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Information and Communication Technology to Enhance Reach and Effectiveness of Physics Teaching

SUNDAR SINGH

Department of Physics, Bareilly College, Bareilly (U.P.) India-243005

Corresponding Author Email: ssg01bcb@gmail.com

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Abstract

The availability of tech-savvy and skilled human resource is one of the major factors affecting the growth and development of a country. Education plays a vital role in shaping the human resource. Education is a key factor for deciding the human development index (HDI). Our constitution makers have directed Union and State governments to take necessary steps and frame policies to bring education within reach of citizens of the country.

Imparting quality education in schools and colleges has always been at the focus of education policy makers. The methods of imparting education and learning have been debated and modified to suit the changing requirements. The teacher centered class-room teaching is still most widely used way of imparting education in India. It needs to be modified to suit the modern requirements, if not fully replaced by other methods of learning. The information and communication technology (ICT) is looked as a means of upgrading and overhauling the complete education system. In medicine, tourism, travel, business, law, banking, engineering and architecture ICT's impact is enormous. However education is lagging far behind in this regard. ICT can reform our education system to bring it at par with global systems without compromising our social values. The use of ICT in imparting education makes it learner oriented rather than the present teacher oriented system. ICT allows teachers to work as coaches and mentors of students rather than content experts. It is believed that ICT encourages and support independent learning. Physics lies at the heart of most of technological developments. So the knowledge of Physics should be given to the learners in a very effective manner. Smart classes will definitely enhance the reach and effectiveness of Physics teaching; however it would require a huge investment. This paper tries to find out ways and means in which ICT should be introduced in Indian education system with special reference to physics teaching to enhance its reach and effectiveness.

Key words: Human resource, ICT, learner oriented, independent learning, smart classes.

Introduction

Information and communication technology (ICT) is actually an extension of information technology (IT). UNESCO has defined information and communication technology to include various technology forms used for creating, displaying, manipulating and exchanging information. ICT as integrated form of technologies is used to facilitate the transfer of information. It also facilitates various types of communications through electronic means.

Different components of ICT include communication devices, computers, softwares and audio-visual systems. ICT equipment includes radio, camera, television, fax, computers, multimedia projectors, overhead projectors, learning management systems etc. Information and communication technologies are nothing but the convergence of computer networks with communication networks and audio-visual devices. Websites, blogs, social media are integral parts of ICT for getting information. Internet is the most important element in ICT. Nanotechnology would play an important role in ICT by the development of advanced nano based electronic devices using quantum dot transistors, magnetic random access memory (MRAM) etc.

ICT's impact in the fields of business, medical, engineering, banking, tourism is enormous. ICT can greatly improve teaching by enhancing already practiced knowledge and at the same time introducing new ways of teaching and learning. It not only provides learning resources but also tools to facilitate interaction and collaboration¹. ICT is useful for information management² and developing basic skills of the students³.

Traditional Learning versus E-Learning :

For a long period, class room teaching has been the most practiced form of teaching-learning process. This traditional lecture based teaching-learning process is greatly teacher centered because he is actively engaged in delivering the knowledge and information for learners who for most parts remain passive throughout the lecture. Traditional mode of learning requires fewer resources and hence is cost effective, a major factor to be considered in the developing countries like ours. In this approach teachers are content experts. An obvious drawback is that learners have no choice of experts. Authorities decide which experts to be assigned duties of knowledge dissemination. Teachers are accustomed to this mode of teaching and are very reluctant to switch to the newer and advanced technology assisted means of delivering knowledge.

Information and Communication Technology has the potential for enhancing the tools and environment for learning because materials to be presented in multiple media motivate and engage students in learning process⁴. Use of ICT for teaching makes it learner centered as they have freedom to choose contents as well as experts for their guidance. Choice of experts available for learners enhances their interest in acquiring knowledge and motivates them for achieving their academic goals. ICT provides more interactive educational materials. Further, ICT enables easy acquisition of basic skills. The use of ICT increases the reach of the teacher beyond the classroom or the institution concerned. A notable aspect of ICT based teaching-learning process is that teachers act as coaches and mentors for the learners rather than being content experts.

Impact on Teachers :

To access the impact of ICT we interacted with a number of teachers particularly engaged in physics teaching. Teachers both from rural and urban area belonging to secondary and higher education were asked questions regarding effect of ICT on teachers and teaching practices. Their responses indicate that teachers in private secondary schools in the urban area have access to computers and multimedia projectors for helping them in physics teaching effectively. However, they are not adequately trained to utilize available ICT resources to their fullest potential.

Private secondary schools in rural area do not have sufficient ICT equipment and lack infrastructural facilities for imparting quality education. In addition to this, teachers in these schools are not trained enough

to make use of whatever little technological resources they possess for assisting them in imparting effective and quality education.

Government run secondary schools both in rural and urban area do not have adequate infrastructure due to lack of funding. However, of late, government is making every possible effort to create basic minimum ICT infrastructure in these schools and to familiarize students and teachers with the benefits of modern technological tools. To improve the situation extensive training is required for teachers to provide them expertise to use ICT for effective teaching. Physics teaching, in particular, will gain greatly by the use of ICT tools such as audio-visual systems and computers as it will make lot easier clarifying and understanding the rigorous concepts. However, as I mentioned earlier, teachers have inertia and lack of motivation to adopt new technologies. Their inertia towards adopting modern methods of learning is acting as a hurdle in the rapid pace of transforming the face of education.

Higher education institutes and colleges in private sector have poor infrastructure for induction of ICT. Moreover, teachers lack motivation and training for integrating ICT equipment and devices in their instructional practices. On the other hand, government aided higher education institutes have adequate infrastructure for induction of ICT to assist physics teaching. Teachers are well qualified and ICT is being used by them for acquiring and disseminating knowledge. Multimedia devices serve as a great help for effective presentations. Visualization of pictures and diagrams makes understanding concepts quite easier. Again the lack of motivation in teachers has to be taken care of through conducting extensive training programmes for integrating ICT into their instructional practice⁵. Simin Ghavifekr and Wan Athirah Wan Rosdy studied about teachers' perceptions on effectiveness of ICT integration to support teaching and learning process in the classroom⁶. Their findings indicate that ICT integration has a great effectiveness for both teachers and students. Athansios S. Drigas and Maria-Theofania L. Kontopoulou carried out studies for utilization of information and communication technology in education of physics⁷. Their results show that the use of ICT is an excellent tool for the education of physics that leads to deeper understanding of science. With ICT integration in education it is possible to supplement, but not substitute, different teaching methods, which include experiments⁸.

Impact on Learners

Younger generations have always been ready to accept changes in learning practices through the induction of newer technologies from time to time. Students have keen interest to use ICT for learning. They are always quite ahead of their elders and instructors in adopting modern means of communication and exchanging information. Internet and mobile phones have completely revolutionized the learning process. Their response suggests that ICT encourages and support independent learning. ICT unlocks hidden potential for those with communication difficulties. Students use information and communication technologies not only for acquiring knowledge and developing basic skills but also for communicating with family members, relatives, friends, professionals and teachers. It also helps them for making Presentations. ICT fosters the spirit of cooperative learning among students. Modern modes of learning are preparing students to face upcoming future challenges in their academic and professional life.

Discussion and Conclusion

Teaching in general and particularly Physics teaching can be made very effective with the use of information and communication technology. Physics education softwares such as Physics Pro, Crocodile Physics, and Andres Physics can be useful in this regard. Important software named myPhysicsLab is available as open source which is useful in simulating simple physics experiments in the lab. Software for the analysis of data and simulation of science phenomena to give a better representation of real life occurrence should be used by teachers. ICTs increase social interaction between learner-learner and learner-teacher which not only helps in

learning process but also arriving at conclusions regarding various social problems. A right balance of technology pedagogy and content knowledge is required for effective teaching. In India there have been enormous geographic and demographic disparities in the use of various ICTs. Digital divide is a cause of concern for making physics teaching effective across various regions of our country. Its use for electronic communication and class-room management systems needs to be increased with time. Infrastructural facilities should be established and upgraded where these already exist. Smart classes, interactive boards and other resources need to be established. Teachers should be trained from time to time for adopting advancements in these technologies for maximizing their benefits in the teaching –learning process. The use of ICT should be increased so as to provide support for educational innovation.

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