√	√	√	√	-	√	√	√
5	Lack of knowledge and skills for ICTs integration.	-	√	-	√	√	√	-	√	√	√
6	Lack of technical support	-	√	√	√	-	-	√	√	-	-
7	Lack of appropriate course content and instructional programs.	-	-	-	√	-	-	-	√	-	-
8	Lack of time	√	√	-	-	-	√	-	√	-	-
9	Lack of appropriate administrative support.	-	-	-	-	√	-	√	√	√	-

Source: Goktas, Yildirim and Yildirim (2009:194)

Table 2: Ratings of Challenges According to Studies

S/N	Challenges	No. of Studies	Affirmative Studies	Ratings
1	Lack of in-service training.	10	3	Low
2	Lack of appropriate software / material.	10	6	High
3	Lack of basic knowledge / skills of ICTs.	10	7	High
4	Lack of hardware.	10	9	High
5	Lack of knowledge and skills for ICTs integration.	10	7	High
6	Lack of technical support	10	5	Average
7	Lack of appropriate course content and instructional programs.	10	2	Low
8	Lack of time	10	4	Low
9	Lack of appropriate administrative support.	19	4	Low

Table 2 shows the rating of the ten studies vis-à-vis the challenges. Studies and challenges in affirmative (1-4) are rated low. Study/challenge in affirmative (5) is rated average, while those between (6-10) are rated high. The table thus, reveals that out of the ten (10) studies reviewed that; three (3) of them agree that lack of in-service training is a challenges (low); six (6) see lack of

ISSN-L: 2223-9553, ISSN: 2223-9944
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appropriate software material as a challenge (high); seven (7) lack of basic technology skills of ICTs as a challenge (high); nine (9) acknowledge lack of hardware (high) and seven (7) lack of knowledge and skills for ICTs integration (high). In the same fashion, five (5) agreed that lack of technical support is a factor (average); two (2) on lack of appropriate course content and instructional programme (low); four (4) agreed in lack of time (low) and another four (4) as lack of appropriate administrative support (low).

Table 3: Summary List of the Enablers for ICTs Teacher Education.

S/N	Enablers	Bullock (2004)	Collins & Jung (2003)	Fabry Higgs (1997)	ISTE (2000)	Jung (2005)	Moursund & Bielefeldt (1999)	Picciano (2001)	Ronnkvist, Dexter, & Anderson (2000)	Strudler & Wetzel (1999)	UNESCO (2002)
1	Having technology plan.	-	√	-	√	√	√	√	-	√	√
2	Offering in-service training.	√	√	-	√	√	√	-	-	√	√
3	Allocation of more budgets.	√	√	√	√	-	√	-	-	-	√
4	Allocation of specific unit & personnel for peer support.	√	-	-	√	-	-	-	√	√	√
5	Supporting teacher educators (i.e Incentives payment).	-	√	-	√	√	√	√	-	√	√
6	Decreasing course load of teacher education.	-	-	-	-	√	-	-	√	-	-
7	Design appropriate course content and instructional programmes.	-	√	-	√	-	-	-	-	-	√

Source: Goktas, Yildirim & Yildirim (2009:195)

Table 4: Rating of Enablers According to Studies

S/N	Enablers	No. of Studies	Affirmative Studies	Rating
1	Having technology plan.	10	7	High
2	Offering in-service training.	10	7	High
3	Allocation of more budgets.	10	6	High
4	Allocation of specific unit & personnel for peer support.	10	5	Average
5	Supporting teacher educators (i.e. Incentives payment).	10	7	High
6	Decreasing course load of teacher education.	10	2	Low
7	Design appropriate course content and instructional programmes.	10	3	low

Tables 3 and 4 show the summary list of enablers and ratings from ten (10) studies reviewed. The ratings were low, average and high for studies in affirmation and within the ranges; 1-4, 5 and 6-10 respectively. Thus; seven (7) studies agree that having technical plan is an enabler (high); seven (7) again see offering in-service training as another enabler (high); six (6) see budget as a factor (high) and five (5) agree that personnel for peer support is an enabler (average). Also, seven (7) studies agree that incentive payment is an enabler (high); two (2) agree that decreasing course load of teacher education is an enabler (low) and three (3) maintain that the design of appropriate course content and instructional programme should be considered as another enabler (low).

The tables; 1, 2, 3, & 4 provide an insight into the common challenges and enablers that have been noted in the literature from different authors. The table shows that once the challenges are clear and the enablers are identified, it is then possible to address the issues without prejudice.

Other researchers have also classified the challenges of the integration of ICTs into teacher education using different titles, such as teacher-level and school-level; material and non-material challenges. On the whole, all the challenges are almost of the same nature. However, there is the need to add that knowledge of instructional design and instructional design process and skills are very important aspect of integrating ICTs in the classroom. There are distinct formats that must be adhered to. In spite of all these challenges, encouragement comes from Ely (2002) and from the most informative research project by Apple Classroom of Tomorrow (ACOT) (Siddiqui, 2008, Parkay & Stanford, 2010), which provides evidence to show that access, use, technical assistance, and funds enhance the infusion of ICTs into the curriculum. This will provide opportunity for teachers to experience different levels of integration – entry, adaptation, adoption, appropriation and invention, progressively.

Approaches to ICTs Integration in Teacher Education

Further approach to ICTs in education operates at three distinct levels – curriculum, topic, and lesson. At the curriculum level, the focus is on the use of ICTs to support the complete content and learning experiences of a whole course, that is a complete course containing a number of topics in different disciplines. This could be in form of CD-ROM, web-sites and online resources, web-based online courses programmes. At the topic level, ICTs can be used to cover certain topics within a course – the topics are approached with clear-cut learning objectives, it could be on CD-ROM, DVD, PowerPoint slides, course manuals, as the case may be. At the lesson level, it could be in form of computer assisted instruction, drill and practice packages, tutorial, instructional games, simulation, and problem solving (Wang & Woo, 2007).

To be in a better position of making use of ICTs at different levels requires sequential approaches to the acquisition of ICTs skills. Kainth & Kaur (2010) present four approaches: (1) ICTs skills development (2) ICTs pedagogy; (3) Subject specific areas, and (4) Practice driven approach. Tinio (2003), presents three general approaches: (1) learning about computers and the internet (literacy), (2) learning with computer and the internet (skill acquisition), (3) learning through computer and the internet (integrating technical skills with curriculum application).

UNESCO Information Programme and Service (2003) expatiate on the three stages in teacher education in terms of ICT contents as follows:

a. Basic computer literacy;
b. The use of ICT hardware and software for teaching/learning activities;
c. Pedagogy-based ICT use, the integrated use of ICT in subject curricula and classroom teaching and management, online collaboration and networking.

The focus of basic computer literacy is on: basic computer parts and functions; computer operating systems; general software applications like Microsoft Office, not necessarily linked to teaching and learning. ICTs use in teaching and learning focuses on the practicum exercises and demonstration on how general application software can be used for various teaching and learning activities – using spreadsheets to create class list for assessment and record keeping; using PowerPoint for presentations in the classroom for a variety of curriculum areas; using publishing software to create a class or teacher newsletter; using Web Quest, that is, online problem-solving tasks in instructional setting. The final stage is integrating ICTs into teaching specific subjects – science, mathematics, language arts and social studies; using online communication tools like e-mail to join a collaborative project online or the internet to research real world problems; and linking schools with local communities.

The above synopsis indicates that to learn with ICTs, one must be technologically literate. This will gradually lead to learning with computer and the internet and using them across the curriculum.

Technology Integration Process

ISSN-L: 2223-9553, ISSN: 2223-9944
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Technology integration means knowing when, who and how specific technological resources should be used to facilitate and improve learning. It requires careful planning and selection of appropriate resources, as well as knowledge and skills of how to implement and evaluate the outcomes.

Integration should be based on specific learning goals to enhance learning experiences at all levels of integration (curriculum, topic and lesson). To achieve the desired goals at different levels, meaningful integration should follow a three – step process: (a) planning the integration, (b) implementing the integration, (c) evaluating the implementation (Newby, Stepich, Lehman, & Russell, 2010). According to these researchers, each phase has specific goal. Planning, involves determining the technology that will produce and enhance learning experience based on situational analysis. Implementation focuses on the selection and use of one or more appropriate technological resources to achieve optimal goals; and evaluating the integration is the process of determining the effectiveness of the technology integration to determine success and failure.

For Resta (2002) integration model also involves three-step: (1) assess the current status of ICT integration; (2) identify priorities and challenges for progression; and (3) process ways and means for further development of ICTs in professional learning progammes; but for Levine (as in Jhurree 2005:470), integration plan is more comprehensive, as it includes: (1) formulation of a planning team; (2) determining training and staff needs; (3) determining budget and funding sources for sustainability; and (4) developing an action plan. These four extra phases are crucial for any meaningful technology integration. According to Tinio (2003), 'one of the greatest challenges of ICTs use in education is balancing educational goals with economic realities" because ICTs in education requires huge capital investment.

How Schools and Teachers can Address the Challenges of ICTs Integration

The framework below will serve as a good measure for schools and teachers in developing nation in the crusade for ICTs infusion.

Table 3: ICTs Integration – Implications for Schools and Teachers

Barriers	Implementation	
	For Schools	For Teachers
Lack of access	-Providing ICT resources including hardware and software.	-Taking advantages of resources offered at school - Access to ICT resources at home.
Resistance to change	-Training in new pedagogical approaches.	- Being open minded towards new ways of teaching.
Lack of time	Providing sufficient time: reducing the number of teachers lesson or increasing the daily lesson time.	- Acquiring skills of self-organization and time managements
Lack of training	- Provides school-based teacher development programme to enable teachers build competence on-the-job to ensure consistency through reflective teaching and active learning using pedagogy and subject specific models. - Provide mentors to teachers in groups for focus workshop. - Organize school-wide meeting to review what participants are doing. - Monitoring and evaluation by	- Preparing themselves by self training through practice and working collaboratively with others. -uses train the trainers' strategy. -Taking up opportunities for training offered at school. - Knowing how to have access to resources.

ISSN-L: 2223-9553, ISSN: 2223-9944
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	the members (build-in) for self evaluating peer evaluation and member's evaluation.	
Lack of technical and instructional support	Providing continued technical support.	- Relying on support services to be able to solve problems in the use of ICTs. - Accessing available support and resourcing.

Source: Bingimlas (2009:243) with Slight Modification.

All the issues in Table 5 must be addressed for pre-service teacher education programme and for in-service teacher professional development programme. Educational administrators, and other educational institutions are to fully exploit the potentials of ICTs as educational tools of the 21st century.

CONCLUSION AND IMPLICATIONS

This paper highlights the importance and challenges associated with ICTs integration into education based on the literature of ICTs and implementation strategies. It posits that ICTs can help create better teaching and learning environment and as such should be integrated into education. The current re-definition of educational technology by AECT, has become the latest beacon to guide and direct our thinking about education in the 21st century.

To enhance the process of ICTs integration into education, the paper presented various technology integration options that can lead to meaningful integration, and how best schools and teachers can overcome the challenges occasioned by such integration.

However, in developing nations the concern on issues relating to ICTs integration in education are serious as it affects teacher education most, for 'no education system may rise above the quality of its teacher'. This is more specific in the area of ICT infrastructure / physical resource, unreliable power supply, curriculum and policy development, professional development of teachers at all levels in ICTs-base pedagogical training. Without addressing these issues, it might be very difficult to harness the huge benefits of ICTs in the information-based society of our time. Teachers at all levels need the knowledge and skills of ICTs as it will also enable them to deliver lectures/lessons to facilitate learning and improve performance.

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