Chapter 100
Quality Preparation of Mathematics and Science Teachers to Integrate ICT:
Lessons from Learner-Centered Teacher Professional Development Approach

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ABSTRACT

This chapter clearly illustrates that emphasis on preparation of teachers to integrate ICT is gaining momentum in the education sector. Arguably, underpinning this emphasis is the convergence of assertions that ICT integration has the potential to enhance the quality of teaching and learning. Nonetheless, considering that the debate about effective teaching has overtime existed between two tensions, namely learner-centered and teacher-centered approaches, the additional concern now is how best to prepare teachers to integrate ICT. It is shown in this chapter that the best teaching approach is context specific since it facilitates the teachers' capacity to enhance student learning through quality teaching. The chapter reviews Teacher Professional Development programs in Sub-Saharan Africa and discusses what constitutes learner-centered education, ICT integration, and provides findings of a case study on preparation of science teachers using ICT.

INTRODUCTION

Information Communication Technology (ICT) continues to permeate various aspects of the society today. Apparently, this is motivating the need to enhance integration of ICT in education, which ideally implies using ICT to facilitate effective teaching and learning process (Mishra & Koehler, 2006). There are numerous advantages associated with ICT in education. Particular to the attainment of Education for All (EFA) is the indication from studies that ICT has the potential to help broaden access to quality education that facilitates meaningful learning (UNESCO, 2007). This realization has intensified the advocacy for teachers to embrace ICT integration in education.

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Despite myriad advantages associated with ICT integration, their realization relies on effective ICT integration. This necessitates radical changes on the role of the teacher in the teaching and learning process. In support, Wellington (2000) urged that the teacher's role becomes an extremely complex one requiring "flexibility and reflection, and often a change of attitude" (p. 219). One probable implication is the need to enhance preparation of teachers in ICT integration. Clearly, effective ICT integration is dependent on how well teachers are prepared to integrate ICT in their teaching. Therefore, it is important that through teacher professional development efforts, teachers encounter experiences that nurture effective ICT integration. This is important considering Levine's (2006) observation that there are conflicting and competing beliefs globally on "issues as basic as when and where teachers should be educated, who should educate teachers, and what education is most effective in preparing teachers" (p. 12). This is a reasonable concern considering that providing quality education to citizens is a key twenty-first century exigency in socio-economic development agenda of a nation.

Teacher Professional Development in Sub-Saharan Africa

Teachers are key determinants for successful integration of ICT in education. Unwin's (2005) cautioned that "without well-trained, qualified and committed teachers it is impossible to deliver effectively functioning educational systems" (p. 126). Therefore there is a need to ensure that teacher preparation programs prepare teachers effectively in ICT integration. Assess to ongoing and appropriate teacher professional development (TPD) in ICT integration improves teachers' confidence and competence in using ICT to meet the needs of students (Swarts, 2008). Unfortunately, TPD opportunities for teachers focusing on ICT integration globally are inadequate (Mandinach, 2005). This has two implications for sub-Saharan Africa (SSA). First, although teachers may want to learn how to integrate ICT in their classrooms, lack of opportunities for professional development obstructs them. Second, since lack of teacher preparation implies inferior ICT integration, then ICT integration in the teaching of science and mathematics is not achieving intended benefits. Encouragingly, initiatives towards preparation of teachers for ICT integration in sub-Saharan Africa are increasing. These include UNESCO's Teacher Training Initiative for Sub-Saharan Africa (TTISSA), African Virtual University (AVU) Teacher Education Project, and teacher in-service programs by Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA).

Despite these efforts, there are concerns about the extent to which teacher professional development initiatives in Sub-Saharan Africa (SSA) comply with international professional standards of teacher competency development. In recognition of the need for teachers to acquire competencies that allows them to offer their students learning opportunities supported by technology, and in response to its function as a standard-setting agency, UNESCO (2008) initiated ICT Competency Standards for Teachers (ICT-CST) project. The ICT-CST project defined a broad framework with three approaches geared towards reforming teacher education, namely, Technology Literacy, Knowledge Deepening, and Knowledge Creation. These components can be useful in guiding capacity development of teachers for ICT integration in sub-Saharan Africa. Explaining this further, UNESCO (2008) has articulated respective policy goals for each approach that may be adapted to suit preparation of teachers. First, the policy goal of Technology Literacy is to prepare teachers capable of taking up new technologies to support student learning and improve learning outcomes. Second, the policy goal of Knowledge Deepening