Impacting Effective Teaching and Learning Process in Schools Through Information and Communication Technology (ICT)

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Abstract—The need to completely employ information and communication Technology (ICT) in the teaching and learning process cannot be over emphasized as it will facilitate teaching and learning process, help learners develop creative thinking and self-confidence, create conducive learning environment, etc. ICT is an indispensable tool in teaching and learning process as courses like mathematics, Engineering, Earth sciences, etc are made easier to both teachers and learners. Educational system cannot be left behind in the adoption of ICT as its advantages outweighs its challenges. The manual teaching and learning process has been dropped in most countries of the world hence any Educational system not completely employing ICT may not meet the challenges of its society nor measure itself among the ever changing communities of the world. This paper suggests that effective introduction of ICT in the teaching and learning process is an indispensable means of improving it.

Keywords: Computer aided instruction, Expert system, intelligent tutoring System, E-learning, Database Management system

I. INTRODUCTION

Technology is developed to solve problems associated with human need in more productiveways. If there is no problem to solve, the technology is not developed and/or not adopted. Applying this principle to educational technology would mean that educators should createand adopt technologies that can address educational problems, of which there are many. Further, a technology will not be adopted by educators where there is no perceived need or productivity gain. This is what Lanshe and Snyder (2000) refer to as the ‘workability’ principle. Therefore, when discussing applications of computer technology to education the question must always be asked, “What educational problem(s) needs to be addressed?” This question needs to be asked at all levels of decision-making, from the teacher planning a programme, to a school administrator purchasing hardware and software, to an educational system officer developing policy and strategic plans. At the teacher level the question becomes: am I satisfied with the educational opportunities Iam able to offer children in school classrooms? While teachers should never be completely satisfied, and they will always strive to do better, the question really is whether what they provide adequately develops the potential of the students and adequately prepares them for a productive life in society. Many educators (e.g. National Centre for Vocational Education Research, 2002) and educational commentators (e.g. Murdoch, 2001) believe that what is during the late 1970s and early 1980s, computers became more affordable to schools. The use of Information and Communications Technologies (ICT) in schools is taken very seriously by governments and education systems around the world. As educational institutions move towards the mainstream use of ICT in teaching and learning there appear to be some critical steps and vital ingredients needed for the successful infusion of ICT into educational environments. Although standalone computers have been in most schools for more than two decades now, networked ICT is relatively new for many schools as they continue to grapple with how to use ICT to enhance teaching and learning environments. Since the development of the first computers many have argued that computers should be used to support learning. These arguments have amplified as computers have evolved into the powerful relatively low-cost technology available today. However, there is considerable debate over how computers should be used in schools (Riel, 2003).

This paper focuses on the use of ICT in schools by students and teachers to support the processes of learning and teaching. It will aim to describe the ways in which teachers could and/or should facilitate student use of computer systems and how they can progress. This paper begins with a background to the use of computers in schools, touching
on a rationale for computers in schools. This leads into a discussion of the professional development needs of teachers for the progression of using ICT in learning and teaching.

II. SCHOOLS, LEARNING AND COMPUTERS

Schools and educational systems must provide the infrastructure and support for students and teachers, and the maintenance of constructive learning environments in which ICT is used. At the same time ICT tools will assist schools and educational systems in carrying this out. Research has consistently shown that few schools and teachers implement ICT support to a degree where the potential benefits are likely to be realized. There are a number of significant problems which impede and prevent teachers from achieving the full advantage offered by ICT applications. Cradler (2002) gave seven requirements for effective use of ICT in education:

1. Suits technology to education goals and standards
2. Having a vision for the use of technology to support curriculum
3. Providing for both in-service and pre-service training
4. Ensuring access to appropriate technology
5. Providing for administrative support for technology use
6. Providing time for teachers to plan and learn how to integrate technology
7. Providing for ongoing technical support for technology use

In general, these requirements fall into five areas of impact:

1. providing the infrastructure of hardware and software,
2. providing curriculum and technical support for teachers,
3. school organization, design, policies and practices, schooling, and management support.

Any discussion about the use of computer systems in schools is built upon understandings of the link between schools, learning and computer technology. When the potential use of computers in schools was first mooted, the predominant conception was that students would be ‘taught’ by computers (Mevarech, Light, 1992). In a sense it was considered that the computer would ‘takeover’ the teacher’s job in much the same way as a robot computer may take over a welder’s job.

Broadly speaking, computer literacy is a component of Technology education, which is distinct from using technology such as computer systems to support learning and teaching processes. The latter is generally referred to as educational technology; and is applied to a wide range of technologies such as blackboards and chalk, pencils, books, and slide-rules to television, facsimiles, and computers. This paper will focus on the use of computer systems as educational technologies. Since the beginning of the 1990s, educators have been particularly concerned that very little of the potential of computers to support learning in schools seems to have been realized, despite a sufficiently installed base of computers. One of the reasons often given for this anomaly is that the technology is not sufficiently accessible, particularly if students have to go to a special room to gain access. The 1990s was the decade of computer communications and information access, particularly with the popularity and accessibility of internet-based services such as electronic mail and the World Wide Web. At the same time the CD-ROM became the standard for distributing packaged software (replacing the floppy disk). This allowed large information-based software packages such as encyclopaedia to be cheaply and easily distributed. As a result, educators became more focused on the use of the technology to improve student learning as a rationale for investment.

Today computers in schools are both a focus of studies in themselves (technology education) and a support for learning and teaching (educational technology). Rationales can be represented for both computer literacy and using computers as part of educational technology. It has been argued earlier that ICT is a mediator of learning as a component of the learning environment. It is generally agreed that in education the unique instructional characteristics of computers needs to be exploited (Committee on Developments in the Science of Learning, 2000). There are four distinct characteristics of computer technology which have clear implications for using computers in the classroom: logical programming, interactive control, graphics and audio output, and information processing. There are many ways in which these characteristics could be used and have been shown to support students and teachers improving learning outcomes and increasing productivity. The degree to which each of these should be applied will depend on an array of variables such as the developmental age and personality characteristics of the student, the characteristics of the learning environment, and the nature of the curriculum content.

Providing the Infrastructure

The infrastructure requirements may be viewed in terms of the electronic resources, hardware, users, and implementation. The relative lack of good quality software and associated courseware is well documented and is being attended to by software producers and educators throughout the world. The problems associated with hardware were mainly lack of it, however there is still a major problem with the appropriateness of the hardware used. The use of inappropriate hardware, the lack of useful software and the difficulty in gaining adequate access to computer systems were noted as major obstacles to the use of ICT by teachers and students. The choice and distribution of hardware and software are crucial to the success of computer use in schools. In the establishment of the computer’s place in the school curriculum, the school needs to carefully consider the establishment of a library of software able to support the use of the ICT in the ways established in the school’s computing philosophy. Schools with a small computing resource would probably need to buy software likely to have wide use in the school. Many packages are of limited use and can only be used for a small number of functions.
within a limited age group. Some packages require individual access to be of use to the teacher. These may best be used in schools with more resources. Some packages are more easily integrated into the curriculum than others which may require a degree of teacher involvement and preparation. Many teachers prefer to use software which requires little teacher preparation and planning. In such instances the software can often determine the content of subsequent lessons rather than the teacher or the planned curriculum. When a teacher is made to plan the ways in which the computer will be used, it is likely that the use will be more applicable to the curriculum and more useful to the teacher and students.

**Electronic Resources**

If the aim is to provide more student-directed learning experiences, then students need to be provided with access to extensive sets of resources which is only feasible using predominantly electronic resources. These resources will consist of data files and software applications (programs) that may be distributed online or on disc. Therefore, schools and systems need to provide teachers and students with ready and easy access to these resources. Increasingly, this access will be online, particularly for data files, and while there is a huge quantity of such resources there are two major problems:

1. Accessing high quality resources,
2. Choosing appropriate resources.

**Networking**

The networking of educational technology resources benefits students, teachers and schools by facilitating information technology learning activities, giving ready access to software, allowing a variety of communications, reducing costs of equipment, increasing processing power, and facilitating the management of student learning (Cradler & Bridgforth, 2002).

Three categories of network scenarios should be considered in the use of computer networks in schools:

1. intra-school networks
2. inter-school networks
3. external networks (Internet)

**Hardware Organization for Adequate Access**

There are a number of methods which can be used to distribute access to a school’s Computer/ICT systems. This depends on the number of facilities available.

**Laboratory**

A group of computers /ICT equipment are made available in a central location which may be booked by a teacher. This may be a dedicated classroom, part of the library or part of a learning resource Centre.

**Mobile Trolleys**

A desktop computer /ICT equipment can be put on a trolley which a teacher may book and wheel into the normal classroom.

**Mobile Laboratory**

A number of reasonably portable computers /ICT equipment (ideally notebook or palmtop size computers) may be available for a teacher to book for a lesson. The Computers /ICT equipment are brought in and set up for the lesson and returned at the end.

**Classroom Computer(s)**

One or more computer(s) /ICT equipment may be allocated permanently to a teacher’s classroom.

### III. IMPACT ON THE LEARNING ENVIRONMENT

ICT has the following impacts on the learning environment:

**Investigating Reality and Building Knowledge**

ICT allows students to investigate more thoroughly the real world. They can more readily access information sources outside the classroom and can use tools to analyze and interpret such information. Information may be accessed through online systems or through data logging systems.

**Active Learning and Authentic Assessment**

In many classroom situations it is difficult to allow students to be sufficiently active as participants. Typically, students are often passive, spending a lot of time listening or reading. It is well known that students are more likely to be interested and attentive and will achieve a wider range of learning outcomes if they can be active. The engagement with the curriculum will increase as they are afforded opportunities to create their own information and represent their own ideas. Computer software can be used to provide students with learning experiences where they are interacting with the computer system.

**Engage students by Motivation and Challenge**

The interactive and multimedia nature of modern computer systems has provided the opportunity for software developers to create increasingly more stimulating features. Computer systems do provide the opportunity to create a wide range of interesting learning experiences. This is likely to help to maintain student interest and interest a wider range of students (Cradler & Bridgforth, 2002). The interactive and multimedia features within software can be used to help students grapple with concepts and ideas.

**Provide Tools to Increase Student Productivity**

In the past students have spent a lot of time doing repetitive, low-level tasks particularly involving writing, drawing and computation. While it may be necessary for students to develop these skills at some time on most occasions they are pre-requisite to some higher level tasks. Unnecessary repetition of low-level tasks is inefficient, non-motivational and may obscure the real purpose of the learning activity. Many computer applications provide the tools to support...
students in quickly completing these lower-level tasks so that they can focus on the main purpose of the activity. Word processors, graphics packages, database packages, spreadsheets and other software support the performance of students.

**Student Learning**

There are many potential uses for computers in the learning process. In some situations changes in relevant industries makes computer use in schools imperative. For example, to provide courses in music, technical drawing, statistics, and business which do not incorporate computer use reduces the relevancy of the courses to the real world. Here the rationale cries out from the work place but needs to be responded to with carefully Impact of ICT on Learning & Teaching.

**Management of Learning Experiences**

The management of high quality educational programmes requires and generates large quantities and types of data. Teachers face many management problems which when analyzed could be suitable for a computer solution. There are many such tasks which maybe both time consuming and tedious for which teachers should consider a computer solution. Such tasks may include: the organization of assessments, the maintenance of library functions, the preparation of reports and the organization of events. There are many school management packages which will complete tasks such as these and thereby free up asubstantial amount of time for other more important tasks. Schools should make use of the opportunity to continually provide more appropriate solutions to the dynamic problems associated with the provision of schooling.

**IV. IMPACT ON THE CURRICULUM**

Earlier it was argued that there is a two-way relationship between ICT and the curriculum where ICT may be used to assist in conveying the curriculum but at the same time may change the content of the curriculum. Further, research has shown that the effectiveness in the use of ICT to support learning is a function of the curriculum content and the instructional strategy such that when appropriate content is addressed using appropriate strategies students and teachers will benefit (Cradler & Bridgforth, 2002). The impact of ICT on curriculum content may be viewed in terms of:

- **Declarative knowledge** - describes objects and events by specifying the properties which characterize them.
- **Procedural knowledge** - focuses on the processes needed to obtain a result.

Most educators would perceive the impact of ICT on the curriculum to be positive. With the use of ICT students can use more primary source material and be encouraged to address real problems and develop analytical and interpretive skills. The classroom can be transformed into a learning community making it possible for many more people to be apart of the learning process in an open and continuing dialogue. While the impact will be evident on almost all disciplines of learning, the degree will vary substantially (Becta, 2002).

**Impact on Teachers and Pedagogy**

Teachers are a key component in the learning environment and therefore the impact of ICT on teachers and the strategies they employ to facilitate the environment are critical. The impact on teachers varies although some general areas of impact may be identified as,

1. the balance of roles they play with a perceived risk of reduced influence.
2. providing greater access to information, leading to increased interest in teaching and experimentation (Cradler & Bridgforth, 2002).
3. requiring more collaboration and more communication with teachers, administrators and parents (Cradler & Bridgforth, 2002).
4. requiring more planning and energy,
5. requiring the development of skills and knowledge of ICT, and
6. providing more time to engage with students, leading to greater productivity (Cradler & Bridgforth, 2002).

The impact on pedagogy can be summarized as being strategies that are,

1. more learner-centred,
2. more cooperative and collaborative,
3. more active learning, and
4. based on greater access to information and sources of information.

**CONCLUSIONS**

The use of ICT has led to easy programming and processing, ICT has helped the schools to eliminate waste and increase performance. The huge manpower spent has been drastically reduced with ICT thereby enhancing overall management procedures. Use of computers has added great speed and accuracy to each task of school administration. It is also more convenient now to store large quantities of information on small and more convenient hardware like disks, pen drives and compact discs. Due to the changes and growth, every society is now dependent on ICT to fast track such growth parameters. Therefore, the Curriculum design in every society should take into account the necessary technological input required to develop the society. ICT is a major agent of change in any society.

**REFERENCES**