Use of ICT in Science Education

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Abstract

This paper proves the Information Communications Technology (ICT) has an important role to play in science teaching. The standards in the field of science teaching emphasize the need for science teachers to use strategies that develop deep scientific understanding while applying research skills and problem-solving abilities to complex questions. Highlights on challenges of ICT in the field of education are described in brief. There are highlights on benefits of ICT in science education. Varieties of technological tool both hardware and software is elaborated. At the end there is an attempt to highlight the role of teachers in effective use of ICT in science education.

Introduction

Kothari Education Commission (1964-66) rightly remarked that, "The destiny of India is being shaped in its classrooms". This statement shows the importance of education in modern India. Teachers of today should realize the significance and need for presenting different learning experiences so as to overcome the individual differences among pupils and make attempts to effectively use media and methods generated by Educational Technology. The advantages of technology should be exploited to the maximum to raise the quality of education and also to give

meaning to teaching learning process. The National Policy on Education (NPE 1986) has emphasized upon the use of computers in higher education and for the first time in the history of Indian Education, NPE (1986) has observed that, "Educational Technology will be employed in the spread of useful information in the training and retraining of teachers to improve the quality of education".

Information Communications Technology (ICT) has an important role to play in science teaching. The developments in ICT over the past two decades possibly represent the greatest opportunities for and challenges to the formal educational process. The standards in the field of science teaching emphasize the need for science teachers to use strategies that develop deep scientific understanding while applying research skills and problem-solving abilities to complex questions. In recent years there has been a shift from the use of science as a vehicle through which students learn and use IT skills to the use of ICT skills as tools to assist learning in science. There has also been growing interest in the use of ICT to support whole class teaching and learning to complement ICT based activities for individual students.

ROLE OF ICT IN EDUCATION

The Information and Communication Technology insurgency brings particular challenges to education system around the world. This mainly occurs in three broad areas. One occurs with participation in information society. The second is ICTs impact on access to do with the way ICT changes the education process. Here the formal learning of ICT is in school and higher educational institutions which make available better organized education. Thirdly, through ICT, non-formal education occurs with 'continuing education', 'adult education' through distance education and other organized programs. The acquisition of ICT skills in educational institutions of higher learning helps in knowledge sharing, thereby multiplying manifold educational opportunities. Integrating ICT literacy will be crucial as it means harnessing technology to perform learning skills. It must encompass the use of ICT to manage complexity, solve problems and think critically, creatively and systematically towards the goal of acquiring thinking and problem solving skills, (Yves et al; 2006). For the students, this can be used for making assignment, collecting data, documentation and conducting research. It can be an effective medium for teaching and learning. This can act as the medium through which teachers and learners can learn. Here, in order to introduce and understand the need of ICT in educational institutions, teachers or students undergoing teacher education must first comprehend and be at

ease with ICT. They must be given opportunities for acquisition of new knowledge. This can be made possible by promoting ICT based training programs introduced in their curriculum. ICT has influenced all aspects of the present teacher education system. It provides the capacity to store, to retrieve and to process e-content both fast as well as accurate.

The benefits of ICT in science

There is considerable research evidence that learners are more highly motivated when their learning is supported by ICT. See Newton and Rogers, Teaching Science with ICT for a review of research evidence.

• Students are more engaged in activities; they show increased interest and demonstrate a longer attention span.

• ICT can provide access to a huge range of resources that are of high quality and relevant to scientific learning. In some cases the resources fill gaps where there are no good conventional alternatives; in other cases they complement existing resources. In some cases ICT resources are less good than conventional alternatives and do not add to learning.

• The multi-media resources available enable visualization and manipulation of complex models, three dimensional images and movement to enhance understanding of scientific ideas.

• ICT widens the range of material that can be used in teaching and learning to include text, still and moving images and sound, and increases the variety of ways that the material can be used for whole class and individual learning.

• ICT can improve the quality of data available to students. Information gleaned from the internet can be more up to date, and data obtained from loggers can include more frequent and more accurate experimental readings.

• Computers also allow repetitive tasks to be carried out quickly and accurately so that more student time can be spent on thinking about the scientific data that has been generated.

•Many ICT tasks do not require the use of a specific classroom or laboratory. They can, therefore, extend learning beyond the teaching space and class contact time, and place the use of ICT at the heart of the learning process rather than as an additional peripheral experience. An activity, started in one classroom, can be continued in a different room later in the day or at home in the evening.

• ICT provides opportunities for teachers to be creative in their teaching and in student learning.

Varieties of Technological Tools

A. Hardware Resources: A network of laptops or note book pcs can provide the effect of virtual laboratory in the classroom. Installation of Liquid Crystal Display (LCD), permanently fixed on the ceiling can also do the same functioning with less expense. Science teaching especially natural science has a lot of impact in using live video clips of nature. It gives an everlasting effect in learning process. The glance of wild animals, birds, variety of plants, flowers make the learning more effective and interesting. Various life systems such as digestive system, circulatory system etc. can be taught lively with the use of video clips of its actual functioning. Other branches of science such as Physics, Chemistry, Geology etc. will also have a mind blowing effect in teaching by using such virtual classrooms with the help of video clips. A virtual laboratory replaces the costly usage of chemicals for demonstration as well as practice sessions. It also depicts actual reaction of chemicals along with teaching theory part. In the changing scenario of urban life, it is significantly important to have actual life experiences of nature with the help of such technological tools. The actual benefit of such teaching aid is that it can be made by the teacher with the help of mobile clippings and digital camera as per the syllabus and standard of students. Once if it is made by the collective efforts of teachers, it can be used permanently.

B. Software Applications

1 Microsoft Word: The advantages of using Microsoft Word to construct electronic worksheets are that most teachers will be very familiar with the software package and that it is commonly available on school network systems. Some ways in which Word can be used in science teaching & learning are as follows.

• Creation of text boxes linked to parts of drawn or scanned diagrams/photographs in which a student can write brief notes.

• Provision of randomly arranged parts of pictorial or flow diagrams that must be dragged and dropped into appropriate positions.

• A still or video image embedded within the document to provide stimulus material on which questions are based.

• Use of live links from a word document to other files on the network system or to websites.

2 Microsoft Excel

Spreadsheets can be used in a whole class activity, to provide a framework for the collection and averaging of class sets of data. Classification, pictorial representation such as

graph, chart, tables etc can be effectively taught with the help of spread sheet. Spreadsheets enable complex calculations to be carried out quickly and accurately. This means that a student can test a range of predictions based on the same data to explore possible relationships between variables, and derive other information related to the original data. Another spreadsheet application is to use experimental data to explore relationships between variables. A spreadsheet can, for example, be used to investigate the relationship between the equilibrium concentrations of reactants in a chemical reaction, and thereby to arrive at the concept of the equilibrium constant. A spreadsheet may, for example, be used to model behaviour such as the swing of a pendulum or the fall of a parachutist, using step by step calculations. In addition, it highlights the thinking skills required to design graphs, whether they are drawn by computer or by hand, to ensure that they are of an appropriate type and include appropriate axes, scales and limits.

3. **Microsoft PowerPoint**

The interest in presentation software has increased recently as projection systems in laboratories and classrooms have become more common. The most widespread package used by teachers is Power Point. This is a powerful yet easy to use package that is capable of much more than a list of bulleted points. Slides can contain text, still and video images, animations and audio clips. Elements within a slide can be animated to attract attention and sequenced to closely follow the desired teaching pattern of ideas and information. Links can be created to allow easy movement between different slides. The entire lesson or unit can be pre planned and framed with the help of power point presentation. Once created, presentations can be shared between groups of teachers and updated easily. They provide a useful, shared focus for whole class teaching, and provide a clear framework for learning. Animated and three dimensional images can often provide easier access to concepts such as the electric motor, which may be very hard to grasp when described by text and a series of two dimensional diagrams in a book. Concepts such as the effect of mutation, or predator-prey relationships, that involve long timescales can also be illustrated very easily.

4. Science CD Roms A growing number of CDs have been produced commercially, with the specific aim of supporting science education. Some of the CDs are designed to be enormous information storage and retrieval systems. Since each CD can store the equivalent of a quarter of a million A4 pages of text, they are clearly capable of storing a vast amount of information. They also have the advantage over books of being able to combine text, still and moving images,

sound and animation, to create attractive and dynamic learning packages which meet the needs of a variety of student learning styles. Many CDs of this kind make use of embedded hyperlinks that facilitate movement and navigation within the resource, so that it does not have to be used in a linear manner. They may also make use of 'hotspots' that enable features such as text, images or sound to become active when the mouse is moved over them or clicked on them. This device, which is available for the creation of 'in-house' materials in more sophisticated software, removes clutter from the original screen and means that a single screen can meet the needs of a range of students.

5. Virtual experiments: A particular type of simulation is the virtual experiment. In some cases students can start at the beginning with a choice of apparatus, and move on to decide on amounts of materials or operating conditions. The software tabulates data arising from the experiment and often generates an appropriate graph from it. This kind of software can be used by teachers to complement student practical work. It can be used as part of a pre-lab discussion to set the scene for the experiment, or to stimulate post-lab evaluation of experimental process and results. It may also be used to extend student coverage to more and/or different practical contexts, or to provide differentiated tasks for particular students within a group.

6. **Using the internet:** The internet is a vast store of information that can be highly relevant, detailed and up to date Search engines such as Yahoo, Google, AltaVista and Ask Jeeves produce best results when the search request is made as specific as possible, using their advanced search facilities. In addition to providing information, the internet can also be a valuable source of free or inexpensive programmes, to support science education. Molecular modeling and chemical structure drawing packages are good examples. The internet is also a rich source of animated images, called applets or small applications, which are programmes designed to run in a web page.

Effective Use of ICT

The effective and efficient use of ICT depends on technically competent educators. They should be able to appreciate the potentiality of ICT and have positive attitude towards ICT. Four phases are conducted to implement ICT content in Teacher education programme so that the student teachers when they become teachers in school would able to utilize ICT tools in classroom instruction in promoting flexible learning environment to meet individual learning objectives of the subject matter content. The four phases are

a) ICT Literacy

b) Effective and efficient use of ICT hardware and software for teaching learning activities.

c) ICT based pedagogy, online support, networking and management.

d) Adopting best innovative practices in the use of ICT.

Conclusion

The use of ICT can make substantial changes in education and training mainly in two ways. Firstly, the rich representation of information changes learner's perception and understanding of the content. Secondly, the vast distribution and easy access to information can change relationship between teachers and students. ICT can also provide powerful support for educational innovations. By using ICT technologies such as Computer, Laptop, Digital camera, video, Internet, websites, CD-ROMs, DVDs, web camera, Radio, TV, application of software such as word-processing, spreadsheet, e-mail, digital libraries, computer mediating conferencing, video-conferencing, LCD and slide projectors, etc., we can overcome all barriers in communication and instruction in higher education institutes of learning. Therefore, the challenge for teachers has been to create a new generation of teachers capable of employing a variety of technology and tools in all phases of academic, administrative, research and extension functions.

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