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# Literature Review on Information and Communication Technology in Education

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### ABSTRACT

Education is one of the main keys to economic development and improvements in human welfare. ICTs stand for *information and communication technologies*. Globalization and technological change—processes that have accelerated over the past fifteen years—have created a new global economy “powered by technology, fuelled by information and driven by knowledge.” Information and communication technologies (ICTs)—which include radio and television, as well as newer digital technologies such as computers and the Internet—have been touted as potentially powerful enabling tools for educational change and reform. The main purpose of ICT in Education means implementing of ICT Equipments and Tools in Teaching-Learning process as a media and methodology.

**Keywords:** Information, Communication, Technology, e-learning, Blended learning, Open and distance learning, Learner centred environment.

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### INTRODUCTION

Education is one of the main keys to economic development and improvements in human welfare. As global economic competition grows sharper, education becomes an important source of competitive advantage, closely linked to economic growth, and a way for countries to attract jobs and investment. Education appears to be one of the key determinants of lifetime earnings<sup>1</sup>. Education is positively related to development—that is, a higher proportion of the population of the most developed countries has attained higher educational levels than the population of

developing countries<sup>4</sup>. Information and communication technologies (ICT) are simply technologies arising from scientific and technological progress in computer sciences, electronics and telecommunications<sup>3</sup>. ICT has had a major impact in the university context, in organization and in teaching and learning methods<sup>5</sup>. Information and communication technologies (ICTs)—which include radio and television, as well as newer digital technologies such as computers and the Internet—have been touted as potentially powerful enabling tools for educational change and reform.

When used appropriately, different ICTs are said to help expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by, among others, helping make teaching and learning into an engaging, active process connected to real life<sup>6</sup>.

### **ICTs and types of ICTs used in education**

ICTs stand for *information and communication technologies* and are defined, as a “diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information.” These technologies include *computers, the Internet, broadcasting technologies (radio and television), and telephony*. ICTs cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centers, commercial information providers, network-based information services, and other related information and communication activities. ICTs as an ‘electronic means of capturing, processing, storing and disseminating information’. The term ICTs designates multimedia, the Internet or the Web, as a medium to enhance instruction or as a replacement for other media. ICTs as an ‘electronic means of capturing, processing, storing and disseminating information’. The term ICTs designates multimedia, the Internet or the Web, as a medium to enhance instruction or as a replacement for other media<sup>7</sup>. Schools use ICTs in two main ways: for administration and routine tasks of classroom management, and for instruction. In the classroom, they have two main instructional roles: for teaching ICT skills and as a tool for teaching other subjects. Data on students’ attendance and performance can be more easily recorded and analyzed. The use of ICTs for administration and routine tasks of classroom management seems to have developed just as quickly, or quicker, than their use in instruction<sup>1</sup>.

### **E-learning**

E-learning encompasses learning at all levels, both formal and non-formal, that uses an information network—the Internet, an intranet (LAN) or extranet (WAN)—whether wholly or in part delivery, interaction and/or facilitation. Others

prefer the term *online learning*. *Web-based learning* is a subset of e-learning and refers to learning using an Internet browser<sup>6</sup>.

### **Blended learning**

Blended learning refers to learning models that combine traditional classroom practice with e-learning solutions. [6] The emerging practice of ‘multi-channel learning’, which focuses on enriching the educational experience by engaging all resources that are available to help effect incremental change by coordinating the various ways to connect learners with information, knowledge, and stimulation, and to mediate those interactions, provides valuable insight into how blended learning approaches can be delivered and tailored in areas of great resource scarcity.[9]

### **Open and distance learning**

Open and distance learning is defined as “a way of providing learning opportunities that is characterized by the separation of teacher and learner in time or place, or both time and place; learning that is certified in some way by an institution or agency; the use of a variety of media, including print and electronic; two-way communications that allow learners and tutors to interact; the possibility of occasional face-to-face meetings; and a specialized division of labour in the production and delivery of courses<sup>6</sup>.

### **Learner-centered environment**

Learner-centered environments are those that “pay careful attention to the knowledge, skills, attitudes, and beliefs that learners bring with them to the classroom.” the impetus for learner-centeredness derives from a theory of learning called constructivism, which views learning as a process in which individuals “construct” meaning based on prior knowledge and experience? Experience enables individuals to build mental models or schemas, which in turn provide meaning and organization to subsequent experience. Knowledge is created through an active process in which the learner transforms information, constructs hypothesis, and makes decisions using his/her mental models. A form of constructivism called social constructivism also emphasizes the role of the teacher, parents, peers and other community members in helping learners to master

concepts that they would not be able to understand on their own. For social constructivists, learning must be active, contextual and social. It is best done in a group setting with the teacher as facilitator or guide<sup>6</sup>.

### ICTs help expand access to education

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus.

- **Anytime, anywhere.** One defining feature of ICTs is their ability to transcend time and space. ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners. ICT-based educational delivery (e.g., educational programming broadcast over radio or television) also dispenses with the need for all learners and the instructor to be in one physical location. Additionally, certain types of ICTs, such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners (i.e., synchronous learning).
- **Access to remote learning resources.** With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at any time of the day and by an unlimited number of people. ICTs also facilitate access to resource persons—mentors, experts, researchers, professionals, business leaders, and peers—all over the world<sup>6</sup>. The college justifies the need for e-learning by stating that it can be carried out anywhere a learner has a computer or any communication-enabled electronic device, an internet connection (physical or wireless) and can address needs that occur anytime<sup>14</sup>.

### The use of ICTs in education

One of the most commonly cited reasons for using ICTs in the classroom has been to better prepare the current generation of students for a workplace where ICTs, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market. EnGauge of the North Central Regional Educational Laboratory (U.S.) has identified what it calls “21st Century Skills,” which includes digital age literacy (consisting of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy, and global awareness), inventive thinking, higher-order thinking and sound reasoning, effective communication, and high productivity. Haddad and Draxler identify at least five levels of technology use in education: presentation, demonstration, drill and practice, interaction, and collaboration. Each of the different ICTs—print, audio/video cassettes, radio and TV broadcasts, computers or the Internet—may be used for presentation and demonstration, the most basic of the five levels<sup>6</sup>.

### Skills Needed in the Workplace of the Future

- **Digital Age Literacy:** Functional literacy Ability to decipher meaning and express ideas in a range of media; this includes the use of images, graphics, video, charts and graphs or visual literacy
- **Scientific literacy:** Understanding of both the theoretical and applied aspects of science and mathematics
- **Technological literacy:** Competence in the use of information and communication technologies
- **Information literacy:** Ability to find, evaluate and make appropriate use of information, including via the use of ICTs
- **Cultural literacy:** Appreciation of the diversity of cultures Global awareness understanding of how nations, corporations, and communities all over the world are interrelated
- **Inventive Thinking**
- **Adaptability:** Ability to adapt and manage in a complex, interdependent world

- o *Curiosity* : Desire to know
- o *Creativity*: Ability to use imagination to create new things
- o *Risk-taking* Ability to take risks
- o *Higher-Order Thinking*: Creative problem-solving and logical thinking that result in sound judgments
- Effective Communication
- o *Teaming* : Ability to work in a team
- o *Collaboration and interpersonal skills* : Ability to interact smoothly and work effectively with others
- o *Personal and social responsibility*: Be accountable for the way they use ICTs and to learn to use ICTs for the public good
- o *Interactive communication*: Competence in conveying, transmitting, accessing and understanding information
- o *High Productivity* :Ability to prioritize, plan, and manage programs and projects to achieve the desired results Ability to apply what they learn in the classroom to real-life contexts to create relevant, high-quality products<sup>6</sup>.

#### **The use of ICTs in improving the quality of education**

ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training.

- *Motivating to learn.* ICTs such as videos, television and multimedia computer software that combine text, sound, and colorful, moving images can be used to provide challenging and authentic content that will engage the student in the learning process. Interactive radio likewise makes use of sound effects, songs, dramatizations, comic skits, and other performance conventions to compel the students to listen and become involved in the lessons being delivered. More so than any other type of ICT, networked computers with Internet connectivity can increase learner motivation as it combines the media richness and interactivity of other ICTs with the opportunity to connect with real people and to participate in real world events<sup>6</sup>. An effective teaching/learning process must

stimulate intellectual curiosity and offer a sense of enjoyment that will move the students from the passive role of recipients of information to the active role of builders of knowledge. ICTs are effective instructional aides to engage students in the learning process. A project in Malawi filmed community members in their traditional jobs to introduce scientific concepts to elementary school children. Brazilian *Telecurso* is a televised educational program for young adults in search of a high school equivalency diploma. The program also uses videotapes of activities familiar to the students when introducing abstract concepts. A training program for bank clerks in the United States was unable to offer on-the-job training because banks refused to accept trainees without some experience. The instructors decided to use videos of actual clerks working at a local bank and trainees role-playing clerk-customer situations. Trainees watched the movies and discussed the tasks involved, potential problems, preferred solutions, and their weaknesses/strengths<sup>4</sup>. ICT has a strong motivational effect and positive effects on behavior, communication and process skills. Multimedia and interactive content on interactive whiteboards is engaging and motivating, particularly for primary pupils, and students pay more attention during lessons<sup>6</sup>.

- *Facilitating the acquisition of basic skills.* The transmission of basic skills and concepts that are the foundation of higher order thinking skills and creativity can be facilitated by ICTs through drill and practice. Educational television programs use repetition and reinforcement to teach the alphabet, numbers, colors, shapes and other basic concepts. Most of the early uses of computers were for computer-based learning (also called computer-assisted instruction) that focused on mastery of skills and content through repetition and reinforcement. [6] Computers have three attributes that make them powerful aides

for drill and practice strategies: large memory, speed, and the capacity to repeat the same task an infinite number of times without reducing performance. In addition, they provide students with the opportunity to learn on their own time and at their own pace. Computer-aided instruction (CAI) programs are divided into modules that maintain a hierarchy of concepts and skills. The students have to master each module before being allowed to move to the next, more complex level. An evaluation at the end of each module gives the students immediate feedback. If they respond correctly to a determined percentage of questions, they advance. Otherwise, they repeat the module or enter remedial units until the skills or concepts are mastered. The program can keep a history of the students' performance—lessons learned topics with which the student had more difficulty, strategies that improved learning, and how many times the student had to repeat the module. With this information, the teacher can develop an individualized plan that addresses each student's specific weaknesses and strengths. CAI was introduced as an aid in mathematics classes, but it is now used for different disciplines, grade levels, and objectives. Computers also can be used as auxiliary tools in mathematics and science classes to free teachers' and students' time. While computers work on repetitive tasks (such as long calculations and statistical computations), teachers and students can concentrate on analytical activities that require higher-order thinking skills. Research indicates that elementary and secondary school students who use calculators have higher test scores and better attitudes toward mathematics than their peers who do not use calculators. Elementary school children who use computers and calculators in the classroom were found to understand mathematical concepts much earlier than expected<sup>4</sup>.

- *Enhancing teacher training.* ICTs have also

been used to improve access to and the quality of teacher training. For example, At Indira Gandhi National Open University, satellite-based one-way video- and two-way audio-conferencing was held in 1996, supplemented by print-materials and recorded video, to train 910 primary school teachers and facilitators from 20 district training institutes in Karnataka State. The teachers interacted with remote lecturers by telephone and fax<sup>6</sup>. Motivate and reward teachers to use ICT. Actions should be built into policies that encourage teachers to use ICT more – and more effectively. Policies in this area should include measures raising the confidence levels of teachers (sufficient on-site support, appropriate in-service and initial teacher training in ICT) but also means of incentivizing, recognizing and rewarding the use of ICT (such as appraisal schemes, making good ICT use part of career paths, or time benefits for teachers engaged in ICT related projects)<sup>8</sup>.

#### **ICTs help transform the learning environment into learner-centered**

- *Active learning.* ICT-enhanced learning mobilizes tools for examination, calculation and analysis of information, thus providing a platform for student inquiry, analysis and construction of new information. Learners therefore learn as they do and, whenever appropriate, work on real-life problems in-depth, making learning less abstract and more relevant to the learner's life situation. In this way, and in contrast to memorization-based or rote learning, ICT-enhanced learning promotes increased learner engagement. ICT-enhanced learning is also "just-in-time" learning in which learners can choose what to learn when they need to learn it<sup>6</sup>. Interactive radio instruction (IRI), turns a typically one-way technology into a tool for active learning inside and outside the classroom. It requires that the learners stop and react to questions and exercises through verbal response to radio characters, group work, and physical and intellectual activities while the program is on the air. For both teacher and student, the

lesson becomes an immediate hands-on, experiential guide. Short pauses are provided throughout the lessons after questions and during exercises to ensure that students have the time to think and respond adequately. Interaction is also encouraged within the learning environment among the teacher and learners as they work together to conduct short experiments, do activities, and reach objectives using local resources and imaginative situations and stories<sup>10</sup>.

- **Collaborative learning.** ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modeling real-world interactions, ICT-supported learning provides learners the opportunity to work with people from different cultures, thereby helping to enhance learners' teaming and communicative skills as well as their global awareness. It models learning done throughout the learner's lifetime by expanding the learning space to include not just peers but also mentors and experts from different fields<sup>6</sup>. Nowadays, several technologies allow co-writing and sharing resources (Wikis, blogs, etc.). The collaborative and co-operative dimensions of the learning process are fundamental and an organizational change is needed in order to explore this dimension. By enhancing the collaborative learning, higher education provides the job market with better workers<sup>5</sup>.
- **Creative Learning.** ICT-supported learning promotes the manipulation of existing information and the creation of real-world products rather than the regurgitation of received information.
- **INTEGRATIVE LEARNING.** ICT-enhanced learning promotes a thematic, integrative approach to teaching and learning. This approach eliminates the artificial separation between the different disciplines and between theory and practice that characterizes the traditional classroom approach.
- **EVALUATIVE LEARNING.** ICT-enhanced learning

is student-directed and diagnostic. Unlike static, text- or print-based educational technologies, ICT-enhanced learning recognizes that there are many different learning pathways and many different articulations of knowledge. ICTs allow learners to explore and discover rather than merely listen and remember<sup>6</sup>.

### **Radio and TV broadcasting been used in education**

Radio and television have been used widely as educational tools since the 1920s and the 1950s, respectively. There are three general approaches to the use of radio and TV broadcasting in education:

- 1) **Direct class teaching**, where broadcast programming substitutes for teachers on a temporary basis;
- 2) **School broadcasting**, where broadcast programming provides complementary teaching and learning resources not otherwise available; and
- 3) **General educational programming over community**, national and international stations which provide general and informal educational opportunities.

The most notable and best documented example of the *direct class teaching* approach is Interactive Radio Instruction (IRI). This consists of "ready-made 20-30 minute direct teaching and learning exercises to the classroom on a daily basis. The radio lessons, developed around specific learning objectives at particular levels of math's, science, health and languages in national curricula, are intended to improve the quality of classroom teaching and to act as a regular, structured aid to poorly trained classroom teachers in under-resourced schools." IRI primary objective is to raise the quality of learning—and not merely to expand educational access—and it has had much success in both formal and non-formal settings. Extensive research around the world has shown that many IRI projects have had a positive impact on learning outcomes and on educational equity. And with its economies of scale, it has proven to be a cost-effective strategy relative to other interventions<sup>6</sup>.



### Uses of Teleconferencing in education

Teleconferencing refers to “interactive electronic communication among people located at two or more different places.” There are four types of teleconferencing based on the nature and extent of interactivity and the sophistication of the technology:

- 1) Audio conferencing;
  - 2) audio-graphic conferencing,
  - 3) videoconferencing; and
  - 4) Web-based conferencing.
- *Audio conferencing* involves the live (real-time) exchange of voice messages over a telephone network.
  - When low-bandwidth text and still images such as graphs, diagrams or pictures can also be exchanged along with voice messages, then this type of conferencing is called audio graphic. Non-moving visuals are added using a computer keyboard or by drawing/writing on a graphics tablet or whiteboard.
  - *Videoconferencing* allows the exchange not just of voice and graphics but also of moving images. Videoconferencing technology does not use telephone lines but either a satellite link or television network (broadcast/cable).
  - *Web-based conferencing*, as the name implies, involves the transmission of text, and graphic, audio and visual media via the Internet; it requires the use of a computer with a browser and communication can be both synchronous and asynchronous.

Teleconferencing is used in both formal

and non-formal learning contexts to facilitate teacher-learner and learner-learner discussions, as well as to access experts and other resource persons remotely. In open and distance learning, teleconferencing is a useful tool for providing direct instruction and learner support, minimizing learner isolation<sup>6</sup>. Inter-school networks (also probably an intranet) could be attached to the intra-school network by use of the telephone system. Such networks would allow teachers and students to communicate between schools, share resources and data. Some areas of education such as distance education are using network teleconferencing where groups of students can interact with a teacher or another group of students using telephones. This could be greatly improved with the use of computer networks<sup>2</sup>.

### CONCLUSION

Information and communication technology (ICT) is a force that has changed many aspects of the way we live. Social, economic, and technological changes of the past decades are making education and training for all more crucial than ever. ICT has had a major impact in the university context, in organization and in teaching and learning methods. ICTs are said to help expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by, among others, helping make teaching and learning into an engaging, active process connected to real life. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market.

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