Abstract—Information and communication technologies (ICT) have become commonplace entities in all aspects of life. Across the past twenty years the use of ICT has fundamentally changed the practices and procedures of nearly all forms of Endeavour within business and governance. Technical Education is a very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. The use of ICT in technical education lends itself to more student-centered learning settings. But with the world moving rapidly into digital media and information, the role of ICT in technical education is becoming more and more important and this importance will continue to grow and develop in the 21st century. In this paper, a literature review and a case study of Atmiya Institute of Technology and Science about effective use of ICTs in technical education was provided.

Keywords—ICT, Innovations, Technologies, Technical Education, Knowledge, Skills.

I. INTRODUCTION

In this First Principles document, information and communication technology or “ICT” includes “tools and resources used to communicate, and to create, disseminate, store, and manage information.” Such tools are frequently lumped together as, simply, “technology.” However, the initial definition frames a rapidly expanding group of different tools used in education and in development. Broad categories of these tools include radio (and audio recordings), television (and video recordings), mobile telephones and smart phones, desktop and laptop computers, and local networks and the Internet. But in each category, new products are being developed, adapted, or marketed all the time for use in developing-country schools and communities. New tools specific to education include the One Laptop Per Child (OLPC) Children’s Machine XO and the Intel Classmate netbooks. Commercial and NGO-focused ICT tools that have proven useful in schools and communities range from the Freeplay hand-crank and solar-rechargeable radios to Frontline SMS7 communications software to VSAT satellite Internet connectivity.

II. TRENDS IN ICT INNOVATION

The development of new information and communications tools is dynamic and accelerating. Rapid changes in the marketplace challenge governments and education systems to keep up to date, but also present many opportunities to extend access to ICT in schools and rural areas, and to engage teachers and students in new ways.

Over the past 20 years, ICT in schools has been commonly associated with desktop computers and fixed-line Internet connectivity. However, throughout that period, radio and television (and DVDs, audio tapes, CDs, and other media) have also been deployed in large-scale projects and have been shown to increase student motivation, promote change in classroom practices, and support other improvements in education systems. Today, reductions in the cost, size, and power requirements of microchips have lowered the cost and increased the flexibility of ICT. These changes have been accompanied by the creation of digital versions of familiar tools such as cameras and telephones, and by the emergence of new, less familiar tools such as tablet PCs and wireless data networks. Non-digital innovations, such as flexible and portable solar cells have also been combined with digital technologies to extend the reach of ICT to infrastructure-poor areas.

Drivers of ICT adoption in developing countries
Country governments and donor agencies, including USAID, have made substantial investments in education technology. Developing and emerging-economy countries that have launched nationwide programs include Argentina, America Chile, The Gambia, Jamaica, Jordan, Mexico, Namibia, Peru, Russia, Rwanda, Sri Lanka, Syria, Turkey, Uruguay, and many others. Some of these programs have used broadcast technologies such as radio (The Gambia) or television (Mexico). Others have established web portals15 to disseminate learning resources and teacher resources (Argentina, Chile), while still others have launched one-to-one (1:1) initiatives using low-cost laptops (Peru, Rwanda, Uruguay).

In addition to these large-scale programs, donor agencies, governments, and other organizations have launched hundreds of pilot projects to test and improve approaches to using technology to improve teaching, learning, and school management, while school committees and parents in countries around the world have used their own resources to give their children access to computers and the Internet in schools.

ICT includes multiple technology platforms and approaches to meet the challenges for next generations.

The range of ICT projects in education is broad, with many different kinds of tools used in many different configurations. Some examples follow:

1. Television broadcasts to create “virtual classrooms” for junior secondary students (Telesecundaria, Mexico,9 and the USAID-supported Mindset Primary School Channel, South Africa10)

2. Radio broadcasts to deliver effective English language lessons to primary students (T4, India, Sous la fromager, Pas a Pas, The Gambia, and Programme Haïtien d’Appui à la Réforme de l’Éducation (PHARE), Mali11)

3. DVD recordings of televised wildlife shows for use in science class (Discovery Channel Global Education Partnership, Romania12).

4. Digital camcorder recordings of teachers’ classroom activities to support training (SIEEQ, Congo13)

5. Mobile-telephone-based SMS messages to request downloadable video resources (Text2Teach, the Philippines; Bridgeit, Tanzania14)

6. Education management information system (EMIS) and databases for school-based reporting (e.g., Kenya, Egypt, Guatemala)

Technology and the Standard Education Strategy

Improved reading

Improved reading forms the cornerstone of the USAID Education Strategy. Technology offers many proven means of supporting students’ efforts to improve their reading skills, including assistive technologies such as text-to-speech. Jamaica’s Expanding Educational Horizons (EEH) project, profiled in this document, pilot tested the use of “talking word processors” to help students improve spelling, grammar, and other basic reading and writing skills.

Gender equality

The Strategy specifies that program designs should “promote gender parity, gender equity and focus on improving education quality for both boys and girls.

Workforce-relevant skills

The Strategy highlights the need for education, including secondary-level vocational and technical education, that helps young people to build “relevant knowledge and skills” that will enable them to “fully participate in and contribute to economic development.”23 Technology plays a dual role in this effort, as an enabling tool and as a subject.

Access in crisis and conflict environments

Ensuring the safety of students, teachers, trainers, and aid workers poses one of the critical challenges to expanded access to education in areas of crisis and conflict. The Strategy lists the goal of “increased equitable access to education in crisis and conflict environments for 25 million learners by 2020.

10 Key Principles for Developing ICT in Education Programs

• Principle 1: Use ICT to achieve education and development goals.

• Principle 2: Use ICT to enhance student knowledge and skills.

• Principle 3: Use ICT to support data-driven decision making.

• Principle 4: Include all short- and longer-term costs in budget planning.

• Principle 5: Explore technology alternatives to find appropriate solutions.

• Principle 6: Focus on teacher development, training, and ongoing support.

• Principle 7: Explore and coordinate involvement of many different stakeholders.

• Principle 8: Develop a supportive policy environment.

• Principle 9: Integrate monitoring and evaluation into project planning.

• Principle 10: “It takes capacity to build capacity”—System strengthening precedes system transformation.

Principle 1: Use ICT to achieve education and development
goals.

Technology is a cross-cutting resource that should be seen as a sustainable, accessible, and valuable means of supporting efforts to improve teaching, learning, school operations, and the education sector as a whole. Projects using technology can entail risks that arise from costs, complexity, and resistance to change at many levels. To make such risks worth the reward, technology should be used to address areas where system capacity is poor, schools are underperforming, or there are gaps in student learning.

A well-designed technology deployment can be used to disseminate resources, connect students to information, enhance teachers’ practices and students’ performance in all subject areas, improve school management, and support data-driven policymaking. Initial deployments can focus on establishing necessary foundations of hardware, communications, and human capacity. Once developed, such foundations can support improvements in all areas of school operations and system management. When ministries and implementing agencies possess—or build—the necessary skills in planning, management, and implementation, such improvements can begin to be extended system-wide.

**Principle 2: Use ICT to enhance student knowledge and skills.**

ICT can be used to help students build knowledge across all areas of the curriculum and to help them build higher-order cognitive and life skills. If schooling is intended to be relevant to work and important to a society, success in school should be accompanied by the development of a broad body of knowledge and a complete range of skills—including literacy, numeracy, information literacy, and independent-learning skills that contribute to achievement in later life. ICT should be deployed to help students build these skills. Although policymakers and ministries of education frequently promote ICT curricula and building technology skills, the return on investment is greatest when technology use is combined with learning about school subjects.

**Principle 3: Use ICT to support data-driven decision making.**

Regular and reliable data are essential to planning and policy, financial management, management of school facilities, decisions about school personnel (including teachers), and support for student learning. United States Secretary of Education Arne Duncan has issued a national call for schools to collect and use data to improve teaching and learning.43 Although the effective use of Education Management Information Systems (EMIS) has encountered many challenges, technology-supported data-management initiatives show great potential to improve policy making and decision making.44 As of 2010, USAID was supporting EMIS and data-driven school-improvement initiatives in countries that include Djibouti, El Salvador, Ethiopia, Guatemala, Jamaica, Liberia, Tanzania, Uganda, Yemen, and Zambia. Many of these initiatives focus on improving data collection at the school level by providing training on spreadsheet-based reporting forms; other initiatives address central management of school information to support policy and planning.

How schools themselves use data is equally important. USAID has supported school-based reporting in many projects. In addition, USAID has recently entered into an umbrella agreement with the Peace Corps to support training of volunteers to guide school leaders and community members in capturing, analyzing, and graphically representing school data, using tools such as geographic information systems and mobile phones.

**Principle 4: Include all short- and longer-term costs in budget planning.**

Estimating full capital and operating expenses of technology projects in schools requires consideration of all equipment and activities needed to ensure that hardware (and software) are installed, operated, maintained, repaired, and replaced, and that teachers and other personnel have the skills and resources they need to use their new tools to meet project goals. Education projects that rely on computers and the Internet frequently underestimate the costs of connectivity, maintenance, security and facilities upgrades, and essential educational components such as teacher development. In the Barbados EduTech 2000 project, the failure to accurately budget the costs of facilities upgrades led to years-long project delays with effects that “cascaded” through hardware procurement, teacher training, donor funding, and many other program components. Even when capital and donor-funded operating costs are correctly estimated, “mainstreaming” operating costs into the regular education budget can still pose challenges. In the Macedonian e-Schools project, USAID jump-started the development of a national broadband network for education with a small catalytic investment; the project, however, faced challenges when the connection grants to schools ended.

**Principle 5: Explore technology alternatives to find appropriate solutions.**

The proliferation of new tools and new approaches is accelerating in both developed and developing countries; these innovations challenge project developers to think creatively about emerging opportunities. Program designers should consider alternative ways of meeting proposed educational objectives, including broadcast or other technologies, low-cost/low-power computers, and mobile telephones.

Core strategies include the following:

Use technology that is appropriate to available infrastructure. New means of accessing information and communications are emerging almost daily, driven in part by demand for mobile services in both developed and developing countries. The GATHER data reporting platform, for example, enables users to access databases to submit or retrieve information by using text messaging, voice recognition, and web pages. GATHER data is an open-source platform developed by the Academy for Education Development (AED), and is currently deployed in Liberia to improve the quality of education information. In
Cambodia, the Educational Support to Children in Underserved Populations project deployed thin-client computer networks in remote schools to achieve cost savings. Thin clients are less susceptible to damage from heat and humidity, and in Cambodia their low energy use enables schools to run computer rooms on solar power—helping increase the likelihood that computer operations are sustainable.

Principle 6: Focus on teacher development, training and ongoing support.

In-service teacher professional development is frequently among the most important and complex components in an education-technology project. Teachers are essential to student learning outcomes, even if a teacher’s primary task is to facilitate. In many cases, however, teachers are unfamiliar with the tools they are asked to use, or they lack necessary skills. Even more important, they are frequently tasked with using these new tools and undertaking new practices within the routines of their normal class periods and workdays—without appropriate training or support. Personnel involved in the Bridge it project in Tanzania, which relies on relatively easy-to-use and familiar tools—smart phones, videos, and video players—attribute the project’s success to its intensive focus on teacher development in relation to its learner-centered lesson plans.

Principle 7: Explore and coordinate involvement of many different stakeholders.

It is vital to engage multiple stakeholders in education-technology projects. Such projects frequently cut across several sectors and entail great expense as well as technical and organizational complexity. Valuable contributions can be made by international and local organizations, including donor agencies, charitable foundations, NGOs, private-sector technology firms, and government agencies, in addition to ministries of education. However, the value of such contributions increases with effective coordination of stakeholders’ inputs and participation.

Principle 8: Develop a supportive policy environment.

Establishing policies, plans, and central agencies to shape the use of technology in education can help ensure that initial expenditures and activities support government objectives, and that high-impact activities receive ongoing funding.

Core strategies include the following:

Facilitate the development of education-technology policies and achievable plans that align with national objectives. Policies in ICT in education should be developed in relation to broader national policies, plans, or strategies for development. The Government of Rwanda’s approach to ICT and development exemplifies a comprehensive and integrated process of policy and planning, leading to, among other outcomes, a well-founded and clear approach to education technology. At the highest level, the Vision 2020 statement identifies the goal of transforming Rwanda into a middle-income country by the year 2020 by supplanting the country’s economic base in subsistence farming with a knowledge economy. A national ICT policy supports Vision 2020, outlining the government’s commitment to a strategy to “transform the education system using ICTs with the aim to improving accessibility, quality and relevance to the development needs of Rwanda.”95 The implementation of the policy is guided by a series of five-year plans that address ICT in relation to “pillars” of development that include infrastructure, social development, the private sector, and education, among others. Based on the country’s second five-year plan (2005–2010), MINEDUC in 2008 released a draft “ICT

Principle 9: Integrate monitoring and evaluation into project planning.

Planning (and budgeting) for monitoring and evaluation of education-technology projects should begin during the first phase of project design. In most circumstances, it is important to emphasize using randomized studies and experimental statistics (e.g., multivariate regression and other means of determining correlations between inputs and outcomes); such methods typically require collecting baseline data or collecting data from control-group samples. Advance planning, budgeting, and preparation are essential if these measures are to be put in place.

Principle 10: “It takes capacity to build capacity”—System strengthening precedes system transformation.

Developing-country school systems rarely have the capacity to effect substantial change in teaching, learning, or school operations—whether technology is used or not. In many instances, the range and intensity of problems are great: schools have no learning resources, teachers lack knowledge of their subjects and, worse, are often absent, and schooling, especially the secondary curriculum, doesn’t improve students’ lives or earnings. Infrastructure in the poorest countries and communities hobble the potential introduction of technologies to address these deficiencies. In such circumstances, investing in computers and the Internet as the means of jumpstarting development of a 21st century workforce is wrongheaded or disingenuous.

III. USE OF ICT @ AITS CAMPUS

1. IIT Bombay Workshop on “Open Source Technology”

The Spoken Tutorial project is about teaching and learning a particular FOSS (Free and Open Source Software) like Linux, Scilab, LaTeX, PHP & MySQL, Java, C/C++, LibreOffice etc. via an easy video tool - Spoken Tutorial. A Spoken Tutorial is a session created for self learning. Each Spoken Tutorial typically runs for a duration of approximately ten minutes. Using these Spoken Tutorials, one can conduct SELF (Spoken Tutorial based Education and Learning through Free FOSS study) workshops.

2. Webinars of Alumni through Skype or Google Hangout.
Skype as an easy and inexpensive way of communication between people all over the world, open the door to a wide range of activities that can improve student engagement and comprehension.

Interacting with people from different cultural and ethnic backgrounds help students understand cultural differences and learn about history and social norms.

Skype is great for students learning a new language. It can connect them to native speakers everywhere in the world and let them fine-tune their foreign language skills.

Learning becomes more authentic, inspirational, and engaging when it transcends the walls of the classroom.

Skype offers an easy way for students and alumni students to engage in synchronous communication.

3. Email Group of Students for Communication.

Students of various departments and semester are able to communicate through the use of a group email ids. Any kinds of messages, circulars, project related information can also be communicated using a group email ids.

4. Feedbacks of Students (Online)

The prime objectives of the online feedback system are:

- To study the difficulties faced by different stakeholders such as students, parents, etc.
- To study the extent of the satisfaction of the online counseling process – students and parents perceptions.
- To determine the benefits and effectiveness of online off-campus counseling process – students and parents perceptions.

5. E-Library

The Library has campus LAN connectivity through the Computer Centre and is connected to Web Server. 50 systems providing network facility are installed for browsing. The MHRD GoI, New Delhi setup a consortia – based subscription to electronic resources for technical education system named as INDEST (Indian Digital Library in Engineering, Science and Technology) and receiving about 2000 on-line journals viz. IEL (IEEE/IEE Electronic Library, ASME, ASCE, Applied Science and Technology Plus (ASTF), ACM Digital Library, Springer Verlag Link, Nature, J-Gate, Indian Standards 18,000 in e-form from 2003 onwards. The Library has installed a Hard Disk cashing solution (500 GB) in the Digital Library to store massive data of archival information.

6. D-Space

The Library has the D-Space facility for keeping repository of the research publications of faculty members and students as well as project report of the students.

7. AAMS (Atmiya Academic Monitoring System)

AAMS (Atmiya Academic Monitoring System) is the academic monitoring system which has the following functionalities.

It allows faculty members to upload the student’s attendance online and also allows the students to view their attendance of each lectures or laboratories. Through the system parents of the students will receive the SMS about the attendance of their child.

It allows the students to view the latest news and circular about the placement and training related activities.

8. Moodle Course Management System

Moodle course management system is be used to facilitate online professional learning, facilitate campus communications, and much more. How Moodle is used also will depend on your expertise in setting up Moodle to allow for maximum educational use. Practical tips for enhancing your Moodle for AITS use. Below are some of those tips:

- Mapping Your Moodle Implementation
- Installing and Expanding Moodle's Capabilities

AITS campus Moodle is organized into the following sites:

- Professional Learning Center (PLC): This is where adult learners can participate in either instructor-led or self-paced, 100 percent online courses, and earn Continuing Professional Education (CPE) and/or Gifted and Talented credit hours. The GT credit hours are done in collaboration with our city’s Advanced Academic Services Office, and the partnership with them has been well worth the investment of getting their staff trained in online learning. We also are working with our Office for Professional Learning to consider what additional courses should be available to the entire City. City level teacher specialists are developing online courses for publication and use within the Professional Learning Center.

- Open Campus:

The Open Campus facilitates teachers, and impacts students who are participating in online literature circles, classroom specific courses facilitated by teachers, and more. The focus of Open Campus is to enhance classroom teachers' ability to create online learning environments that complement their teaching.

- iTech:

This is the Technology Center, a place where support areas and online communities for technology department initiatives are facilitated. There are many examples of Moodle being used as a "support area" where you can facilitate sharing frequently asked questions and ideas about a particular initiative.
Mapping your Moodle implementation is an important step to take before you start creating Moodles on a server. Another point to consider is how you will enhance that Moodle installation. Many modules and enhancements are available to make Moodle even more versatile than it already is.

IV CONCLUSION

In order to conclude we will try to proceed to synthesize from a general viewpoint the results obtained, taking into consideration the relevant aspects of the literature. The results provided by both the quantitative and qualitative analysis of the literature obtained will be exposed especially regarding those aspects which are related to ICTs for Education and ICTs in Education. ICTs for education refers to the development of information and communications technology specifically for teaching/learning purposes, while the ICTs in education involves the adoption of general components of information and communication technologies in the teaching learning process.

This literature review has sought to explore the role of ICT in education as we progress into the 21st century. In particular ICTs have impacted on educational practice in education to date in quite small ways but that the impact will grow considerably in years to come and that ICT will become a strong agent for change among many educational practices. Extrapolating current activities and practices, the continued use and development of ICTs within education will have a strong impact on: ICT and teaching learning process; quality and accessibility of education; learning motivation, learning environment and ICT usage and academic performance.

The adoption and use of ICTs in education have a positive impact on teaching, learning, and research. ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would provide the rich environment and motivation for teaching learning process which seems to have a profound impact on the process of learning in education by offering new possibilities for learners and teachers. These possibilities can have an impact on student performance and achievement. Similarly wider availability of best practices and best course material in education, which can be shared by means of ICT, can foster better teaching and improved academic achievement of students. The overall literature suggests that successful ICT integration in education.

REFERENCES


