Enabling Secondary Level Teachers to integrate Technology through ICT integrated Instructional System

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Publication Date: 5th September 2010

Abstract: Institutions providing pre-service teacher education are responsible for preparing teachers capable of functioning in the knowledge society, which India aspires to be. Schools of a knowledge society would require teachers to integrate technology into the instructional system and they are to be prepared for it accordingly through teacher education programmes, especially pre-service ones. With this requirement as a backdrop and on the basis of the argument that teachers are to be taught through methods, which they are later expected to adopt, this article aims to highlight the need to integrate technology in the instructional system of teacher education institutions of India. In this article only the secondary level of teacher education of India (Bachelor of Education) has been considered and it has been emphasized that teachers need to be taught during teacher education programmes through methods that integrate Information and Communication Technology (ICT) so that they may be prepared to integrate ICT when they teach in schools. The article first upholds the rationale for shifting towards ICT integration. It also clarifies the process of ICT integration and thereby underscores the difference between occasional use of ICT and ICT integration in the instructional system. While depicting the present scenario with only occasional use of ICT supplementing traditional methods of teaching, it has been cautioned that the present practice, which does not amount to technology integration, could leave teacher trainees unprepared for integrating technology when they teach in schools.

Keywords- knowledge society, teachers, Bachelor of Education programme, instructions, ICT integration

1. Introduction

If teachers are expected to develop their students as citizens for the knowledge society, they have to be prepared for this role, through out their career and also through pre-service teacher education programmes. As suggested by Hargreaves (2003), we can promote an educational system with highly skilled teachers, capable of generating ingenuity and creativity in children, provided they experience creativity and flexibility and are themselves developed as knowledge society professionals. Therefore, teachers need to be trained during the pre-service teacher education programmes through methods they are expected to follow later. But there is a wide spread concern about the teacher education programmes that are being offered. An overall lack of political and public confidence in teacher training systems is apparent and there is a profound mismatch between the radically new key competencies demanded from students in the knowledge society and the teaching skills that teachers are equipped with after their passage through teacher training colleges and in-service training programs (Moreno, 2005). Schools of education, responsible for preparing teachers have been time and again blamed for mediocrity in preparing teachers for the 21st century classrooms and for the failure of the public schools. They have been urged to make revolutionary changes in teacher–training programmes to prepare teachers to meet the demands and high standards necessary to prepare students to become productive citizens of the 21st century (Schwab, et al, 2003; Field, 2009). The National Knowledge Commission (NKC, 2005) of India had also recommended that teacher training of school teachers be revamped if they are to function effectively in the knowledge society. As per the Curriculum Framework for Quality Teacher Education (1996) of India, no nation can even marginally slacken its efforts in giving necessary professional inputs to its teachers. Still the situation is such that many policy makers are questioning the quality of teacher education programmes and the ability and/or willingness of universities to provide innovative programs that will produce better-prepared teachers (Schwab, et al, 2003).

Reform of teacher education at all levels is required because as stated by Moreno (2005) pre-service teacher education is almost everywhere, one of the most obsolete pieces of education systems but the need for reforming training of secondary school teachers is acute as there is a global need for thorough reform and transformation of teacher education programmes for the secondary level teachers for developing 21st century competencies. As per India's Central Advisory Board of Education (2005), secondary education is the largest provider of the workforce in all spheres of national productivity and is the first point from which knowledge workers would emerge. In India pre-service teacher education programme for the secondary level is known as the Bachelor of Education (B.Ed.) programme. B.Ed. degree is awarded by universities and affiliated colleges (Rajput & Walia, 2001). There are many aspects of the Indian B.Ed. programme that require urgent reforms to contextualize teacher education to the demands of the knowledge society. This is apparent from the draft curriculum recently developed by the National Council of Teacher Education (NCTE) of India. Among the various aspects that need to be reformed, one happens to be the instructional system of B.Ed. programmes. The instructional system needs to be in the context of the requirements of the knowledge society, such as the ability to use Information and Communication Technology (ICT) for collaborative and lifelong learning (Moreno, 2005; Tan, et al, 2006). It has to develop these abilities in trainee teachers so that they can foster these abilities in their students.

In this article first the need for integrating ICT into the instructional system of B.Ed. has been spelt out. Thereafter the process of ICT integration has been clarified to highlight the difference between ICT integration and occasional use of ICT. In the light of these two propositions the present practice of using ICT for instructional purposes has been critically assessed.

2. Rationale for shifting towards ICT integration for enhancing instructional efficiency

The ability or inability of societies to master technology and particularly those that are strategically decisive in each historical period largely shapes their destiny (Castells, 2000). In the new world of education and training there is a new wisdom about the capacity of digital media to enhance learning and accommodate learner convenience and preferences (Inglis Peter& Joosten, 1999). Another compelling reason for preparing teachers for ICT mediated teaching and learning is that children are today adept in using ICT. Also, computer based educational technologies are being increasingly resorted to in educational institutions because they can create an engaging learning environment that provides content of high educational value (Goldman, Digiano & Chorost , 2009). Hence, the European Council held in Lisbon on 23 and 24 March 2000 recommended the need for "ICT literacy", i.e. learning to operate the technology and also higher-order skills such as knowing and understanding what it means to live in digitalized and networked society (Punie & Cabrera, 2006). In India, the National Task Force on Information Technology and Software Development (1998), the Centrally Sponsored Scheme "Information and Communication Technology (ICT) in School" (2004), the National Policy on ICT in School Education (2009) strongly recommend the use of ICT for teaching-learning processes. The XI five year Plan of India has proposed a six fold increase in the spending on ICT in school education from that of the previous one. These moves reflect the urgency to harness ICT for systemic change in the education sector (Kasinathan, 2008). However, systemic change in the education sector will be possible only with systemic change in the way ICT is used for instructional purposes. A lecture delivered through teleconferencing or a CD with video or even information made available through a computer followed by testing only alters the source of information and agency of testing without accommodating the learner's active participation in learning process. This kind of use encourages individualised learning and fails to tap the potential of technology for interactive and collaborative learning (Laurilard, 1993). Hence, Instead of

occasional use of ICT and/lectures on ICT in education, it needs to be integrated in the instructional system.

Technology integration into the instructional system is also called for because it can facilitate collaborative learning and thereby put into practice the theories of social–constructivism. The social constructivist approach to learning views knowledge creation occurring first in a social context and then being appropriated by individuals as they interact in a socio-cultural environment (Bruner, 1960; Bandura, 1977; Bruning, et al, 1999). Vygotsky's, (1978) zone of proximal development (the distance between the actual developmental level -as determined by independent problem-solving and the level of potential development -as determined through problem-solving under adult guidance or in collaboration with more capable peers) is bridged by collaborative learning opportunities (Duffy & Jonassen, 1992). Knowledge is socially constructed, and best supported through collaborations so that participants share knowledge and tackle projects that incorporate features of teamwork, real-world content, and use varied information sources (Scardamalia & Bereiter, 2003). Collaborative learning helps students learn more thoroughly, deeply and efficiently than learning alone. Students also learn to depend on peers instead of depending solely on the authority of experts and teachers (Bruffee, 1998). Collaborative work involves coordinated, synchronous activity with intertwined inputs emerging from a continued attempt by learners to build and maintain a shared conception of the problem and ways to solve it (Dillenbourg, 1999). Experiences in collaboration is necessary because teachers need to know about collaboration–how to structure interactions among students so that more powerful shared learning can occur; how to collaborate with other teachers; and how to work with parents to learn more about their children and to shape supportive experiences at school and home (Shulman, 1992). Ability to function collaboratively is also a requirement of the knowledge society.

Technology integration and collaborative learning can be intertwined. ICT has the potential not merely to transmit information and thereby substitute the source of packaged information but also to support collaboration, leading to a number of computer applications developed deliberately and explicitly to facilitate collaborative knowledge construction (Dias, 1999). Computer-supported collaborative learning with the help of modern ICT has great potential to improve teaching and learning (Jarvela, et al , 2001) and this potential has to be tapped by teacher educators. Web 2.0 technologies like wikis, blogs and podcasts if effectively deployed could enhance learning experiences, and deepen levels of learners' engagement and collaboration within digital learning environments (Boulos, et al 2006). This is because sociability aspects of Web 2.0 tools built through their social soft wares make them ideal for educational purposes as they can support conversational interaction, feedback and social networking (McLoughlin, et al , 2007). Web 2.0 technology is ideal for collaborative content creation. There is therefore, an emerging need to redefine pedagogy in teacher education institutions and harness web 2.0 technologies to promote collaborative learning (Safran, et al, 2007). Trainees may be trained to use web 2.0 technologies and teacher educators may design learning activities requiring collaborative work. Preparedness for ICT mediated collaborative functioning is thus to be built during pre-service education as the ability to continually advance knowledge collaboratively is one of the requirements of the knowledge age (Tan, et al , 2006). Teacher educators of B.Ed. institutions of India therefore have to shift from lectures meant for individualized learning to technology mediated collaborative projects.

3. Process of ICT Integration

Teachers are required to integrate technology but acquiring the hardware and asking teachers to integrate technology may not lead to technology integration. Technology is integrated when it is used in a seamless manner to support and extend curriculum objectives and engage students in

meaningful learning (Dias, 1999). The pedagogical approach to integrate technology involves judicious selection of technology as per the requirements of the content, framing objectives of learning and delineating the tasks and sub tasks to be performed by the learners (Rogers, 2002). ICT has to be to fitted into the teacher education curriculum and facilitate instructions by teacher educators. This is against the technocentric approach to technology integration that undermines pedagogical appropriateness of technology and requires instructions to fit into the technology in which the institution has invested. Technology in such cases is the end rather than the means for transforming education and such investments in ICT may eventually remain underutilized (Suri, 2008).

Successful integration of technology is where the technology does not stand out but is seamlessly integrated and effortlessly used by both teachers and learners. This is against the occasional use of technology for obtaining information, analyzing and synthesizing the information and presenting it professionally (Harris, 2005). ICT integration aims to enhance students' learning, aid better teaching and reduce routine drudgery for teachers. It involves steps like designing appropriate learning opportunities that apply ICTs to support diverse needs of the learners, planning strategies to manage technology and student learning, applying it for record keeping, developing effective classroom management strategies while using ICT (A framework for training in-service secondary school teachers on ICT, 2010). Thus ICT is to be used as a routine in all the activities comprising instructions by teacher educators and trainees. To fulfill the aim of technology integration, planning is required. It may begin with an ICT audit to take stock of the level of preparedness of the school as a whole for technology integration. This is followed by development of a vision, strategy and target for technology integration (ICT integration Guidebook ICTPD.NET) and trainees need to be prepared for it.

Dwyer et al (1990) in the Apple Classroom of Tomorrow (ACOT) research (Report No.8) mention that technology integration included five stages which are:

Entry: At this stage teachers have little experience of teaching with advanced ICT and as a result are nervous and excited. Traditional tools like textbook, blackboard, worksheet, overhead projector remain important. ICT is used to strengthen or replicate traditionally imparted instructions involving lectures, recitation, worksheets and the like.
Adoption: In this stage electronic technology supports text-based drill-and-practice instruction. But whole-group lectures and recitation and individualized seat work still remain important.
Adaptation: In this stage teachers are more comfortable in using technology and start integrating it. ICT leads to greater productivity by students in terms of pace and amount of work done.
Appropriation: In this stage teachers attain mastery of the technology, understand it and use it effortlessly as a tool to accomplish real work. Students too work with computers frequently. There are project-based instructions with co-operation and collaboration.
Invention: In this stage teachers are reflective about the use of technology and its use. They design new instructional paradigms as they realize that knowledge needs to be constructed by children rather than their receiving it. Project-based instructions dominate in this stage leading to more interactions and collaborations aided by an on going support system.

Moersch's (1995) six level framework for technology integration also provides a hierarchy of steps leading to technology integration. The steps are as follows:
Non use: There is perceived lack of access to technology-based tools or a lack of time to pursue electronic technology implementation. Existing technology is predominately text-based.
Awareness: Computer-based applications have little or no relevance to the individual teacher's instructional program.

Exploration: Electronic technology is employed either as extension activities or as enrichment exercises to the instructional program.
Infusion: technology-based tools augment isolated instructional events.
Integration: technology is perceived as a tool to identify and solve authentic problems relating to an overall theme/concept.
Expansion: classroom teachers actively elicit technology applications and networking from business enterprises, governmental agencies, etc. to expand student experiences directed at problem solving, issues resolution, and student activism surrounding a major theme/concept.
Refinement: Technology is perceived as a process, product (e.g. invention, patent, new software design) and tool to help students solve authentic problems related to an identified real-world problem or issue.

Dexter (2002) had also stated certain principles that have been described as 'e tips' for integrating technology while teaching in classrooms. As per these, teacher needs to -

- Devise appropriate teaching strategies comprising objectives of learning, the tasks necessary to achieve them, the type and combination of technological devices to be used and the stage of teaching-learning at which they are to be used.
- The teacher must consider what added value can be obtained through technology that on its own is devoid of any inherent instructional value. The teacher should also use technology for assessment of learning outcomes.

Integrating technology is thus not about merely technology but it is primarily about content and effective instructional practices and integration is defined not by the amount or type of technology used, but by how and why it is used (Earle, 2002). It is also apparent that technology integration is much more than acquiring the ability to operate technology and using it occasionally. Hence, this cannot be done all of a sudden but requires time and practice. Teacher trainees would have to be initiated into activities like planning and developing strategies for using technology for improving the standards of teaching and learning. Teacher educators will also have to ensure that the trainees regularly use technology and pass through the stages involving greater use of technology by teachers to that by learners and finally proceed towards a phase when students use technology for problem solving and collaborative learning, while teachers become facilitators. Besides, knowledge of teaching, especially by integrating ICT is tacit and hence, trainees need to experience it and try it out during practice teaching and reflect upon it as an iterative process as teacher educators guide them through the various stages of integration.

4. The Present Scenario

Teaching methods have not evolved sufficiently and transmission with lectures, books and marked assignments dominate. Digital technologies used are also for supporting this model (Laurilard, 2002). This is also true for the B.Ed. curriculum that usually tends to inform the trainees about educational technology but with hardly any effort to integrate technology in the teaching-learning process. The B.Ed. curriculum thus keeps technology at the fringes (Author, 2006) and the trainees' preparedness for technology integration at the lower levels of the hierarchy suggested by ACOT (Report No. 8) and Moersch.

The NCTE of India makes it mandatory for every institution offering B.Ed. to have ICT facilities including computers, TV, Camera, ICT equipments like ROT (Receive Only Terminal), SIT (Satellite Interlinking Terminal), etc. The list however does not specifically mention the Internet. There is a need for Internet too for accessing information and communication and especially for accessing web 2.0 technologies for collaborative learning. This is because collaborative learning,

team work and networking are essentials of technology integration as suggested in the framework for training in-service secondary school teachers on ICT developed by Ministry of Human Resource Development of India and the ACOT Report (Report No. 8). Projects involving problem solving through ICT suggested by Moersch's hierarchy is also facilitated by web 2.0. At present preparation for teaching with technology at teacher education colleges is done mainly through the textbooks and lectures delivered on topics covering the technologies listed by NCTE and a few more and the benefits that technology could bring to the classroom. It is well known that in India during practice teaching, trainees adopt lecture based methods of teaching. Didactic approach is nurtured as grading is influenced to a great extent by the oratory skills of trainees and how well they use the blackboard.

5. Conclusion

Despite the widespread take up of ICT by European schools, it has not had a transformative impact on teaching and learning in education and training institutions (Punie, et al, 2006). Similarly in India although schools are being provided with ICT facilities and teachers are urged to utilize it, teachers need to be trained not merely to use ICT but to integrate it into their daily teaching. Using technology occasionally to support the traditional lecture based methods may create novelty in the classroom and thus raise the level of attention among learners but it does not amount to technology integration as this approach keeps technology at the periphery of the instructional processes while the verbal exposition is central. The present practice of having a theory based course in the B.Ed. programme that teaches 'about' ICT prepares the trainees for such peripheral use. Hence, there is the need to shift towards a paradigm with ICT integration in the instructional system of the entire teacher education programme.

It is time that B.Ed. institutions start differentiating between occasional use of technology for supporting traditional methods of teaching, which amounts to technocentrism and integrating ICT for improving the standards of teaching and learning, if teachers are expected to integrate technology at schools. Teachers need to be prepared for communicating and teaching through various media, preparing software for different media, online teaching and learning, distributed learning, using web 2.0 technologies, open resources, Learner Management Services, tools for evaluation, conferencing through various modes and so on and also be aware of legal and ethical issues regarding the use of ICT. They also need to have the experience of providing technology mediated instructions to their learners and ultimately become facilitators of learning while making their students collaborative learners. ICT integration will also help teacher trainees in developing abilities to become life long learners as they would be initiated in practices like using ICT for solving problems with the help of solutions emerging from information that has been accessed, processed and shared using ICT. A shift towards an instructional system that integrates these technologies would require revision of the B.Ed. curriculum along these lines. It would also necessitate extending the B.Ed. programme form the present one year duration.

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