CHAPTER II

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MULTIMEDIA : A CONCEPTUAL FRAME - WORK

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COMPUTER INTRODUCTION

The special feature of education has been its use of physical and Intellectual tool. Computers represent a true common tool, restricted in application only by the imagination of the user.

Computers are becoming familiar in Indian Schools. Computers are taught in all the schools mostly now a days. Appropriate computer technology places users in control of their own learning. It encourages both independent and collaborative learning, while extending and supporting the learning process. The rapidly changing nature of computer technology continues to expand the range of resources available for any subject - specific learning. Teachers must be flexible, imginative and willing to renew their visions of teaching and learning, if they are to fully realise the depth of educational technology.

COMPUTERS IN EDUCATION

Computers in Education are revolutionary both in Teaching and Learning processes. Computers allow the development of interactive and individualised relations with the learner and no other technology has this potentiality exept a human teacher. Computers allow a large variety of contents and symbolic modes. Uniqueness of computers lies in their informational capacity to present the learner a whole world in a capsule enabling the learner to interact directly with a domain of knowledge. Computers have brought a revolution in information technology - composing, communicating, processing, retrieving, preserving and destroying information. It is difficult to decide how

to use computers because the technology keeps on changing and new studies induce the teachers to shift their properties for use of computers. For the development of skills needed for national development, computers are used in education.

The interactive computer based instruction changes the human thought structure for children, learn differently with computers when compared to the traditional teacher based instruction. The systematicity and the potential multidimensionality of the computers as instructive, individualised tutors facilitate the learners to learn effectively.

COMPUTER MANAGED LEARNING (CML)

In education, an early attempt made in computer managed learning was the Individually prescribed Instruction (IPI) project, in which a computer was programmed to provide daily tests and assignment lessons for students. Teachers, freed from record keeping, and from deciding what and how students should learn, were to function as tutors, helping the children to maximise the learning from their computer - prescribed lessons.

Though there initial applications of computers to education were motivated principally by the existence of the computer, naturally they had specific objectives, and could be counted successful if these objectives were achieved. However, the concept of 'effectiveness' in this context has been defined in vastly different ways. Criteria that have been used include the amount of learning, the rate of learning, the cost of learning, the thoroughness of learning as measured by tests at a later stage, the change in attitude towards computers, the drop - out rate, or simply the fact of the construction of educationally oriented computer based materials.

COMPUTER ASSISTED INSTRUCTION (CAI)

Computer is one of the machines of automation in teaching and learning process. In educational technology computer is considered as hardware. Computer is considered to be the electronic brain. According to the entry behaviour of the learner, the computer services take decisions about the instructional material. Where as the other teaching machines present simply the instructional material as they were arranged.

Computer Assisted Instruction (CAI) is the natural outgrowth of applications of the principles of programmed learning. There are different instructional design methodology for developing CAI program. Many literature on CAI enumerates a number of different types of instructional programmes under the broad category of CAI. The different types of CAI applications are games, simulations, problem solving, drill and practice and tutorial programs.

The psychological principles involved in the CAI are :

- principle of small steps

- principle of active responding

- principle of immediate reinforcement

- principle of self - pacing

- principle of student - evaluation.

By considering these psychological and practical advantages, CAI is viewed as potentially the ultimate expert system. CAI can be modified to suit many needs of individual learners. The level of task difficulty, the extent

of remediation, the pacing of instruction, the frequency of reinforcement and the use of motivational elements can all be adjusted to suit the learners requirements. The use of CAI reveals increase in both effectiveness and efficiency. It is possible to use the computers to teach new skills or concepts, give remedial teaching, provide for enrichment of learning, promote creative thinking and problem solving, etc.

COMPUTER ASSISTED LEARNING (CAL)

In 1977, Kemmis, Atkins and Wright proposed a framework for computer assisted learning, despite the rapid changes in technology since then. They proposed four paradigms for applying the computer to education.

- the instructional paradigm
- the revelatory paradigm
- the conjectural paradigm
- the emancipatory paradigm

Instruction : The Computer as Tutor (CAI)

Based on the psychological theories, early experiments largely with CAL was developed from the use of programmed learning. The overall aim is to teach a learner a given piece of subject matter, or to impart a specific skill. It involves breaking a learning task into a series of sub - tasks; each with its own stated pre - requisites and objectives. These separate tasks are then structured and sequenced to form a coherent whole. This type of computer assisted learning is given names like 'skill and drill', 'drill and practice', instructional dialogue' and so on.

Revelation : Simulation

Simulation is a technique that teaches about some aspect of the world by imitating it. Learners are motivated by simulation at the same time they learn by interacting with them in a manner similar to the way they would react in real situations. In the simulation method, students observe movements or processes as they occur in real life. Opportunities are often provided for students to become involved in the simulation or activities are provided to test or reinforce their understanding the material / concept presneted. Simulation simplifies the rality also by omitting the changing details. Thus, simulation helps the learner to build useful mental model of part o f the world and to provide an opportunity to test it safely and efficiently. In the simulation, the students learn by actually performing the activities to be learned in a context that is similar to the real world. Simulation may serve for initial presentation, for guiding the learner, for practice, for assessing learning for any combination of these phases. Simulation that assesses learning usually does not incorporate any of the other phases, but when the other phases are present they are usually in combination. Simulations have various advantages both practical and educational. For example, in science, a computer program can be used to simulate a natural phenomenon, a laboratory experiment and an industrial process.

Conjecture : The Computer as 'Tutee'

In this category, the students are allowed to manipulate and test his own ideas and hypotheses. Modelling must be distinguished from simulation. Every simulation involves using a simplified representation, i.e., model of

some situation, but in a simulation the model is ready - created by the programmes. The user can then alter and experiment with the external conditions and variables affecting the model, but cannot tamper with the model itself i.e., internal conditions.

Emancipation : The Computer as a 'Tool'

The fourth and final paradigm suggested by Kemmis et. al., involves using a computer as a labour - saving device, a tool that relieves mental drudgery. As such, it can be used for calculating, for tabulating date, statistical analysis, or even for drawing graphs. This fourth type of CAL is unique in two ways: Firstly, it uses the computer purely as a tool for the learner's convenience, to be used when and where he wants it; secondly, the computer is only partly involved in the learning process, ie., to take over the inauthentic part of the learning task.

Advantages of CAL

The following are the advantages of CAL :

✦ It frees teachers from other work and hence increases educational productivity.

✦ It reduces the time taken to understand the difficult concepts

✦ It individualises instruction by responding appropriately to current student input, possibly taking into account also the student's performance to date. It also allows the individual student to have some control over the content and sequence, of his or her course.

+ It forces active participation, in a way that a text book cannot, and a lesson often does not.

+ Partly as a result of interactive student participation, it offers fast feedback.

+ It allows students to make their mistakes in private.

+ It offers a wider range of experiences that are otherwise available to the students.

+ It captures the interest of some reluctant learners.

+ It is good for low - aptitude students and for revision.

INTERACTIVE MULTIMEDIA LESSONS FOR EDUCATION - INTRODUCTION

Recent studies indicate that computer - aided instruction (CAI) supplies a significant opportunity to improve the quality of teaching largely and cost - effectively. It has been pointedout that CAI may present a 50 percent increase in retention, a significant improvement in the learning rate, an improvement in course completion, and a decrease in the overall cost of education, particularly when distance learning is involved. As per these statistics the computer technological improvement , simulation tools and graphics software continue to grow, expand, and improve the development of technology - based educational tools and interactive multimedia software. It is not only justifiable but also commendable.

Modern education demands the new technology. Technology - based education is expected to modify the curricula structure and offerings, change in the development of teaching methods and the role of a university faculty

in classroom teaching. In addition to the traditional utilization of computers for number crunching, finding the solution of a large system of equations, and for the graphical display of results, there has been a recent trend to use the power of high - performance computing to teach physical sciences and engineering based on fundamental and basic principles rather than by using mathematical models and equations. One such project is known as the CoLoS (Conceptual Learning of Science). It is USA project founded by the Hewlett -Packard Company in collaboration with the CAEME Centre for Multimedia Education and Technology. Eleven universities - such as Massachusetts Institute of Technology, North eastern University, Rutgers, Stanford University, University of California - Berkeley, University of California - Davis, University of California - San Diego, University of Illinois at Chicago, University of Utah, and Washington State University - are participating in the CoLoS USA project. In realizing the conceptual learning of science (CoLoS), the development of interactive multimedia lessons is the milestone.

It is stressed that, inspite of the fact that multimedia production requires extensive software and hardware resources, the major development components are readily available and affordable, and educators are encouraged to take advantage of these recent advances to develop highly successful educational modules.

MULTIMEDIA MODULE COMPONENTS

Content

Content is the foremost concern of any educational multimedia product. Content is essential for computer tutorials. All the topics are not suitable for computer-based instruction. So care is to be taken to select

only those topics which benefit from the use of computers. Abstract and difficult concepts to be visualized generally work well in tutorials where the visualization capabilities of the computer can be stressed. Electrostatics chapter in physics is an example of an abstract concept which students offen have difficulty in integrating into their intuition.

Eventhough content is the basis on which tutorials should be judged, good presentation is important to convey the content to the student. In the design of a multimedia, tutorial instructors have to give more concentration in presenting the content than they concentrate on writing text book. The usage of hyperlinks alows students to control the sequence of presentation of consepts. Interaction between the students and the computer can engage the students more fully and lead the student to understanding of the ideas being covered rather then merely presenting the concepts. Since multimedia tutorials delivers information through graphics, animations, video and sound, educational multimedia modules may appeal some students who find text book learning rather difficult or boring.

Presenting material in a multimedia tutorial is expensive. For full utilisation of the computer's interative possibilities requires a great detailed programming to accommodate a variety of student responses. Developing graphics, animations, video, and sound consumes lot of time and these additions require huge amounts of space in computer. So the tutorials cannot exhaustively cover a subject and retain the features which distinguish them from textbooks. A balance between desirable flexibility and the available computer resources must be carefully considered while developing the software.

Multimedia Asset Development

In a multimedia software package simulation software and multimedia assets are considered to be the building blocks. Simulation software is required to students and faculty to simulate and solve a wide variety of problems and to stress practical applications of some of the concepts. On the other hand multimedia assets enhance these simulations with video, sounds and animated discussions. The accessories of multimedia assets are computer graphics, computer animations, digital videos and digital sound. The development of multimedia assets can be divided into three general areas: (1) Computer graphics production, (2) Video production and (3) Sound production. Each of these topics will be discussed in more detail.

Computer Graphics Production :

It is essential for development of quality computer graphics to present visual ideas clearly. Three - dimentional animated computer graphics are especially useful in simulating real situations in semi - immersive virtual reality. The computer graphics to be developed for the lessons are either two - dimensional, three - dimensional, or three dimensional with animation.

Two - dimensional graphics development consist of scanned images or computer - generated images. Scanned images will be captured from a photograph of the graphic idea with a suitable resolution scanner.

Three - dimentional graphics development of still images or pictures involves a three - step process. Step: 1 The object is modeled in either an organic modeling environment or a mechanical modeling environment, depending on the desired shape or complexity of the object. The difference

between the two modeling environments is that the former utilizes a spline mesh for optimal modeling of curred shapes and the latter utilizes a square mesh for optimal modeling of objects composed of polygons. After determining the modeling environment, the object is created in wireframe form.

Step : 2 In the three - dimensional graphics development is the texture mapping of the model. Each wireframe surface in the model is assigned a 'texture' which is a picture of a surface. The modeling software used will wrap the texture around a complex object giving it the desired appearance of the surface. At this stage surfaces that are transparent (glass) or translucent are identified and textured appropriately. Light sources are then used judiciously to create the desired shadows and the 3D model is rendered to create the desired image.

Step : 3 In the three - dimensional graphics development is the rendering of the image. In this part of the process, the computer will calculate the required light, texture map, and shadow of each pixel in the image based on the light sources in the model. There are two rendering schemes that are used to creats the final images: phong shading and ray tracing. Phong shading can be used when a sharp, high - resolution image is not necessary. This type of rendering does not take into account obstacles between an area in the image and a light source, and consequently does not calculate shadows. Therefore, phong rendering is quickly done and is used when shadows are not necessary or to test the placement of objects in a model without performing a slower ray - trace rendering. Ray tracing is a complete rendering sheme that takes into account the rays of light on each pixel in the image coming from each light source. This rendering scheme also calculates reflections of light from objects.

Another possible rendering scheme is ray painting. This is a special - effect rendering scheme. Ray painting, for example, would be used to make an image appear to be oil - painted on a canvas or air - brushed onto a metal surface. This rendering scheme is only used if the special effect would add impact to the lesson under development.

Three - dimensional animation development is an expansion of 3D still graphic image development. In animation development, the 3D model is developed and textures are mapped and then the animation is defined. Defining an animation involves applying motion to an object or objects in the model, arranging the lighting, calculating the chronology of the animation or the required frame rate, placing the camera with the correct perspective, applying motion to the camera, and simplifying the model to enhance motion and focus attention. Special effects may also be applied to an animation such as object morphing, explosions, motion blur, and different levels of transparencies.

Video Productions

Video production is essential in a multimedia education environment. The video production is a multistep process. First video must the made on tape which involves full-scale movie production. The most important issue to be considered in producing a video for computer playback is the impact of the video versus the play time. Disk space is a limiting factor, so a video clip must make its point clearly in the shortest time possible. Another important issue is the movement of the subject and the camera. A video for computer playback has a limited amount of data that can be updated to the computer screen; so as to avoid choppy screen; so as to avoid

choppy motion or skips, camera motion must be limited.

The movie must be digitally captured to the computer after it has been recorded on video tape, The number of frames per second captured is chosen based on the content of the movie, the disk space available for the movie, and the desired motion continuity. The size of the movie is also chosen based on these factors as well as logistics in the program itself. The frame rate and size have an inverse relationship, so a balance must be achieved. The frame rate is not absolute at this point because it can be changed during editing. However, it can only be reduced so it is advantageous to achieve the highest frame rate possible during the capture process.

The next step is editing the movie. Among many software tool, Adobe Premiere is an excellent software tool for editing digital movies. In this step, portions of the raw video are cut and pasted to make the final product. Also, dissolves between video sequences are added and the sound is normalized. If any background sound is desired, it is also added. Any special effects that are desired will be performed during this part of the process.

The final procedure in the production of video is compression for CD - ROM playback. The compression scheme is chosen based on the platform on which the movie will be played as well as the desired quality of the movie versus the disk space required.

Sound Production

Multimedia sound assets include narration and sound effects. The

sound production procedure for narration is to first write the score to be recorded. Next, a sound - proof area must be set up in which to record the narration. Using a good - qualaity computer microphone, the narration can be recorded directly to the computer hard drive. Sound effects require either props brought into the recording area or remote recording devices taken to the sound.

After the completion sound recording to the computer hard drive, the sound can be edited. Editing options include mixing the sound with other sounds, changing pitch, adjusting volume, removing unwanted noise or silence, or applying special effects such as reverb, echo, and reverse play.

File Format Conversion

Once a multimedia asset has been developed, the next step in the procedure is to prepare that asset for the platform on which it will be used. File formats of graphics , animations and video vary from one software package to another, not to mention from one computer platform to another. The issues to consider regarding file format conversion change in performances, quality, data transfer size, and disk space usage. Multimedia asset development and file format conversion provide the pieces with which to build the multimedia modules. However, these pieces alone are not sufficient for teaching a subject. In the next step, these multimedia assets are combined with other information and assembled into a coherent program that will become a multimedia lesson.

Authoring System Integration

An authoring system is an environment in which a multimedia lesson

is to be created in a timely and cost‑efficient manner. The CAEME centre uses Macromedia's Authorware with support from macromedia's Director and Novell's AppWare. These authoring environments provides tools to develop user interactions, enter text, perform limited animation in two dimensions, evaluate user input, and integrate multimedia assets such as sound, animations, and graphics. Authorware has generally been the package of choice for educational applications because of the ease in which these applications can be constructed. Macromedia's Director allows a programmer more control over the program, but at the cost of greater development time. Novell's AppWare is the most difficult of these packages to learn, but offers the greatest control to the programmer. AppWare can be described as a graphical programming language where we construct a program by connecting objects and functions. AppWare was designed to build applications for Novell's NetWare, and as such does not have a great deal of support for multimedia. For programming problems it is both easier to use and more portable than high level language like C or FORTRAN. The most widely used authoring packages are Macromedia's Authorware and Director

.   Developers follow the lesson plan previously written on paper to create the tutorial during authoring. At this stage, the developer has the lesson plan and the multimedia assets in the correct format for integration into the lesson. With this preparation, the task of building a lesson is reduced to entering text, performing simple animations, and defining interactions and user input.

COMPUTER ANIMATION TECHNOLOGY

The term 'Computer Animation' suggests that computers bring something new to the traditional way of animating. Traditional animation is

defined as a technique in which the illusion of movement is created by photographing a series of individual drawings on successive frames or film. Some typical application of computer - generated animation is entertainment (motion pictures and catoons), advertising, scientific and engineering studies, and training and education. Animator Pro enables to produce animation squences of greater sophistication in a fraction of time taken with authorware. The term 'Computer Animation' genatally refers to any time sequence of visual change in a scene. In addition to changing object position with translations or rotation, a computer - generated animation could display time variation in object size, colour, transparency, or surface texture. Changing camera parameters such as position, orientation and focal length can also generat computer animations. One can produce computer animations by changing lighting effects or other parameters and procedures associated with illumination and rendering.

Principles of Animation

An object seen by the human eye remains on the retina of the eye for 1/8 th of a second after viewing. This makes it possible for a series of images that are changed very slightly and very rapidly one after other to seeningly blend together into a visual illusion of movement. In other words, if one changes slightly the location or shape of an object rapidly enough the eye will perceive the changes as motion. The same action can be done on the computer also. The sequence would be to place an image on the screen, then erase it, and replace it with another, slightly different image. If this is done repeatedly, then the movement occurs. For an animation program, it is necessary to provide the programmer with a series of drawings making a story board of the animation. If the available computer has several 'pages'

then drawing on one page, drawing a slight different image on the other page and flipping between the two can produce smoother animation than if the drawing and erasing are conducted on the same page. Sometimes it is possible to bring out information by the use of animation.

Design of Animation Sequences

An animation sequence is designed with the following steps.

The storyboard is an outline of the action. It defines the motion sequence as a set of basic events that are to take place. According to the type of animation to be produced, the storyboard could consist of a set of rough sketches or it could be a list of the basic idea for the motions.

The second step is object definition to be given for each participant in the action. The object can be in terms of basic shapes, such as polygons or splines. Further, the associated movements for each object are specified along with the shape.

The third step is key - frame specifications. A key - frame is a detailed drawing of the scene at a certain time in the animation sequence. Within each key frame, each object is positioned according to the time for that frame. More key frames are specified for intricate motions than for simple, slowly varing motions.

The fourth step is Generation of In - between Frames. In - between frames are the intermediate frames between the key frames. The number of in - betweens needed is determied by the media to be used to needed is determined by the media to be used to display the animation. 24 frames per second are required for film and graphics terminals are refreshed at the rate of

30 to 60 frames per second. Typically, time intervals for the motion are set up so that there are from three to live in - betweens for each pair of key frames. Depending on the speed specified for the motion, some key frames can be duplicated.

Conventional Animation

A conventional animation is created in a fairly fixed sequence : The story for the animation is written, and then a storyboard is laid out. A storyboard is an animation in outline forms a high level sequence of sketches of showing the structure and ideas of animation. Next the sound track is recorded, a detailed layout is produced (with a drawing for every scene in the animation), and the sound track is read - that is, the instant at which significant sounds occur are recorded in order. The detailed layout and the sound track are then correlated. Next, certain key frames of the animation are drawn; these are the frames in which the entities being animated are at extreme or characteristic positions, from which their intermediat positions can be inferred.

The intermediate frames are then filled in with in - betweens, and a trial film is made (a pencil test). The pencil test frames are then transfered to cels (sheets of acetate film). The pencilled frames are assembled and then actually filmed as a pencil test to check smoothness, continuity and timing.

When the pencil frames are satisfactory, they are permanently inked and acrylic colours are painted on. In the hands of master, cel paint applied to the back of acetate sheet can produce beautiful and subtle effect, with feathered edges or smudges, or simply flat and perfectly even. This type of animation is called key - frame animation. It is this composite

that becomes the final photographed frame in an animated movie.

Computer Assisted Animation

Computer animation programs typically employ the same logic and procedured concepts as cel animation, using layer, key frame, and tweening techniques. Tweening action requires calculating the number of frames between key frames and the path the action takes, and then actually sketching into a cel with pencil the series of progressively different outlines. On the computer, paint is most offen filled or drawn with tools using features such as gradients and anti - aliasing. The word ink, in computer animation terminology, usually means special methods, providing edge detection, and layering so that images can blend or otherwise mix their colours to produce special transparencies, inversions and effects. One can set one's frame rates on the computer, but the rate of which changes are computed and screens are refreshed will depend on the speed and power of the hardware.

ROLE OF MULTIMEDIA BASED COMPUTER ANIMATION COURSEWARES IN SCHOOLS

Most of the multimedia animation softwares have been designed to remove the difficulties, which the teachers and pupils have in teaching learning processes. Especially the scientific concepts can be understood easily with the help of computer animation coursewares. For example, when the working of Van de Graaf Generater with animation is seen by a physics student, he enjoys and understand very easily the parts and all working details. Simillarly the Biology students and chemistry students at the higher secondary stage understand the difficult concepts soon when

animated pictures are shown to them with the help of computers.

CONCLUSION

Computer is certainly one of the most versatile and ingenious developments of the modern technological age. Computer specialists promote the widespread use of computers in instruction because they are convinced that computers would provide the means for the tailoring of educational process to individualised students. It makes the reality for individualised instructions. Educators are using computer for instructions as CAI (Computer Assisted Instruction) and CMI (Computer managed Instruction).

Researchers believe that multimedia offers an effective and efficient means of improving the quality delivery and presentation of educational and informational material. Many studies have shown that interactive multimedia technologies are effective means of achieving instructional objectives. The storage and retrieval systems of multimedia can contain more information than any human training agent can possibly embrace, and can have many terminals through which students can have access to the information. The graphical arts and animation provide quick understanding. The main educational advantages of multimedia are critical thinking, individualised learning and the students can learn at their own time and pace. The learners are able to understand the concepts very easily. Computer Animation Technology reduces the monotony, because it brings forth the real life situations.

The above layout in terms of conceptual framework of the study helps the investigator to proceed his goal of developing multimedia based coursewares for teaching physics for higher secondary student learners.