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Information and Communications Technology for Workforce Development

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Rapid innovation in ICT is transforming the way we work, the way we interact, the way we learn, and the way we live. In the education and training sector, ICT increases access to learning by making it possible for workers to fit their education into family and work schedules and by providing a greater programmatic choice of quality courses. ICT allows multiple workers to simultaneously enrol in training programs and work in their workplace in order to achieve their particular learning goals in a timelier manner. This paper deals with the ICT conditions, role of ICT, application of ICT, and effectiveness of ICT in the area of workforce development.

Keywords : ICT-mediated learning, open and distance learning, workforce development

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Introduction

New information and communication technologies have dramatically changed the way we live, learn, work, and even think about work. Due to remarkable developments in science and technology, and in particular, information and communication technology (ICT) such as the internet, knowledge became a significant element of production. However, as knowledge became more and more rapidly produced, its life span grew short. There were always new things to be learned. To address the short life span of knowledge, the concept of a lifelong learning society emerged as a new paradigm in the world, and how to build life-long learning societies became our priority.

The rapid pace of technological change is expected to continue to propel demand for highly skilled workers who can develop new technologies, bring them to the market, and exploit the new technologies in the production of goods and services. Shifts in organizational forms and the nature of employment relationships, brought about by new technologies and global competition, also favour such high-level cognitive skills as abstract reasoning, problem-solving, communication, and collaboration, attributes associated with so-called "knowledge work."

Workers of the future may expect to work on short-term assignments, on a contract basis, or within several project teams. They may have to work for more than one employer at any given time or even in new careers several times. Additionally, it is estimated that fifty per cent of technical workers' skills become obsolete within three to seven years. Lifelong learning is the only way to prevent obsolescence and remain competitive in a job market where work is becoming increasingly knowledge-intensive. One of the challenges with regards to lifelong learning is to provide recurrent opportunities for access to education and training throughout the life of a person.

On the other side, technology has great potential to support the education and training of the workforce prior to labour market entry, and as a part of lifelong learning. Technology mediated learning is gaining ground through such applications

as computer-based instruction, Internet-based instruction, and other methods of customised learning. Information technology potentially allows access to instructional materials any time, any place.

This article is to present the currents and possibilities of using ICT in the area of workforce development through literature review and international cases. For the purpose of the study, conditions for using ICT were first reviewed and the role and applications of ICT for workforce development were analysed. Lastly, through the review, the significance and requirement of using ICT in education and training in order to develop workforce are suggested.

ICT Conditions for Workplace Development

Certain critical conditions prevail before ICT-mediated learning can be successfully implemented in the area of workforce development. Chief among those are: (1) strategic readiness; (2) pedagogical readiness; (3) organizational readiness; and (4) technical readiness. This study is to suggest the critical conditions required to activate ICT-mediated learning on the national level.

Strategic Readiness

Strategic readiness is achieved by developing a comprehensive strategic master plan for the integration of ICT-mediated learning in the area of workforce development. This plan includes the vision, mission, values, objectives, strategies, timeframe and the evaluation scheme of the ICT initiative. It also outlines the appropriation budget to cover costs related to hardware and software, connectivity, development of educational software, software licenses, maintenance and staff training and development. The plan clearly delineates the purpose of ICT-mediated learning with respect to the current teaching and learning practices. It also establishes important benchmarks

against other countries and makes provision for supporting legislations and policies. This strategic plan should be widely disseminated amongst all key stakeholders.

Pedagogical Readiness

Pedagogical readiness focuses on the fit between ICT-mediated learning and the teaching and learning practices in current use. To be pedagogically ready, a country must have completed the following key processes: (1) assessment of the compatibility of ICT-mediated learning with the current philosophy of learning; (2) examination of various opportunities for including ICT-mediated learning in the area of workforce development; (3) assessment of the technological proficiency requirements of prospective learners; (4) provision to ensure that ICT-mediated learning will meet learners' educational needs; and (5) provision to ensure that instructors are competent to facilitate ICT-mediated learning.

Organizational Readiness

Organizational dimension focuses on teachers' empowerment for integrating ICT-mediated learning in the area of workforce development. The following key questions are used to assess organizational readiness: (1) to what extent do technical education and vocational training institutions embrace innovation and change? (2) do teachers support the integration of ICT-mediated learning in education and training? (3) has the necessary leadership been provided to champion and rally support for ICT-mediated learning? (4) has the existence of training support systems been communicated to teachers and trainers? Organizational readiness also ascertain that necessary actions have been taken to ensure that teachers and trainers possess the necessary competencies to facilitate ICT-mediated learning. These actions include: (a) conducting needs assessment to determine the IT comfort level of teachers; (b) establishing minimum training standards; (c) developing training plans; and (d)

establishing appropriate mechanisms to monitor training results.

Technical Readiness

The technical readiness addresses issues related to infrastructure requirements for ICT-mediated learning. The following key questions are used to assess technical readiness: (1) has an overview of existing learning technologies been established? (2) has existing learning technologies been benchmarked against those available in the marketplace? (3) how well does the current technological infrastructure meet the basic requirements for implementing ICT-mediated learning, in terms of hardware, connectivity, educational software, software licenses, systems maintenance, and staff training? (4) is it necessary to develop a plan for a new technological infrastructure? and (5) has the existence of technological support systems been communicated to all key stakeholders?

Role and Currents of ICTs for Workforce Development

A great deal of research already showed that ICT is an effective tool which is utilized in school education (Attwell, 1999; Furst-Bowe, 1996; Lafreniere, 1997; Lee, 2005; Mayer, 2001). The major positive functions of ICT in the technical education and vocational training can be categorized as 1) learners can access to training courses and knowledge resources more easily, 2) ICT-mediated learning has the potential to become cost-effective owing to flexibility, and 3) learners can receive customized training considering their own preferences and characteristics.

ICTs are revolutionizing education by removing distance and making knowledge more accessible to all (Industry Canada, 1997). Technology-enhanced learning will play a crucial role in the development of a lifelong learning culture. It has the capacity to empower learners by providing them with multiple pathways that offer choices and

channels to meet their education and training needs (Human Resources Development Canada, 1998). It is not surprising therefore to see a growing interest in ICT mediated learning across the world. ICT-mediated learning can enhance teaching and learning; it has the potential to become cost-effective as it offers greater flexibility regarding time and location of training delivery (Furst-Bowe, 1996). Additionally, ICT-mediated learning may facilitate institutional policy regarding access and equity (Lafreniere, 1997). Finally, technology also provides greater flexibility to adapt teaching and learning to meet learners' cognitive and learning styles (Lee, 2005).

Although ICTs are by far the most significant elements undergirding the foundation of workforce development, there is a paucity of literature and research regarding its implementation and use for teaching and learning. Attwell (1999) noted: "hilst there is a wealth of studies and debate on the use of information and communication technologies in university and higher education, there has been only limited work on the potential impact for vocational education and training" Even the database of UNESCO-UNEVOC International Centre for Technical and Vocational Education contained very limited information on the current use of ICTs for workforce development. The literature dealing with the usage of ICT-mediated learning in workforce development is scarce, fragmented, and difficult to access. This lack of research-based information on the use of ICTs in workforce development is also echoed by Zircle (2002).

Applications of ICTs for Workforce Development

This study revised what Imel (1998) had identified four different applications of ICTs in adult education, fit into workforce development, namely: technology as curriculum, technology as a complement to instruction, and technology as a delivery mechanism. This study is to present the applicable areas of ICTs to workforce development as follows.

Technology as curriculum

When using technology as curriculum, the focus is on developing ICT literacy skills. There are two types of ICT literacy skill sets. The first is generic ICT literacy skills such as keyboarding, word-processing, using databases, using spreadsheets, desktop publishing and using the Internet for research and communication (Kasworm and Londoner, 2000). In this network economy every graduate from training programmes needs to possess these essential and generic ICT literacy skills. The second ICT skill sets are the occupationally specific ICT literacy skills. Examples of these skills include the ability to use CNC equipment, work with CAD/CAM, and operate equipment with digital system controls.

Technology as a complement to instruction

When technology is used to complement instruction, the emphasis is on providing opportunities to practice skills taught and extending learning by working with specific software applications (Kasworm and Londoner, 2000). Simulators are often used in technical education and vocational training to address safety concerns during the initial phase of training and to offset cost in renting equipment for training crane operators and truck drivers. In its simplest form, technology can be used for drill and practice to complement instruction.

Research (Mayer, 2001) indicate that the amount of information retain from learning can be significantly increased by appealing to the senses of hearing and seeing. Consequently, technology can provide a wide array of audio visual aids and effects to maximize learning outcomes in education and training. For example, in many workforce development systems, technology-mediated learning is replacing the traditional chalkboard class.

The use of ICT for on-site teaching and learning has three main purposes. The first is to enhance teaching effectiveness by using a variety of audiovisual aids.

Research(Mayer, 2001) indicates that ICT can be used to create external conditions that can significantly enhance learning and retention. The second application is to use ICT to complement formal classroom or laboratory instructions by providing additional opportunities for drill and practice. The third application is to facilitate individualized and self-directed learning on campus or in the workplace. All these applications require access to specialized labs equipped with appropriate ICTs.

Technology as delivery mechanism

When technology is used as a delivery mechanism, the focus is on packaging course content for digital delivery. Common approaches in current use include: computer-assisted instruction (CAI), computer-based instruction (CBI), and web-based or online instruction. open and distance learning programmes make extensive use of technology as their delivery mechanism.

The most promising application of ICT in workforce development is in the area of open and distance learning (ODL). ODL is an important option for countries where people are separated by land, water, or distance as well as for low- income countries. UNESCO (2002) defines ODL as an "educational process in which all or most of the teaching is conducted by someone removed in space and/or time from the learner, with the effect that all or most of the communication between teachers and learners is through an artificial medium, either electronic or print" (p. 22). The infrastructure and level of technology available in the region determine the choice of the medium. This may include printed study guides, educational television, radio systems, multimedia systems, and Internet-based systems. The open nature of ODL helps learners take responsibility for "what they learn, where they learn, (and) how quickly they learn" (UNESCO, 2002, p. 22).

ODL in the field of vocational training may have to be supplemented by hands-on work imparted through residential schools, home experiment kits or collaboration with the workplace (UNESCO, 2002a). John (2002) noted that in developing

countries ODL has been successfully used to change the social lives of people, raising them from economic vulnerability to economic empowerment. Dhanarajan (2002) also noted that ODL has been successfully used for training workers in many fields ranging from farming to electronics, health to engineering, and animal husbandry to automobile engineering. ODL has also been used to successfully impart carpentry skills, building construction as well as other vocational training.

There are many obstacles that hinder the full implementation of distance learning. Some of these barriers include: lack of infrastructure, underfunded programmes, high costs of installation and maintenance, lack of organizational support, and lack of training of those involved. Some factors affecting costs of ODL include: number of course materials that need to be developed, the frequency with which course material must be revised and changed, and the choice of technology. Advocates of ODL often cite economies of scale in their support of this mode of delivery. However, this concept does not necessarily apply to distance learning. There are many cases where it would be more cost efficient to attend classes on campus instead of studying through distance education. Many North American universities that invested heavily in distance education are now phasing out their programmes due to low enrolment and a high dropout rate. (UNESCO, 2002).

Conclusion and Suggestions

In this study, we presented the recent situations and possibilities of using ICT in the area of workforce development. Traditionally, the area of technical education and vocational training has been underprivileged for using ICT. Even though of it, the rapid development of communication technology has driven to apply ICT to technical education and vocational training. The present study analysed the conditions for using ICT, the function of ICT for workforce development, and the areas of applying ICT to education and training so as to provide some implications for

national policy making. In this section, we conclude that ICT is one of the effective learning-teaching tools for workforce development and suggest further studies related to ICT in the area of technical education and vocational training.

ICT-mediated learning appears to hold great promise for achieving the Millennium Development Goals related to education for all. However, the integration of ICTs in education requires considerable investment in time and resources. Consequently, when planning to integrate ICT in education and training, policy makers must be able to make informed decisions, which are supported by evidence-based information. There is a growing interest among policy makers for the utilization of research to inform educational policy and practice. The *No Child Left Behind law*, which places great emphasis on the results of experimental research to determine the effectiveness of educational programs is a good example of this trend.

Can research inform decision-making and practice regarding the use of ICT for teaching and learning? An analysis of the extensive amount of research (Russell, 1999) conducted to assess the effectiveness of ICT-mediated learning lead to the conclusion that there is no significant difference to be observed in performance measures between learning with and without technology. However, a meta-analysis of over 500 studies indicated that students receiving computer-based instruction tend to learn more in less time (Baalen, van & Moratis, 2001). After reviewing the literature and research on learning technology, the Institute for Higher Education Policy (1999) concluded: "It may not be prudent to accept these findings at face value. Several problems with the conclusions reached through these studies are apparent. The most significant problem is that the overall quality of original research is questionable and thereby renders many of the findings inconclusive" (p. 3). Brennan, McFadden and Law (2001) also concluded that: "the gaps between the often rhetorical claims of 'effectiveness' and the reality of well-researched studies are not often bridged" (p. 64). As a young field, learning technology research tends to be too anecdotal and lack a theoretical underpinning (Conole, Oliver, Isroff & Ravenscroft, 2004); more related studies are necessary to be conducted.

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