

TECHNOLOGY IN AID OF PHYSICS TEACHING

Rashid Ahmed, Maqsood Ahmed, M.Alam Saeed and Fazal-e-Aleem

Centre for High Energy Physics, University of the Punjab, Lahore-54590-Pakistan

Abstract

In present age, technology is playing vital role in every field of life. Role of a teacher is pivotal in teaching, particularly in science/physics teaching. Likewise, for efficient and effective teaching, the vital role of technology in education cannot be overlooked. By incorporating technology such as power point and Internet, the effectiveness of a teacher is amplified in the classroom. There are many tools now available in aid of physics teaching. We have arranged the available information on this topic and tried to present in such a way that it can be helpful for school and college teachers in their teaching and tutorials.

Introduction

The main purpose of teaching is to enhance student learning. Traditional teaching methods at times encourage passive learning (Jones T H and Paolucci R 1998). Passive learning hinders understanding and long-term preservation of key concepts. In conventional classroom students gain most of their knowledge through classroom lectures and textbook reading, but good quality teaching involves a great deal more than just passing on information. Students enter the classroom with their own worldviews, which have been developed and created over their lifetime (Cobern W W 1991). Student's worldview often differs to a great extent from that of scientists and engineers. Due to this, often students emerge from our classes with serious misconceptions (Aarons A B 1990, Halloo I A and Hastens D 1985, McCloskey M Karamazov A and Green B 1980, McDermott L C 1984 and McDermott L C 1991). This problem can be solved with the help of technology, which provides us base for active learning. The aid of technology like Internet enhances student's learning, enthusiasm to attend and take part in class, retention of information. This helps the students to integrate information, concepts and course materials, leading to a better understanding of class content. In this paper, we will focus on tools, which are helpful in teaching, specially related to the computers. Purpose of this paper is also to motivate the educators to use the technology while preparing and delivering their lecture. This will make teaching more effective and their students gain confidence in utilizing these resources independently. However, a word of caution is in place in asserting the fact that the role of teacher is pivotal and technology only helps us in enhancing this. We now give brief descriptions of the computer related and other technologies, which are helpful in physics teaching.

Audio Tape Recorders

Audio tape recorders are excellent for recording lectures, interviews, or other audio/verbal information where visuals are not required. Students carry tiny cassette recorders to make audiotapes of the class lecture. Audio cassettes of many good teachers are available in the market.

Overhead projector

Overhead projector, for the last three decades, has provided a mean of communication during the lecture that many of us find essential. This is used to display prepared diagrams and outlines that can be reviewed during or after the class. Some teachers copy them and put in the library for students. In this way, we see students being able to learn outside of class time. With the use of overhead projector, a teacher can deliver his lesson systematically.

Computer Based Learning

The vital role of computer technology in education cannot be overlooked. By using the computer in our teaching and learning we can organize ourselves better. By using it to create visual effects through modeling physical problems or experiments, we can organize the rhythm and method of work. We can thus develop strategies to solve problems and choose the kind of tutorials that are essential for better understanding. We can enhance the current framework of understanding of a student by making the learning meaningful. Computers can also facilitate the teacher through preparation and distribution of materials that can help students learn to solve the problems. They can make physics more accessible to students by developing an innovative Internet Website and live classroom. Databases are one of the most fundamental uses of computer. In computer one can store numerical and textual data and organize it in ascending, descending or alphabetical order. There is a wide range of software in the market that can be used in the physics teaching/learning environment (Fazal-e-Aleem 1997). Teacher should therefore consider the use of computers as a very useful tool in teaching. Most of the science now a today is being done with the support of computers and lot of the scientific work at present is fully dependent upon the use of computers for calculations, simulations, graphics representations, modeling and communications of all types.

Internet and World Wide Web

Internet is an attractive medium, which provides escalating variety of opportunities to support the teaching and learning of physics (Hammond R 2002). It hosts many interactive computer-based courses. There are many websites which contain very useful information about physics teaching, in the form of lecture notes, Visualization, Demonstration Applets, Quizzes, Tutorials and many more (Fazal-e-Aleem et al 2003) which can be accessed through Internet. It is one of the important information sources available to the teachers especially for those who want to start a new course. He or she can learn from the lecture notes prepared by experienced teachers and get guidelines/ideas about the course nature, level and organization of the lectures. With the help of these sites, he or she can get good material and manage lecture in a very short period. When a new teacher goes through the lecture notes of experienced teachers, he gains confidence, which is as important, as content for classroom management (Rashid A et al 2003).

Computers - Audio

Computers may be used to illustrate and process audio and record it in digital format through suitable peripherals. This highly developed technology allows for the recording, analysis and handling of all types of audio signals and could be used for many research purposes where audio signals contain the required data. Graphic representations of the audio signals allow for many research/analysis/ manipulation opportunities for the science/physics students.

Computers - Videotape recorders and video cameras

Videotape recorders and video cameras are very useful recording devices for both audio and visual information. Visualization of physical phenomena has always been significant component for the reinforcement and understanding of physics concepts. Visualization of physical phenomena through demonstrations, simulations, models, real-time graphs, and video can contribute to students understanding of physics concepts. These visualization techniques provide students with visual associations that they may capture, and preserve the essence of physical phenomena more effectively than verbal descriptions (Cadmus R R Jr 1990). Videotape recorders and video cameras may be used to record instrument readings over time; time-lapse video for phenomena taking

minutes, hours or days; accumulating short running segments or stills from live action, other videotape recorders, or video laserdiscs. These can be used for data collection and presentation.

Computers – Communications

When a modem is attached to the computer, the world is at a keystroke away. Through the modem, the teacher/student can access web resources, gather current information his or her interest from Internet and retrieve files and essential material about physics. It also allows the teachers and students to communicate with each other and other teachers, students and professionals through direct communications (e.g., MSN), electronic mail, transferring text files, programs and graphics with ease.

Computers - Desktop Publishing

A noticeably sophisticated, but an extension of word processing, desktop publishing allows the user to fit in graphs, images, charts, etc. easily into the final printed product. Since the original source of many materials may be the computer, desktop publishing allows for easy access to and transfer of the files into the document file. Laser printing may then complete the process for high quality output. Desktop publishing allows the teacher and student to generate high quality printed products within the classroom with a minimum effort.

Computers - Desktop Video

With the rapid changes in technology, computers are now widely applied for the production of video at the consumer level. Products currently available allow the user to shoot or computer-produce and edit together all types of information, which will finally appear on videotape. Special effects and editing functions are now available at a fraction of the cost of professional products, yet the quality of the image is still very high. Desktop video provides a way in which teachers and students may use their creative capabilities to produce video in a science context, be it for information accumulation or presentation.

Computers - Graphics

Computer graphics have advanced most remarkably in the past few years. Computer with appropriate programs can now be used easily to create high quality graphics with striking impact. Since most of the physics is visual, graphing programs is a necessity for good communication, both for the teacher and student. Computer may now import graphic files from distant systems, or directly from scanners, video cameras, video laserdiscs, or CD-ROM's and manipulate these with specialized software functions to produce the final desired product. Programs with input hardware such as digitizing modules and digitizing tablets make the production of presentation materials much easier than ever before. CAD (Computer Assisted Design), a specific type of computer graphics program, is easy to use. These programs allow the user to design in two or three dimensions and may be used by students to design their own experiments or models of objects.

Computers - Interactive Systems

The world of multi-media is rapidly approaching with computer-based interactive systems leading the way in providing information, simulations and a variety of hypermedia, all under the control of the user. CD-ROM and video laserdisc, when attached to the computer with proper software, represent the most powerful information and teaching/learning tools so far devised. These are excellent sources of information of all types and allow the user to investigate an indefinite number of avenues related to the subject being researched. In many cases, the information may be cut and

pasted into word processors or desktop publishing programs for later use as part of a lecture or presentation.

Computers - Sensors

Sensors attached to computers with appropriate software, allow us to take readings over a period of time. These readings are then saved in a database and later used for analysis through graphs, charts, etc. Sensors for light, heat and sound are willingly available and may be easily integrated by students in various science projects.

Computers - Simulations

Computer simulation is the discipline of designing a model of an actual or theoretical physical system, executing the model on a digital computer, and analyzing the execution output. Once a process or phenomenon has been modeled, the attributes may be used to produce a simulation. Simulations are powerful in that they allow the user to modify various parameters of the situation and observe the results of the change. Simulations may be simple or very complex, requiring super computers. However, many physics related simulations are available for personal computers (Fazal-e-Aleem et al 2003). For those students who are most interested in computer applications, the design and production of computer simulation may be an exciting and vastly rewarding experience.

Computers - Spreadsheets

Spreadsheets can be regarded as computerized, numerical record-keeping systems and has three major functions, namely storing, calculating and presenting information. Spreadsheets can change any educational process with a quantitative base. Powers of this tool lies in the fact that the user may set up hypothetical situations using a model based on numbers and formulae, and then explores the changes that occur in the final result when the variables are modified. Since most physics relies on mathematics and formulae, the spreadsheet is an excellent tool to which the physics student should have access.

Computers - Video Inputs/Imaging

Computers well equipped with the suitable peripherals and software may be connected to the video output from video cameras, videotape recorders, video laserdiscs and CD ROM's. Computers can also be linked to CCD's (Charge Coupled Devices for direct access to images formed in the visible and infrared parts of the spectrum.) As an example, computer may be connected to telescopes using the CCD chip for imaging. This technology has become of extremely high importance in contemporary astronomical research, but falling prices now allow schools and individuals to have access.

Photographs

It is a usual part of students' lives to take photograph and when it is used in the science context to record data and events to assist in the presentation of data and other information, it provides ease to demonstrate. The very high quality of the image combined with the ease of production make photography a very good choice for many presentations. It must be remembered that the 35 mm single lens reflex camera can be matched to a large number of science instruments such as the microscope and telescope to get photographs in amazing detail and prettiness. Low cost automatic and semi-automatic cameras make contemporary photography a snap. These photos can be easily transferred to video or computer.

Video Laserdiscs

Video laserdisc is an outstanding source of an unbelievable amount of audio-visual material. Teachers and students can use this technology as source of video stills or running segments. This may be used as basic information incorporated into a self made video program as part of a presentation. Video laserdiscs are available on many science-related topics and are easy to use, vast sources of information.

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Using Computer Technology and Course Web Pages to Improve Student Performance
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