THE COMMONWEALTH *of* LEARNING

Commonwealth Educational Media Centre for Asia

Educational Multimedia

A Handbook for Teacher-Developers

Version 1.1
March 2003

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Editors
Usha V. Reddi
Sanjaya Mishra

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Contributors to the Handbook

This handbook has been prepared by a team of experts on behalf of Commonwealth Educational Media Centre for Asia, New Delhi.

Dr. Usha V. Reddi — **Section 2**
Director, Commonwealth
Educational Media Centre for Asia (CEMCA),
New Delhi

Dr. Anurag Saxena — **Section 3**
Dy. Director, C-DET
Indira Gandhi National Open University (IGNOU),
New Delhi

Dr. Anita Dighe — **Section 4**
Director, Campus of Open Learning (COL),
University of Delhi,
Delhi

Dr. Madhu Parhar — **Section 5**
Reader, Staff Training and Research
Institute of Distance Education (STRIDE)
IGNOU, New Delhi

Dr. Sanjaya Mishra — **Section 6, 8**
Programme Officer, Commonwealth
Educational Media Centre for Asia (CEMCA),
New Delhi

Prof. A. Srinivasa Rao — **Section 7**
Retd. Professor of Physics
Nizam College, Osmania University,
Hyderabad

Dr. C. B. Sharma — **Section 9**
Reader, School of Education,
Indira Gandhi National Open University (IGNOU),
New Delhi

Dr. P.R. Ramanujam — **Language Editor**
Prof. and Director, Staff Training and
Research Institute of Distance Education (STRIDE)
IGNOU, New Delhi

For further information, and comments, contact:

Dr. Usha V. Reddi
Director,
Commonwealth Educational Media Centre for Asia
52, Tughlakabad Institutional Area,
New Delhi - 110 062
Phone: +91-11-26096730, 26056965, Fax: +91-11-26085208
Email: cemca@nda.vsnl.net.in Website: http://www.cemca.org

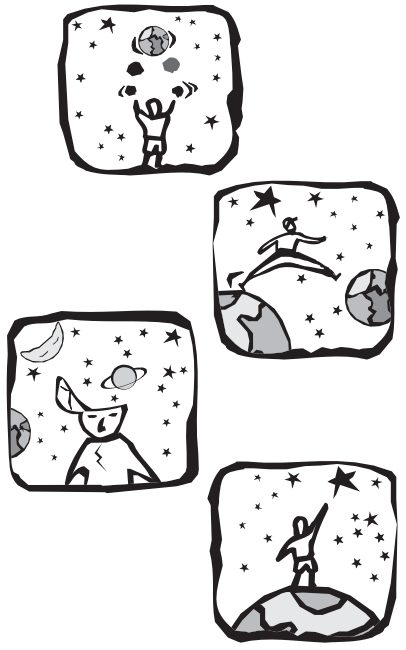
ISBN: 81-88770-00-0

Print Production

Production Design: Sanjaya Mishra

Layout & Cover Page: Graphic Shield Team

Illustrations: Ashwini Patel



Printed at : Graphic Shield, New Delhi. Phone: 25033114 Mobile: 9810790989
Published on behalf of the Commonwealth Educational Media Centre for Asia (CEMCA)
by Dr. Usha V. Reddi, Director, CEMCA, New Delhi.

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Introduction to the Handbook

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Why this handbook?

Multimedia has always fascinated educationists because of its strengths to communicate difficult concepts in simple ways. With the availability of more and more sophisticated computers with multimedia capabilities, the potentialities to use multimedia have also grown tremendously. In the case of Open and Distance Education, which depends on self-learning materials, the use of multimedia enriches the teaching learning experiences by providing a multi-sensory perspective. While it has been acknowledged that multimedia can be useful in the teaching-learning scenario of both face-to-face and distance learning settings, educators tend to believe that development of multimedia requires knowledge of high-end programming. This is true only partially. Today, with the availability of software like Flash, Director, 3D Studio Max, etc, we can develop multimedia lessons with a little practice of the software. Therefore, you see many highly skilled multimedia designers in the market. But knowledge of the software alone is not enough to prepare a good educational multimedia. In order to be useful to the learner, a multimedia programme design needs to have a sound pedagogical base. This handbook intends to help teachers in understanding the basic concepts of multimedia and various issues involved in the development of educational multimedia.

Who are the target audience?

As the subtitle of the handbook suggests, the book is meant primarily for teachers who want to develop educational multimedia and therefore we use the term "Teacher-Developers". The Commonwealth Educational Media Centre for Asia (CEMCA) conducts a large number of workshops on multimedia courseware development. This handbook is also expected to serve as a pre-workshop reading material for the workshop participants.

What is the scope of the handbook?

Though the handbook has an underlying philosophy of "how to" approach, it is not a manual for developing educational multimedia for any particular software. However, you will find references to some of the useful software in development of educational multimedia. The handbook deals mainly with the conceptual clarity, and tells you what can be done and what can't be done.

How is it organized?

The book is organized in nine sections including the introduction. The remaining eight describe the process of multimedia development from scratch. The following sections constitute the main body of the handbook:

Section 2: Multimedia as an Educational Tool

Section 3: Hardware and Software for Multimedia Development

Section 4: Understanding Our Learners

Section 5: Instructional Design for Multimedia

Section 6: Scripting for Multimedia

Section 7: Development of Multimedia

Section 8: Delivery of Multimedia

Section 9: Evaluation of Multimedia

How to use the handbook?

You can use this handbook the way you like. We do not prescribe any particular way. However, if you have received this handbook as a participant in any of the upcoming one, we would expect you to come to the workshop after having read the handbook. This will enable you to effectively participate in the deliberations of the workshop. Others can use this handbook either from 'beginning to the end' approach or can use it as a reference handbook and read the specific sections as and when required.

Who are behind the development of this handbook?

This handbook has been developed by CEMCA in a team mode involving many specialists in their respective areas of operations. You can see their names on the credit page. At CEMCA, we will be able to respond to your views and opinions on this handbook via email at <cemca@nda.vsnl.net.in>.

What additional support are you looking for?

After having gone through this handbook, if you need additional support, please do not hesitate to contact us or participate in one of our workshops on Educational Multimedia.

Editors

Multimedia as an Educational Tool

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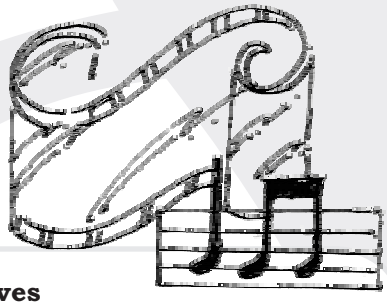
For many of us, the lure of computers is a powerful one. However, many of us also refrain from using computers for fear of failure. We want to hone computer skills, but are scared to make the effort because we lack those very skills. Too many of us, especially in the field of learning, are caught in this modern tug-of-war.

Throughout the 1980s and 1990s, the concept of multimedia took on a new meaning, as the capabilities of satellites, computers, audio and video converged to create new media with enormous potential. Combined with the advances in hardware and software, these technologies were able to provide enhanced learning facility and with attention to the specific needs of individual users.

A primary application of the interactive multimedia for instruction is in an instructional situation where the learner is given control so that he/she may review the material at his or her own pace and in keeping with his/her own individual interests, needs, and cognitive processes. The basic objective of interactive multimedia material is not so much to replace the teacher as to change the teacher's role entirely. As such, multimedia must be extremely well designed and sophisticated enough to mimic the best teacher, by combining in its design the various elements of the cognitive processes and the best quality of the technology. With today's multimedia courseware, once a programme has been designed and built in with the appropriate responses, it should be flexible and permit change and alteration.



In this section of the handbook, we shall look at the usage, advantages and disadvantages of multimedia in education and training. Some of the prototype multimedia lessons are also given at the end as examples.

Objectives

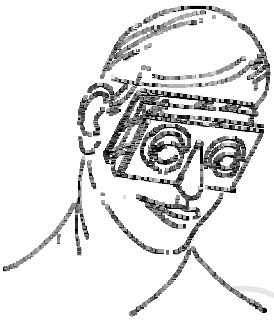
At the end of the section, you will be able to

- Define multimedia as propounded by authorities and construct your own definition of multimedia;
- Describe the use of multimedia in educational settings; and
- Explain the advantages and disadvantages of multimedia.

Definitions

"Multimedia" is a term frequently heard and discussed among educational technologists today. Unless clearly defined, the term can alternately mean "a judicious mix of various mass media such as print, audio and video" or it may mean the development of computer-based hardware and software packages produced on a mass scale and yet allow individualized use and learning. In essence, multimedia merges multiple levels of learning into an educational tool that allows for diversity in curricula presentation.

"Multimedia is the exciting combination of computer hardware and software that allows you to integrate video, animation, audio, graphics, and test resources to develop effective presentations on an affordable desktop computer" (Fenrich, 1997).



Specific uses of multimedia include:

- drill and practice to master basic skills
- the development of writing skills
- problem solving
- understanding abstract mathematics and science concepts
- simulation in science and mathematics
- manipulation of data
- acquisition of computer skills for general purposes, and for business and vocational training
- access and communication to understand populations and students
- access for teachers and students in remote locations
- individualized and cooperative learning
- management and administration of classroom activities

"Multimedia is characterized by the presence of text, pictures, sound, animation and video; some or all of which are organized into some coherent program" (Phillips, 1997).

Today's multimedia is a carefully woven combination of text, graphic art, sound, animation, and video elements. When you allow an end user, i.e. the viewer of a multimedia project, to control 'what' and 'when' and 'how' of the elements that are delivered and presented, it becomes interactive multimedia.

As such multimedia can be defined as an integration of multiple media elements (audio, video, graphics, text, animation etc.) into one synergetic and symbiotic whole that results in more benefits for the end user than any one of the media element can provide individually.

The need for making multimedia courseware

Why use multimedia at all? Of what use is multimedia in education? The answers to these questions could be sought through an understanding of the capabilities and limitations of the medium.

Besides being a powerful tool for making presentations, multimedia offers unique advantages in the field of education. For instance, text alone simply does not allow students to get a "feel" of any of Shakespeare's plays. In teaching biology, an instructor cannot make a killer whale come alive in a classroom. Multimedia enables us to provide a way by which learners can experience their subject in a vicarious manner. The key to providing this experience is having simultaneous graphic, video and audio, rather than in a sequential manner. The appeal of multimedia learning is best illustrated by the popularity of the video games currently available in the market. These are multimedia programmes combining text, audio, video, and animated graphics in an easy-to-use fashion.

Moreover, under conditions of chronic under-funding, multimedia can provide an enhanced or augmented learning experience at a low cost per unit. It is here that the power of multimedia can be unleashed to provide long-term benefit to all. Multimedia enables learning through exploration, discovery, and experience.

Technology does not necessarily drive education. That role belongs to the learning needs of students. With multimedia, the process of learning can become more goal oriented, more participatory, flexible in time and space, unaffected by distances and tailored to individual learning styles, and increase collaboration between teachers and students. Multimedia enables learning to become fun and friendly, without fear of inadequacies or failure.

Advantages of multimedia

Benefits to Learners

- Work at own pace and control their learning path
- Learn from an infinitely patient tutor
- Actively pursue learning and receive feedback

The pedagogical strength of multimedia is that it uses the natural information-processing abilities that we already possess as humans. Our eyes and ears, in conjunction with our brain, form a formidable system for transforming meaningless sense data into information. The old saying that "a picture is worth a thousand words" often understates the case especially with regard to moving images, as our eyes are highly adapted by evolution to detecting and interpreting movement.

For example, a photograph of Ganges in Varanasi, apart from being aesthetically pleasing, can contain a wealth of information relating to the culture, religion, geography, geology, climate, history, and economics of the area. Similarly, a recording of a politician's speech can allow us to discern significant semantic features not obvious in a written transcript.

For the student, one advantage of multimedia courseware over the text-based variety is that the application looks better. If the courseware includes only a few images at least it gives relief from screens of text and stimulates the eye, even if the images have little pedagogical value. More often than not, the inclusion of non-textual media into courseware adds pedagogical value to the application. For example, a piece of courseware describing a dig at an archeological site would be more valuable to the student, if it included images of the site, such as enhanced aerial images showing features like old field boundaries, or diagrams illustrating where the digging and scanning took place. In this respect, using the text only, even in a creative way, has obvious limitations as compared to the use of both text and pictures.

Practical disadvantages of multimedia

Multimedia requires high-end computer systems. Sound, images, animation, and especially video, constitute large amounts of data, which slow down, or may not even fit in a low-end computer. Unlike simple text files created in word processing, multimedia packages require good quality computers. A major disadvantage of writing multimedia courseware is that it may not be accessible to a large section of its intended users if they do not have access to multimedia-capable machines. For this reason, courseware developers should think very carefully about the type of multimedia elements that need to be incorporated into applications and include only those that have significant value.

Multimedia has other weaknesses too. While proponents of this new technology are very enthusiastic about its potential, they often leave the financial and technical issues unattended. Development *costs* in multimedia are very high and the process of developing effective multimedia takes time. Time spent on developing the

multimedia package requires money so that the true cost of an interactive programme mounts with each delay.

Further, if the prerequisites for using multimedia include *access* to computers with related software, the user must possess a minimum level of computer literacy in order to exploit the capabilities of this medium for learning. And finally, *training* of the educator who is unfamiliar with the production and design of multimedia courseware or packages can be equally complicating.

The critical question, then, is: How do we overcome some of the identified barriers and begin the process of multimedia implementation alongside the instructor, textbook, and blackboard? It is the barriers rather than the technologies which we must address before multimedia, or for that matter, any media technology becomes as accepted as the printed text or guidebook.

Use of multimedia in an educational setting

Let us look at some examples of what is called "innovative use". Let us say a student wants to write a paper on desert animals. Traditionally, the primary source for obtaining information would be the encyclopedia generally available in the library. With access to interactive multimedia, the student would collect various textual materials about the camel from sources on a CD-ROM. In addition, the student may be able to copy a diagram or the skeleton and muscular structure of the camel and the ostrich to study what is common about the two creatures. With a multimedia approach, the student could also access Web sites on the Internet to get more information. The student could then add film clips on these animals in their natural habitat (all may be from the same CD-ROM) and blend them into a report. Then by adding titles and credits, the student now has a new and original way of communicating his/her own individual perspective.

Benefits to Teachers

- Allows for creative work
- Saves time for more challenging topics
- Replaces ineffective learning activities
- Increases student contact time for discussion

Besides student use, teachers should find multimedia of great use in delivering their lessons. For example, a history teacher could use a multimedia CD to create a lecture on the non-violence movement by using film clippings and audio tapes on Mahatma Gandhi or Martin Luther King, also by incorporating other audio visual information with text to make the subject come alive. All this material would be available on a videodisc.

Similarly, a university professor might use a multimedia CD to prepare or to update information or to teach so as to enliven and also add insight to his/her teaching, thereby improving the quality of the course. The uses of multimedia need not be seen as a tool for classrooms only. In an industry dealing with hazardous materials, workers need to be trained. It could be risky to provide hands on training. In this case, simulated learning can take the place of actual hands on training by using all

the features of interactive multimedia. Training can thus take place individually at the learner's pace and on his/her own time. Medical procedures, first-aid training and instruction of paramedics or even surgeons are made both simple and interesting through the use of multimedia. The doctor or paramedic can run through a complete procedure on videodisc and analyze all the possible outcomes and can evaluate the possibilities before treatment of the real life patient starts.

In all the above instances, the user can and normally does work individually and in an interactive mode with the medium.

In the next section we look at the hardware and software required for development of educational multimedia.

Hardware and Software for Multimedia Development

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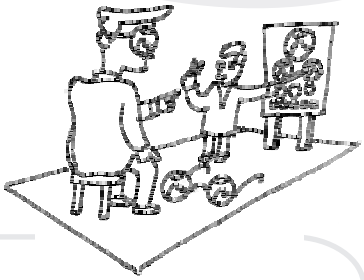


Objectives

At the end of the section, you will be able to

- Outline the hardware requirements for multimedia development;
- List various software for developing multimedia; and
- Choose suitable software for developing multimedia.

Computers are now making it possible to combine sound, images and motion together. In earlier sections, you have read about definitions of multimedia as propounded by experts. You can now describe the use of multimedia in educational settings. In this section, we introduce you to the inside story of multimedia i.e. about the hardware and the software which enable you to get the end product called *'multimedia'*. Understanding these concepts is very important as it is only the hardware (the computer), the software (tools for designing multimedia) and yourself (your conceptual understanding and skills) which will be crucial for multimedia development. In this section, we will confine ourselves to the Microsoft Windows platform only. There are other platforms also like Apple Macintosh, Silicon Graphics, Sun Microsystems and even mainframes. Since Windows-based systems (or Windows operating systems) have a worldwide presence, availability and affordability, it becomes an automatic choice for our purpose. In this section you will learn about the hardware and the software. In fact the software tells the hardware as to what to do. This section also highlights the software that enables development of multimedia. You will also learn about some of the ways to choose the best combination of hardware and software to suit your requirements.

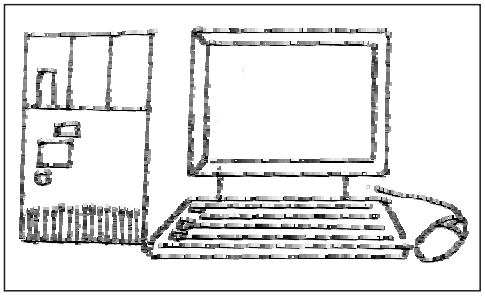
The developments in the field of hardware and software for multimedia are such that it is practically impossible to be current in print. The description in this section is only informative (and does not necessarily claim to be exhaustive) for enabling you to familiarize with the concepts and capabilities of some of the software used in developing multimedia.

An *operating system* is the program that is responsible to manage all the other programs in a computer, once it is loaded into the computer. The other programs are called *applications* programs. The operating system determines the distribution of time and order for multiple application programs running simultaneously. It also manages the sharing of memory among multiple applications. It communicates with the attached hardware devices about the condition of operations and any errors that may have occurred. Linux and Windows 2000 are examples of operating systems while MS-Word is an example of an application program.

In this section we discuss various terminologies used in computer operations and usage to emphasize their importance in multimedia development.

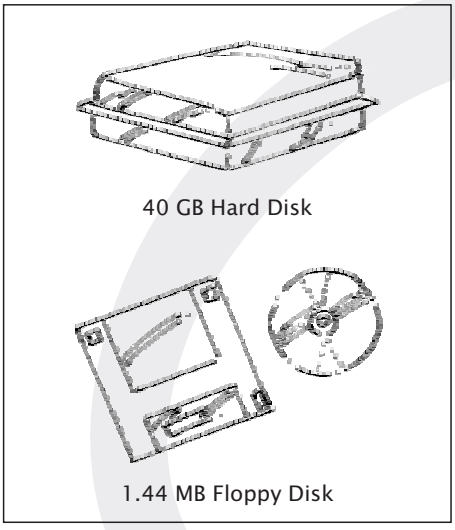
Hardware required for Multimedia

To begin your quest with a multimedia project you must have a decent computer. A decent computer means you should have adequate hardware. Hardware interprets your commands into computer activity. As of now, if you are asked to develop a multimedia project, you would ask for a fast computer with lot of speed and storage. There are many more things that you need to know like which component makes a computer fast, what is the device for storage, etc. The components are thus divided into five categories viz. *System devices, Memory and storage devices, Input devices, Output devices, and Communication devices.*



System devices

These are the devices that are the essential components for a computer. These include microprocessor, motherboard and memory. Microprocessor is basically the heart of the computer. A *microprocessor* is a computer processor on a small microchip. When you turn your computer on, it is the microprocessor, which performs some operations. The microprocessor gets the first instruction from the *Basic Input/Output System* (BIOS), which is a part of its memory. BIOS actually loads the operating system into random access memory (RAM). A *motherboard* is a device in the computer that contains the computer's basic circuitry and other components. Motherboard contains computer components like microprocessor, memory, basic input/output system (BIOS), expansion slots and interconnecting circuitry. You can add additional components to a motherboard through its expansion slot.



Memory and Storage devices

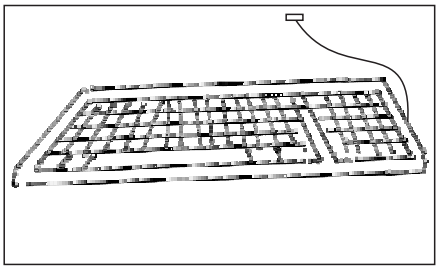
RAM (random access memory), also called primary memory, locates the operating system, application programs, and data in current use so that the computer's processor reaches them quickly. RAM is called "random access" because any storage location can be accessed randomly or directly. RAM is much faster than the hard disk; the floppy disk and the CD-ROM. RAM can be taken as short-term memory and the hard disk as the long-term memory of a computer. However, RAM might get slow when used to its limit. That is why, you need more memory to work on multimedia. Today's personal computers come with 128 or more *megabytes* of RAM.

Users of graphic applications usually need 128 plus megabytes of memory.

A *hard disk* stores and provides access to large amounts of data on an electro magnetically charged surface. Today's computers typically come with a hard disk that contains several billion bytes (gigabytes) of storage. The popular ones currently are 40 GB and above. Hard disk contains a part called *disk cache* which is responsible for improving the time it takes to read from or write to a hard disk. The disk cache holds data that has recently been read. The other type of hardware cache inside your computer is cache memory. Cache stores something temporarily e.g. Temporary Internet files are saved in Cache.

A *compact disc* (CD) is a small medium that can store data pertaining to audio, video, text, and other information in digital form. Initially, CDs were read-only, but newer technology allows users to record as well. *CD-ROM* (Compact Disc, read-only-memory) can store computer data in the form of text, graphics and sound. To record data into a CD, you need a *CD recorder*. Normally this type of CD is either *CD-Recordable* (CD-R) or *CD-Rewritable* (CD-RW). For the latter you can use the CD as a floppy disk write, erase and again write data into the same disk. In the CD-R, once the data recording is completed, it becomes a CD-ROM and nothing can be deleted.

Input devices



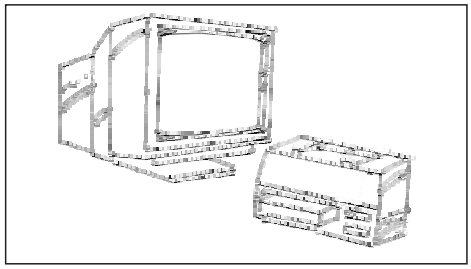
A *keyboard* is the primary text input device for your computer. It was very popular when DOS was the popular operating system. After the emergence of Windows, its role became limited to dealing with text and for some commands only. The keyboard contains certain standard function keys, such as the *escape key, tab, cursor movement keys, and shift* and *control keys.* A mouse is also a primary input device but it is not suitable for dealing with text.

A *mouse* is a small device that you move across a pad in order to point to a place on a display screen and thus execute a command by clicking it. The mouse is an integral part of any personal computer. A cable connects the mouse to the computer.

Microphone is another input device that can interpret dictation and also enable us to input sound like the keyboard is used for text.

A *digital camera* records and stores photographic images in digital form that can be fed to a computer as the impressions are recorded or stored in the camera for later

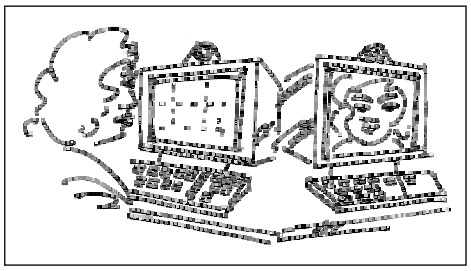
loading into a computer. The digital cameras are available for still as well as motion pictures.



Output devices

A *printer* is a device, which on receiving the signal from computer transfers the information to paper. Earlier the *dot-matrix* printer was a popular low-cost personal computer printer; now *inkjet* printers have taken its place. Dot-matrix printer strikes the paper a line at a time while inkjet sprays ink and laser printer uses a laser beam to attract ink (also called *toner*). A *monitor* is a device for display. It is just like a television set and is measured diagonally from two opposing corners of the picture tube. The standard monitor size is 14 inches. Very large monitors can measure 21 inches diagonal or greater.

An *amplifier* is an electronic device that increases the power of a signal. Amplifiers are used in audio equipments. They are also called *power amplifiers*. Speakers with built-in amplifiers have become an integral part of the computers today and are important for any multimedia project.



Communication devices

A *modem* modulates *digital signals* going out from a computer or other digital device to *analog signals* for a telephone line and demodulates the analog signal to convert it to a digital signal to be inputted in a computer. Most new personal computers come with 56 Kbps modems. Modems help your computer to connect to a network.

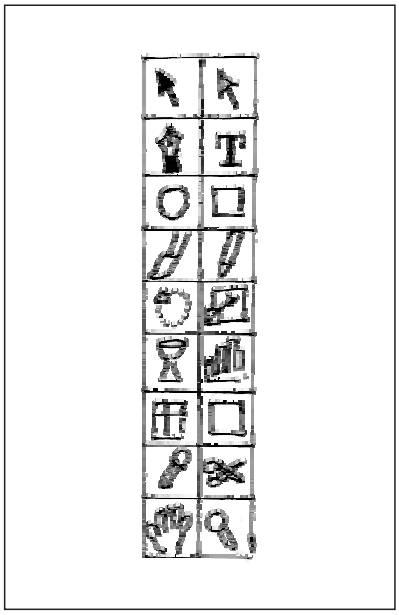
Additional Hardware

You are now aware of the basic devices on your computer. However, there are a few more devices that you should know. Video capture is one of the most important hardwares to be used for multimedia work on a personal computer. Video-capture results will depend on the performance and capacity of all of the components of your system working together. *Video capture* from analog devices like video camera requires a special *video capture card* that converts the analog signals into digital form and compresses the data. Video-capture card use various components of the computer to pass frames to the processor and hard disk. For good quality video, a

video-capture card must be able to capture full-screen video at a good rate. For example for a full-motion video, the card must be capable of capturing about 35 frames per second at 720 by 480 pixels for digital video and 640 by 480 for analog video. To determine what settings will produce the best results for your projects, you must be careful in defining these parameters.

A *sound card* is a device that attaches to the motherboard to enable the computer to input, process, and deliver sound. The sound card generates sounds; records sound from analog devices by converting them to digital mode and reproduce sound for a speaker by reconverting them to analog mode. *Creative Lab's Sound Blaster* is a standard sound card, to the extent that some people use the name as a generic term.

A *video adapter* provides extended capability to a computer in terms of video. The better the video adapter, the better is the quality of the picture you see. A high quality video adapter is a must for you while designing your multimedia project.



Configuration of a Multimedia Computer

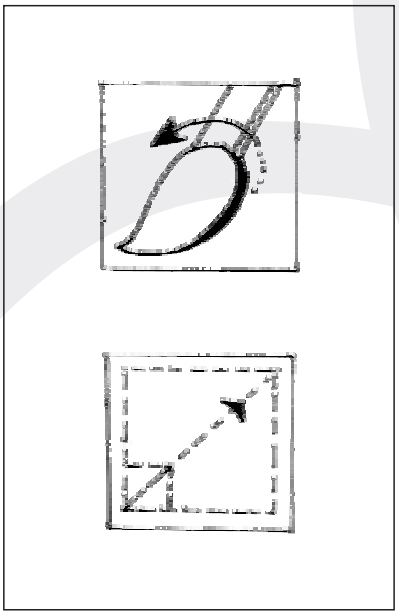
A good multimedia system should have a Pentium 1.6 Ghz (or the one with similar capabilities) onwards processor, at least 256 MB of RAM, 40 GB onwards hard disk drive, 1.44 MB Floppy drive, 17 inch onwards SVGA monitor, 32MB AGP card, 52 X CD-ROM drive, a 32 bit sound card, high wattage sub-woofer speakers, 104 PS/2 keyboard, PS/2 mouse and 56K fax data voice modem. If you wish you can add a CD-recorder, scanner, printer, digital camcorder and a video-capture card. Remember, there is no set rule to define the exact hardware combination of a good multimedia computer. The combination is dependent on the nature and contents of the multimedia project you are dealing with. Fortunately, there exist hardware tools for performing almost any action; the need is to use only that hardware, which suits your purpose. For a ready reference, see table-1:

Multimedia design software

The basic tool set for building a multimedia project can be divided into five categories: *Painting and drawing tools, 3-D Modeling and animation tools, Image editing tools, Sound editing tools, Animation Video* and *Digital Movie tools.* The software in your multimedia toolkit and your ability to use it will determine the quality of your multimedia work.

Table-1 : Components of a Multimedia PC

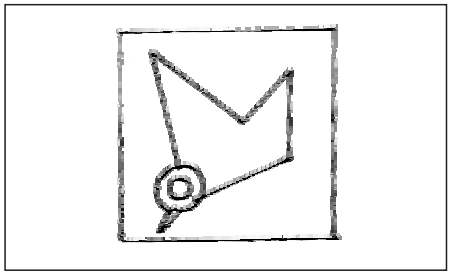
Component	Description	Standard
The Power Supply	It converts AC current into DC current as all computer components operate on DC current.	Any standard ATX Cabinet.
The System Board	All of the parts inside the computer are assembled on the system board.	Prefer to buy genuine board for the processor. Intel web-site has a motherboard selection feature.
Central Processing Unit (CPU)	The CPU is the brain of the computer. Pentium is a popular chip presently.	Pentium 4 processors, AMD etc, with 1.5 GHz speed onwards.
RAM (The Memory)	Random Access Memory (RAM) is critical for multimedia. The more memory the better off the computer is.	Minimum 256 MB
The Floppy Drive	A floppy drive is a storage device for smaller files (1.44 MB)	Buy any 1.44 MB
Hard Drives	Hard disk drive stores software and data. More storage is better for large projects.	40 GB onwards
CD Drive (read/write)	CD drives can store what hundreds of floppy disks together can. Maximum capacity of CD is about 800 MB presently.	ROM - 52 X RW 48X x 16X
Modem	Modem enables communications between your computer with other computers, the Internet and the World Wide Web.	56 kbps onwards
Sound Card	Sound Cards allow conversion of digital sound to analog sound and vice-versa.	Sound Blaster e.g. Creative Live Value Card
Keyboard	The keyboard sends typed information to the system board.	Multimedia Key Board
Monitor	Monitor is a display device. Choose how many colors they can display and about their resolution.	17"
Mouse	Mice are used as a pointing device.	Scroll Mouse
Printer	Inkjet printers have the ability to turn out good-looking output, including graphics at a lower cost than laser printers. Laser printers produce the best quality, but their cost is high	Choose as per your requirements.
Scanner	Scanners are used to digitize photographs, artwork and documents.	Choose as per your requirements.
Digital Camera (Still/ movie)	To capture pictures and prepare movie.	Choose as per your requirements.
Video Capture Card	To capture analog video and convert into digital format	Choose as per your requirements.
Graphics Card	To view graphics on the screen clearly.	32 MB Minimum



Painting and drawing tools

Graphic impact of your multimedia presentation is very important in influencing the students. It is the graphics that would create the first impression of your multimedia project. These tools are, therefore, very useful in giving you the desired capability in terms of drawing and painting. Painting and drawing tools generally come with a graphical user interface with pull down menus for quick selection. You can create almost all kinds of possible shapes and resize them. These tools have the capability to color with paint and clip arts. One can use brushes of different sizes and shapes according to the need. One can use layers to give different treatment to each element. Most of these tools come with built-in plug-ins for performing different tasks. Once you are done with the drawing it can be imported or exported in many image formats like .gif, .tif, .jpg, .bmp, etc. We will give a brief description of a good drawing software known as *Corel Draw.*

With *Corel Draw*, you can create illustrations from scratch. It has wide-ranging features to handle text and to create drawing with precision. It can be used to improve clip art, pictures and photos. It is an ideal tool for any design project like technical drawings, advertisements, logos, etc. It can be used in creating full-color illustrations for multifarious drawings and graphics for any designing project. It has lot of clip arts and high-quality drawings, which can be inserted into your multimedia project. One can also generate drawing for an animation sequence by using Corel Draw.

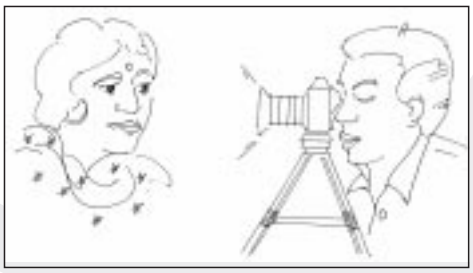


3-D Modeling tools

Realism means that you depict things in the way they actually are. With the help of 3-D modeling and animation tools the objects that appear in perception in your project can look realistic. It has become conventional to use 3-D modeling in multimedia design. These tools offer features like multiple windows to view your design in each dimension. They have *drag* and *drop* menus from where you can drop shapes into your design and combine them to create complex designs. A good 3-D modeling tool is 3D Studio Max.

3D Studio Max is a tool for making 3D models and designs that can be converted into 3-dimensional animations. You must have seen many websites with animated symbols. In fact many of such symbols are made by using this tool. You can virtually lead your imagination to go wild and visualize any symbol easily with the help of this

tool. It has applications in creating web pages; designing advertisements; making cartoon films and in creating multimedia based training programmes. One can give special effects to the design especially in terms of sound and animation.



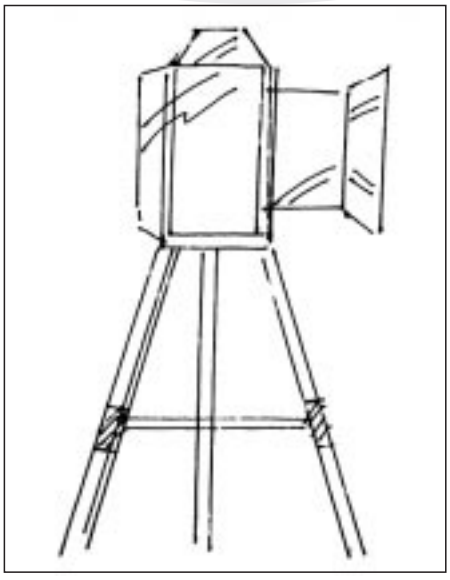
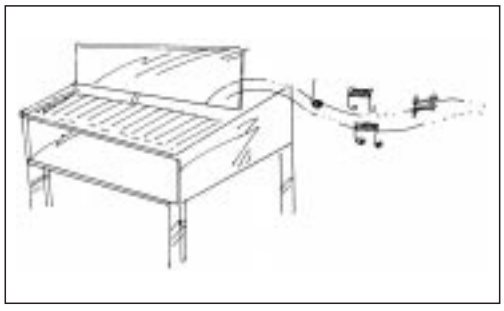


Image editing tools

While Painting and Drawing tools let you create a drawing from scratch, Image editing tools are used to edit existing bitmap images and pictures. However, these tools are similar to painting and drawing tools as they can also create images from scratch. They are capable of converting any image data type file format. Image editing tools are primarily used for reinventing and recreating the image, which make them an important tool for designing a multimedia project. We will introduce two good image processing software here: *Adobe Photoshop & Paint Shop pro.*

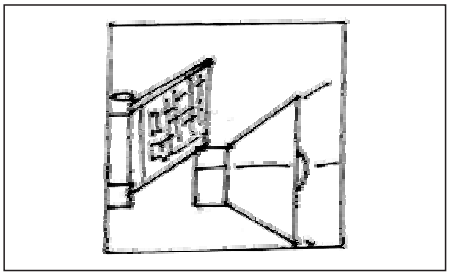
Adobe Photoshop is a cutting-edge image processing software package that enables you to create and edit images on computers. *Paint Shop pro* is also an exceptional drawing and painting utility that yields professional-quality effects. With both these tools you can edit an image in almost any desirable way. One can add elements in layers; edit text and use effects filter to make the existing image look even inferior to the edited one. It can mix and manipulate colors at a click of a button. You can manipulate your images with special effects and techniques. Images can be imported and exported across programs in any format. These tools have been used to edit and create images for motion pictures, animations and for artwork. With the help of these tools, you can master the special effects you've always wanted.



Sound editing tools

Sound editing tools let you hear sound as well as visualize it. You can cut/copy and paste sound and edit it with great accuracy. You can integrate sound into your multimedia project very easily by using sound editing tools. One such software is *Cool Edit*.

Cool Edit can be used to record your own music, voice, or any other audio. It makes you a professional as far as handling of sound is concerned. You can edit, mix the sound with any other audio and add effects to it. *Cool Edit* can record from a CD, keyboard, or any other sound played through your sound card. One good feature of this software is that it can read and write MP3, which is the hot sound format in the



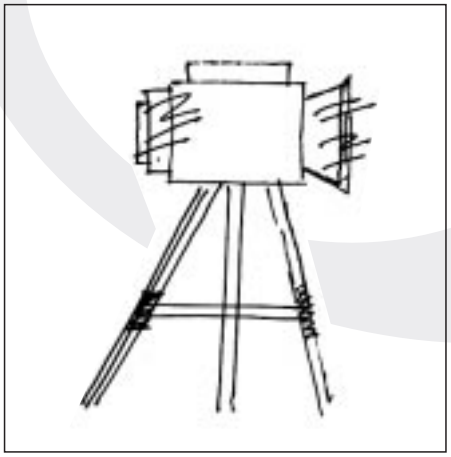
present times. Once you are done with your sound file, it can help you in converting the file to any desired format. In other words, there is a similarity in these editing tools--what Photoshop can do to images; *Cool Edit* can do for sound.

Sound Forge is another professional quality sound editing tool that is used in multimedia work.

Animation, video and digital movies editing tools

Animations are graphic scenes played back sequentially and rapidly. These tools adopt an object-oriented approach to animation. These tools enable you to edit and assemble video clips captured from camera, animations and other sources. The completed clip with added transition and visual effects could be played back. Adobe Premiere and Media Shop Pro are two good examples of these tools.

Adobe Premiere is a powerful tool for professional digital video editing. It is primarily used to produce broadcast quality movies. It has excellent editing tools that enable you to work with complete flexibility. This software first digitizes the sound and video and then allows you to edit them to preserve picture quality. It can edit video and multimedia movies in AVI as well as MPEG format. It can create titles and graphics and then add them to your multimedia project. It uses digital filtering for incorporating special effects. This software has applications in film editing and movie making.



Media Studio Pro also gives you the most complete set of advanced video editing tools. It can capture the video from VCR, TV or camcorders. It is capable of capturing a batch of scenes. It brings all the components of a multimedia project like video, sound, animation and titles together. One can add effects and transitions and finally save the video in the desired format. It can retouch videos by painting directly over any frame in a video sequence. It has an audio editor, which can remove background noise and add another sound to your video.

For creating animations *Macromedia Flash* is the industry standard. A file created in Flash is called a movie. A movie in Flash occupies very less file size, and hence is more popular for the Web. You can also create presentations and 2D Animations using Flash.

Integrated Design Software

Multimedia authoring tools are tools which organize and edit your multimedia project. These tools are required to design the user interface for presenting the project to the learner. In other words, these tools are used to assemble various elements to make a single presentation. You can compose comprehensive videos and animations with these tools. There are four basic type of authoring tools viz. *Page based tools* (like Tool book, Visual Basic), *Icon based authoring tools* (like Authorware), *Time based authoring tools* (like Macromedia Director) and *Object Oriented tools* (like Media Forge).

Page-based tools organize elements as pages of a book. These tools are used when the content of the project consists of elements that can be viewed individually. These tools organize them in a user-defined sequential form. *Icon based tools* organize elements as objects. These tools display the flow diagrams of activities along with branching paths. *Time based tools* organize the elements along a time-line. These tools play back the sequentially organized graphic frames at user-set speed and time. *Object Oriented tools* organize the elements in a hierarchical order as related "objects". These tools make these objects perform according to properties assigned to them.

We will give here a brief description of two such tools Authorware (Icon based) and Macromedia Director (Time based).

Macromedia Authorware has a visual interface, which one has to simply drag and drop icons to create an application. You do not need to be a programmer to use this software as it has an interactive design. Authorware provides direct support for graphics and animations made in Flash. Authorware can capture and integrate animations and video made in different programmes like Flash and QuickTime. It can integrate sound into your project in order to enhance the effect. It has an anti-aliasing feature which smoothes out the edges of text and graphics. Authorware has built-in templates which give you flexibility and convenience while developing your project. You can learn about basic authoring, editing and publishing ways with the help of a multimedia tutorial which is built-in with this software.

Macromedia Director is a multimedia authoring application capable of producing animations, presentations and movies. It provides a wide range of possibilities for integrating different multimedia elements. It supports inputs from programs like *Shockwave*, *Photoshop* and *Premiere*. It has applications in building professional

multimedia presentations. You can also integrate Real Audio and Real Video in Director projects. Compatibility of Director with other packages means that you can use your favorite tools and software to create content for your project and then bring that content into Director for authoring.

Table-2 : Choosing software

Features	Description
Usability	Should have a capability to deal with a variety of text, images video and sound formats with precision and ease.
Animations	Should have wide ranging capabilities in terms of interactive simulations, media support, animated buttons, illustrations,maps,etc.
Smoothness	Should have anti-aliasing feature, meaning that all letter and image edges are smooth.
Integration	Should have integration capabilities with a wide range of software used for different jobs like Real, ActiveX, Shockwave, Flash, QuickTime, Photoshop and other applications .
Delivery	Should be able to develop one piece of content for delivery on different media types.
User freindliness	Should be the easiest, most versatile, and have the most pre-built models .
Clientele	Should have applications for instructional designers, subject matter experts, training developers and others.

Choosing Multimedia Software

Multimedia is making a difference by providing ways of delivering learning materials that are less expensive and more convenient. The key to any learning process is that it must be relevant and it must keep the learner engaged. Educational multimedia is no exception. This can be proved after seeing the growing use of graphics, illustrations, animations and sound in educational multimedia. It is therefore essential to choose that software which enables you to execute your project with the minimum possible effort and maximum possible productivity. Multimedia software have unlimited features. You can choose among several hundred colors, dozens of fonts, a wide variety of color-coordinated templates and many other incredible options. Before starting to select software, one should start with an outline of the project and decide what is expected from the project. Table-2 gives a ready reckoner for selecting software.

Hardware is the first thing that you should have to begin your quest with a multimedia project. Hardware is necessary to interpret your commands, queries and responses into computer activity. You have read about hardware components viz. system devices, memory and storage devices, input devices, output devices and communication devices. Fortunately there is an abundance of good hardware answers to almost every problem. These areas are fast getting converged. May be tomorrow you would be able to see some more innovative steps in this direction which offers you even better capabilities.

Similarly in software too, entire suites of integrated production tools are now available. The need is to use them judiciously to create good projects. Powerful features are continuously being added to the software that allows developers to work more smoothly and conveniently between applications. Emergence of these integration features has resulted in collaboration and unison of multiple tools. The integration has enabled us to use your graphics from a previous work and save time on rebuilding it.

In short, the options available are enormous. All that you have to do is to choose the right hardware and software to complete your multimedia projects.

In the next section we will discuss about learner characteristics in order to develop good programme for them.

Understanding Our Learners

4

A typical profile of learners in distance education programmes, would be as follows:

- A wide age range as opposed to regular conventional students who would have a small age range;
- A mix of male and female students;
- A mix of students of married and single status that would create differences in responsibility and time availability;
- Students with varied status in society with social commitments and responsibilities that could affect their learning environment and competing interests.

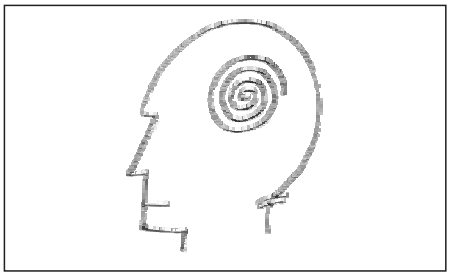
It is possible that the general distribution of the students could cover a region, a whole country and for some programmes, many countries. They may be away from the institution offering the programme, in urban or rural setting, with varying learning facilities. The educational background of the learners may also vary. An open learning institution would bring in students with a wide range of basic education and language competence. On the other hand, in a dual mode system, admissions might be standardised on specific examination grades, with a specific minimum cut off point.

In terms of professional/occupational background, it is possible that in the case of some programmes, the students may have undertaken some professional training or could already be employed. They may have varied aspirations and motivation for joining the distance education programme. Considering the varied backgrounds of the students of such programmes, it is important to understand our learners.

Objectives

At the end of the section, you will be able to

- Discuss the importance of understanding our learners;
- List various factors that need be known about learners;
- Explain how adults learn; and
- Prepare a generic picture of the target learners.

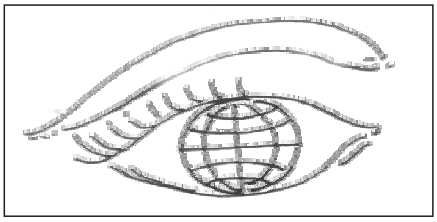


Why is it important to know our learners?

Given the wide range, background and interests of the learners, it is important to know our learners so that we understand their:

- educational and social background;
- present knowledge level;
- learning needs and their learning styles;
- values, attitudes, and their cultural background;
- motivation and desire for learning.

Information about our learners would be useful in defining our learning objectives and in determining our mode of communication as well as in designing the learner support system.



What do we need to know about our learners?

There are different aspects of our learners that we need to know about. But some of the most important ones are:

Demographic factors such as,

- What age group?
- What sex, marital status?
- What occupations (if any)?
- What educational and income background?

Motivation factors such as,

- Why do they want to learn?
- What are their aspirations?
- What are their hopes and expectations?
- How would the programme relate to their lives and their work?

Learning factors such as,

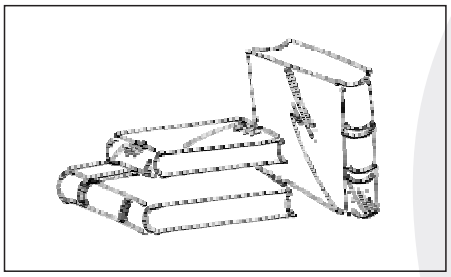
- What learning styles do they have?
- What learning skills do they have?

Subject background such as,

- What knowledge and skills do they already have in the subject?
- How do they feel about the programme?
- What personal interests and experiences do they have that could be relevant?

Resource factors such as,

- When, where and how will they be learning?
- Who will be paying their fees and expenses?
- How much time will they have for the programme?
- What access do they have to media/facilities?
- What access will they have to human support - counsellors, other learners?



How will we collect information?

There are different ways in which we can collect information about our learners. Some of these include the following:

- Meeting some of the prospective learners and discussing with them (individually and as a group) to know what they would like from the course or the programme and what they already know/feel about the subject;
- Sending a questionnaire to the prospective learners and trying to elicit the information we need. If this can be followed up by discussion with the learners, so much the better;
- Making a summary of the student enrolment and personal data to identify students' characteristics/profile;
- Making a summary of any surveys, which may have been done by institutions in relation to students' characteristics/profile;
- Keeping in touch with our learners- through meetings or by reading and commenting on their assignments- once they start working on the materials.

How do adults learn?

An adult learns differently from a child for an adult is a developed individual. However, there are certain characteristics that are common to the learning of all of us. Thus it is important to understand the following:

Self-directed learning: Adults have a self-concept and, unlike children, they are less dependent and more self-directed as learners. However, there are social, cultural and gender differences. Learners from certain cultural and social backgrounds exhibit lack of self-confidence and have low self-esteem. By and large, women prefer collaborative learning rather than individualized learning.

Prior experience: With the process of growing up, adults gather experiences which are their own. These experiences determine the way one learns and these also facilitate or hinder one's learning. It is important to recognize the varied experiences and perceptions of the adults as they largely affect their learning process.

Problem-centred learning: On the whole, adults tend to be more task-centred or problem-centred. Problems and tasks that are more related to one's world of work and life generate interest in adult learners. As a result, learning situations that are based on these problems and tasks contribute to effective learning. People are known to learn best when learning is based on their lived experience.

Learning by doing: Adults learn better by using their psychomotor skills and by doing rather than by rote learning. As a result, adults need to feel challenged by giving them opportunities for learning by doing.

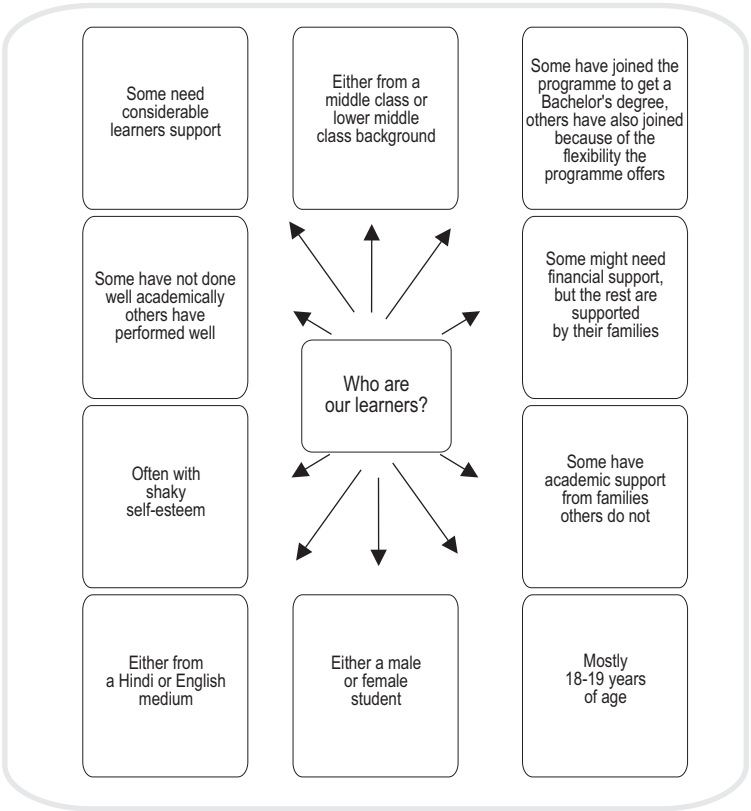
Preference for democratic style of learning: Adults prefer a democratic, participatory style rather than an authoritarian style of learning. Rather than the popular perception that views students as 'empty vessels' whose minds have to be filled with knowledge, a dialogical, interactive, cooperative style of learning finds favour with adults.

Experiencing a sense of progression, a sense of achievement: Adults learn best when they feel they are making progress. Adults have varying learning needs. But in order to meet those needs, it is important for them to experience a sense of achievement, a feeling that their creative urge is challenged.

Picturing our learners

It would be useful to have a mental picture of our learners and start identifying their attributes and characteristics. Thus, the following profile has been drawn of students who are enrolled as first year students of a Bachelor's degree programme in a dual mode university in north India.

Fig 1: Picturing our learners



Implications of understanding learners' characteristics

The information on the learners would be helpful in developing materials that are learner-sensitive and learner-friendly and in setting up a Learner Support System that is relevant to the needs of the learners. Specifically, it would enable us to:

- understand the language level that would be easily understood by the learners in comprehending concepts, new information, theory, etc.;
- understand the entry level of the learners with regard to knowledge and skills so as to build on what the learners already know or possess;
- include examples that are based on learners' experiences;
- include references and further readings that the learners are able to access within their learning environment;
- present information in a manner that would minimise their learning difficulties;
- develop materials that would ensure interaction between the learner and the text;
- evolve a Learner Support System that is sensitive to the learners' needs;
- develop a system that ensures regular feedback on the quality of materials that are issued as well as students' perceptions on the efficacy of the Learner Support System.

By applying the principles and steps outlined above, it is possible to effect dramatic improvements in quality and learner centredness of self-learning materials prepared by many an open and distance learning system, whether single or dual mode.

In the next section we will discuss the concept of instructional design for multimedia.

Instructional Design for Multimedia

5

As a teacher or a trainer, you must have taught, conducted or attended a number of classes or training sessions. You would have noticed that some classes were well planned and some others were not so. This happens not only in face-to-face instructional situations but also in educational audio, video or computer programmes. It may also happen in the instructional print materials like self-learning material, textbooks, handouts etc. The effectiveness of any instructional programme or instructional material depends upon an appropriate planning or designing, what is called in professional parlance, "Instructional Design".

Instructional Design is relatively a young discipline. If we unravel the meaning of the term, it is made up of two words, *Instruction* and *Design*. In its literal meaning, **Instruction** means a set of events that facilitate learning. The word **Design** is a generic term, which means "a creative pattern". These days we read about Designer watches, Designer clothes, etc. This means that the watch or the dress is specially designed, hence unique. To make an item unique through the process of designing, we use knowledge, observation and creativity. The purpose of designing instruction is to plan and create situations that enhance learning opportunities of the individuals. This means that the instruction has to be planned if it is to be effective and designed in some systematic way. This section for example, has been designed to facilitate your learning about the meaning, theories, models and application of instructional design for multimedia.

Objectives

At the end of the section, you will be able to

- Define Instructional Design
- Explain the basis of Learning Theories in Instructional Design
- Describe a few models of Instructional Design
- State Instructional Design for Multimedia.

Instructional Design - Concepts

There are several words and phraseologies associated with the word 'Instruction'. Most common ones are **Instructional Science**, **Instructional Technology** and **Instructional Design**. According to Mukopadhyay (2001) 'Instructional Science provides the theoretical construct to the process of instruction'. 'Instructional Technology is the applied aspect of Instructional Science based on Instructional Design'.

The meaning of Instructional Design is indicated by the word 'Design' itself. Design has been claimed as a science by itself. (van Patten, 1989). In layman's language, 'Instructional Design means the plan of action with a purpose'. For our understanding in this section we will describe instructional design as a separate entity, which is separate from Instructional Science and Technology. Instructional Design is a discipline of study and has evolved over the last forty years as a science. It is a young profession deriving its inspiration and contents from areas of communication, psychology, media etc. to form its own theory. Various authors have

defined instructional design in their own way. Some of the definitions are given in the box below:

> Instructional Design simply means using a systematic process to understand a human performance problem, figuring out what to do about it and then doing something about it (McArdle, 1991).
>
> Instructional Design is the science of creating detailed specifications for the development, evaluation and maintenance of situations which facilitate the learning (Richey, 1986).
>
> Instructional Design is the entire process of analysis of learning needs and goals and the development of a delivery system to meet the needs (Briggs, 1977).

In simple words, instructional design is a pedagogic or teaching device that makes instruction as well as the instructional material more engaging, effective and efficient. The statement "whereas physicians engineer health, architects engineer space, instructional designers engineer human performance" (van Patten, 1989) focuses on the importance of instructional design.

Learning Theories and Instructional Design

Learning theories have significant bearing on instructional design, as there is a logical development from learning to instruction. Instructional design optimizes learning outcomes while learning theories are the backbone of any instructional design. Instructional design is the articulation or the manifestation of the learning theories, and its main aim is to optimize learning by using the known theories of learning.

Strain (1994) states that a wide divergence of views exists among the researchers in instructional design regarding the relative contribution of various schools of psychology and claims that instructional design has grown out of the systems approach with its roots firmly in behaviorists psychology that has dominated instructional design since the 1960s. However, Hannafin and Reiber (1989) point out that instructional design developed in the 1980s by Gagne, Merrill, Reigeluth and Scandura is largely due to the influence of cognitive theories of learning. Of course the emphasis has been on how information is retrieved, selected, processed and perceived. More recent developments are due to Constructivist learning theories. Instructional designers no longer depend on any one theory. They draw upon and incorporate from different learning theories, mix those with other information and apply the results to meet human needs (van Patten, 1989).

Let us examine the three basic schools of theories of learning, namely, Behaviorism,

Cognitivism and Constructivism. These three schools of learning theories have implications for instructional design. A brief introduction to the three learning theories is given in the table-1.

In short, behaviorists believe that learning results in changing the learning behaviour whereas cognitivists believe that learning occurs when learners add new concepts and ideas to their cognitive structure. Constructivists believe that the learners construct knowledge for themselves -- each learner individually. All the three learning theories have implications for instructional design.

Table -1: Descriptions of various learning theories

Theory	Psychologists	Descriptions
Behaviourism	✔ John B. Watson ✔ Ivan Pavlov ✔ E. L. Thorndike ✔ B. F. Skinner	• Behavioural researches have been conducted on animals but are related to human behaviour. • Based on observable changes in behaviour which can be measured. • Learning results from the classical conditioning of simple reflexes. • Learning is the formation of a connection between stimulus and response.
Cognitivism	✔ Jean Piaget ✔ Lev Vygotsky ✔ Bruer Jerome ✔ David Ausubel	• Cognitive Psychologists studied human behaviour. • Theory is based on the thought process behind the behaviour. • Learning involves associations established through contiguity and repetition. • Stressed on the role of reinforcement which provides feed back about the correctness of responses. • Learning involves subsuming new material to existing cognitive structure.
Constructivism	✔ George Herbert Mead ✔ D. H. Jonassen ✔ D.N. Perkins	• Learners construct their own perspective of the world, through individual experiences and schema. • Learners construct their own knowledge. Learners are encouraged to search for other related relevant information. • Prepare the learner to problem solving ambiguous situations.

Learning Theories and their Implications for Instructional Design

Behaviourists emphasize changes in behaviour as the outcome of learning. Behaviourist principle of reinforcement, retention and transfer of learning are important design considerations, as learning is facilitated by reinforcing the correct performances. Statements of behavioural objectives allow the learners to know specifically when they have achieved their objectives. In this way, learners can monitor their own progress. The knowledge of objectives serves as a reinforcing agent. The frequency of reinforcement is also a design issue. Presenting the content of the instruction in smaller steps, followed by testing and reinforcing performance immediately, does this. Retention of the information for the learners is also important for the instructional designer. Materials that provide more reinforcing activities help in the retention of what has been learnt.

Cognitive psychologists like Piaget, Bruner and Ausubel contend that learning is an internal process that cannot be observed directly. Learners first remember and then retrieve information from the memory. Cognitivists emphasize on how the human mind works. They put particular emphasis on memory. The implication of this theory for the instructional designers is that they could use various techniques like chunking, mnemonics and meaningful organization of content and give practice for storing and retrieving information. Practice implies provision of increased opportunities to the learners for reward and reinforcement. Cognitive structures are created through practice, which leads to an efficient use of long-term memory. For example, instructional designers include pictures used in video programmes or practice exercises in the self-learning material that offer opportunities for practice. Practice is important in learning cognitive tasks as well as motor skills.

Constructivists promote an open ended learning experience where methods and results of learning are not easily measured and are different for each learner. The implication of constructivism for the instructional designer is that the learners should attach themselves to the content domains. Constructivists believe that learning occurs when it is situated, contextual, problem based, social and authentic.

Learning theories influence Instructional Design in a significant way. Learning theory becomes an essential element in the preparation of instructional design professionals because they permeate all dimensions of instructional design (Schiffman, 1991). There is no one single theory which designers keep in mind while designing the instructional strategies and content. Ertmer and Newby (1993) feel that the

- behavioural approach can effectively facilitate mastery of the content,
- cognitive strategies are useful in teaching problem solving tactics, and
- constructivist strategies are suited for dealing with ill defined problems.

Instructional Design: Theory and Models

Let us examine a few instructional design theories and models. Before we do so, let us see the difference between a theory and a model.

A *theory* provides a general explanation for observations and explains the behaviour whereas a *model* is a mental picture that helps us to understand something that we cannot see or experience directly (Dorin, Demmin and Gabel, 1990).

There are various instructional design theories and models developed by various authors. Let us explore what is an instructional design theory. Reigeluth (1999) defines an instructional design theory as the one "that offers explicit guidance on how to better help people learn and develop". The kinds of learning may include cognitive, emotional, social, physical and spiritual learning.

Reigeluth (1999) states four major characteristics that all instruction design theories have in common. These are:

- Design orientation,
- Identification of *methods* of instruction and situations,
- Methods of instruction that can be broken into more *detailed component methods,* and
- Choice of *Probabilistic* Methods.

The design theories have become important as they help the stakeholders to develop a vision of the instruction early in the design process (Diamond, 1980). This vision is in terms of ends (how learners will be different as a result of it) and the means (how those changes in the learners will be fostered). Banathy (1991) states that instructional design theories should allow for much greater use of the notion of "user-designer". This means that the users play a major role in designing their own instruction.

These theories are also important as they provide guidance at three levels (Reigeluth, 1999). These are:

- methods that best facilitate learning under different situations,
- learning tool features that best allow an array of alternative methods to be made available to learners,

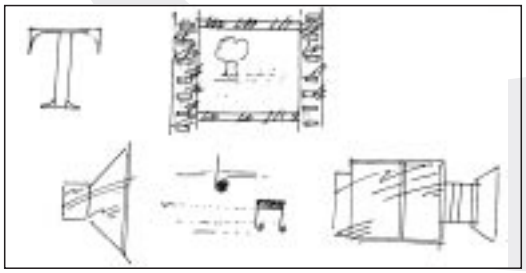
available to learners,

- system features that best allow an instructional design team to design quality-learning tools.

In table-2 different models of instructional design are summarized with their features.

All these models are suitable for the design of instruction of course units (in print, multimedia and online) and have the following components in common:

- Identify and analyze the instructional objectives,
- Plan and design solutions to the instructional objectives,
- Implement the solutions, and
- Evaluate and revise objectives, strategies, etc.



Multimedia

Media is a Latin word and is used to describe ways to convey messages and information. When we talk about media we think of newspapers, magazines, radio, TV, audio- video programmes, computers, etc. Many prefixes are used with the word Media like ***Multimedia***, ***Electronic media***, ***Interactive media***, etc. The most common buzzword used in education is Multimedia, which is the integration of text, audio, video, graphics and animation into a single medium. Instructional multimedia is the integration of various forms of media in the instructional process. It is the technology that combines print, radio, television, animation, photographs, and other forms of illustration. Integration of different media multiplies the impact of a message. The focus is on instruction and learning. According to the research reports by Mayer and McCarthy (1995) and Walton (1993) 'multimedia has gained acceptance with many benefits derived from its use. Learning gains are 56% greater, consistency of learning is 50-60% better and content retention is 25-50% higher'. Instructional multimedia focuses on what the learner is expected to do upon the complexion of the instruction.

On the one hand, research on multimedia has established learning gains of significant order over the conventional instructional strategies, and on the other, has shown how instructional design is a tested, well-researched mechanism of enhancing human learning. By logical extrapolation, we can say that instructional multimedia can be more effective, if it is backed up by scientific instructional design.

Table- 2: Models of instructional design

Models of Instructional Design	Description
Gagne-Briggs Model	To design instruction • Categorize learning outcomes • Organize instructional events for each kind of learning outcome • There are nine instructional events • Events are tailored to the kind of outcome to be achieved • Model is adapted to Web Based Instruction
David Merrill	The model by David Merrill (Component Display Theory) is based on the following assumptions • Different classes of learning outcomes require different procedures for teaching and assessment • Teaches individual concepts • Classifies objectives on two dimensions • Formats instruction to provide student directed teaching
Dick and Carey	This model • Uses a systems approach for designing instruction • Identifies instructional goals in the beginning and ends up with summative evaluation • Is applicable for K-12 to business to government
Hannafin and Peck	The Model has three phases • Need assessment is performed in the first phase • Second is the design phase • Instruction is developed and implemented in the last phase All the phases involve a process of evaluation and revision
Gerlach and Ely	The Model • Includes strategies for selecting and including media within instruction • Is suited to higher education

Source: http://lts.ncsu.edu/guides/instructional_design/selecting_models2.html

Instructional Design for Media

Media has become an integral part of education. There are two major forms of media-radio and television (mass media) and audio and video (modular media). The radio and television as media depends upon the audio and video programmes. Hence, from the software angle, we can examine the modular media, though their implications for instructional design will be widely different when we integrate inflexible mass media like radio and television or flexible audio and video programmes in designing our multimedia instructional system. To avoid complexity and also to allow space for creativity of the teacher in designing instruction through multimedia, we will focus on instructional design of modular media, namely the audio and video programmes. There are, however, several formats and status within the overall scheme of instruction. Let us examine some of the possibilities (Table-3).

Thus as shown in table-3, there are at least 12 alternative possibilities. Instructional design is spread among the 12 possibilities in the matrix. The Integrated and Reinforcing programs are part of the multi-channel learning system (MCLS) context.

Conventionally, instructional design components are: objectives, content (content analysis and level validation), transactional methods (lecture, video, audio, etc. or in combination) and evaluation (interim and end of learning). In self-learning print materials all these are explicit. In audio/video that is not usually true, though both objectives and evaluation can be built into the programme, in the script and at the production stage.

The audio/video programmes are close to linear Programmed Learning Material (PLM). An examination of raw scripts would indicate that these are developed frame by frame, except for the end-of-frame questions and answers, as is common with PLM. In the conventional audio/video format, there is no way of skipping frames except through fast-forward. In videodisc or CD-ROM, there is random access facility and one can skip frames.

Figure 1 illustrates the instructional design process in audio and video media. The instructional design of media largely depends upon two components, namely, the content, duly analyzed and sequenced and choice of media format. Objectives and assessment can back up the media effectiveness.

The design presented above is for non-interactive audio and video programmes. With suitable modification, it is possible to use the design for creating interactive video and audio.

Table - 3: Media format and status in Instruction

Format → / Status ↓	**Lecture or Illustrated Lecture --Audio** main focus	**Documentary -- visual** main focus audio second fiddle narrative	**Docu-drama --** Combination of documentary & drama formats drama brought into for illustration documentary the main stay	**Drama --** Best combination of audio & video most powerful communication in affective domain
Integrated -- media is part and parcel of the instructional material where print material refers to media back and forth.	01	02	03	04
Stand Alone -- media programmes is self-contained and replaces print material or works as alternative.	05	06	07	08
Complementary or Reinforcing-- neither integrated nor stand-alone, media enriches learning through print mode.	09	10	11	12

Note: *Numbers entered into the cells indicate various alternative possibilities*

Instructional Design for Multimedia

We have discussed so far how multimedia is a single, integrated medium that consists of media like text, audio, video, graphics, animation, etc. The major challenge in designing instruction through multimedia is, therefore, the *choice of media* and their *application* for optimizing human learning with reference to the stated instructional objectives. We must, hence, consider the various components that constitute the instructional design for multimedia learning system such as objectives, content, media options, and evaluation options.

Objectives: the first challenge is to specify the objectives of the multimedia learning. The objectives must be stated in behavioural and measurable terms. They can range from simple to complex, from lower to higher order learning. The objectives may belong to the domains of cognition, psychomotor and affection.

Content: the content of any instructional design is necessarily informed by stated objectives of learning. Depending upon the objectives the content will also range

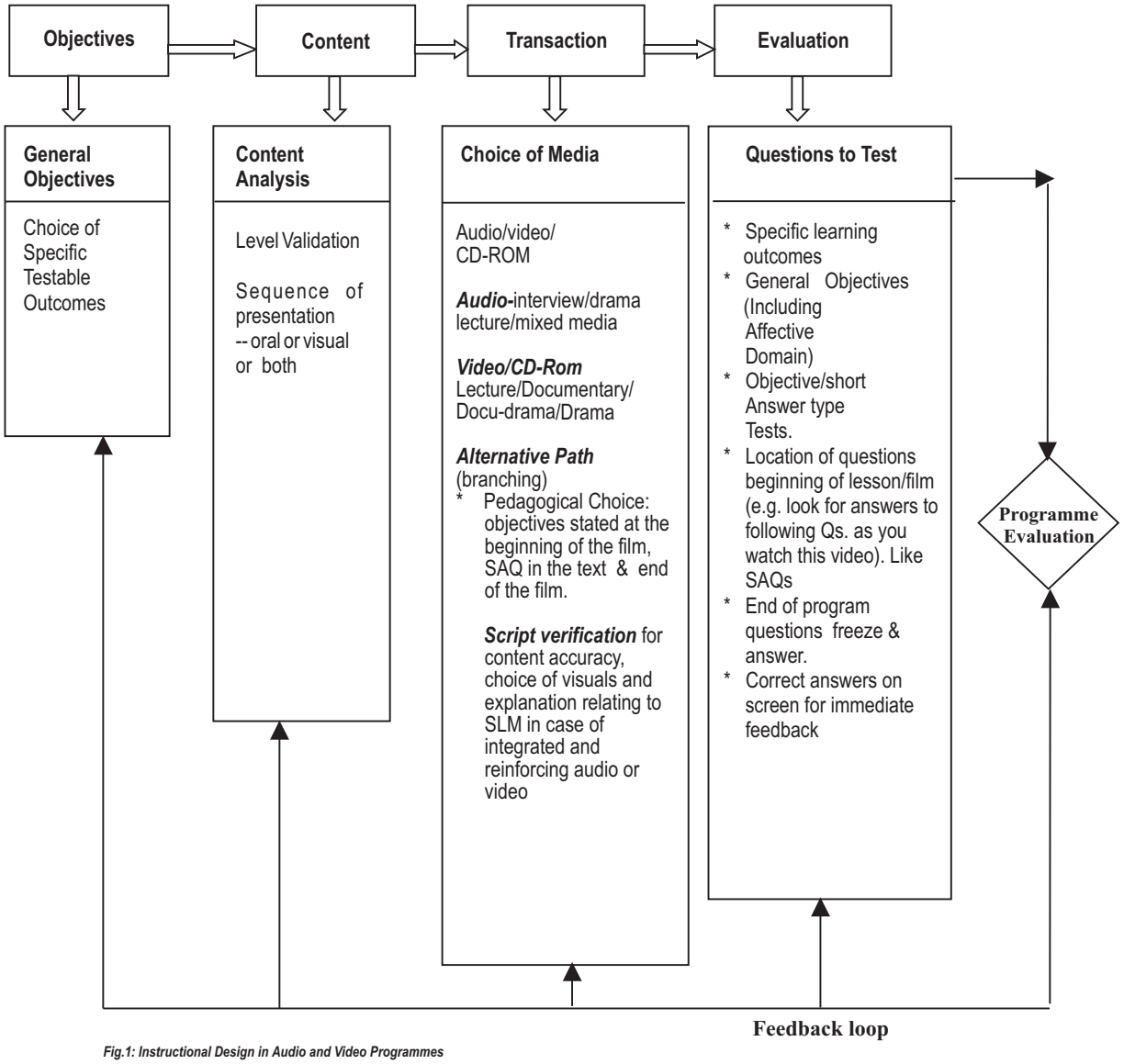


Fig.1: Instructional Design in Audio and Video Programmes

from simple to high level of complexity. The choice of content must also ensure that there is adequate and correct provision for the achievement of objectives.

Media Options: as mentioned above multimedia essentially incorporates several media like text (as in printed text), audio, video, graphics, animation etc. It is important to match the learning objectives and decide the media to synchronize the design and learning from it. Each media can offer either the whole or part of the content with or without referring to one another. For example, dissection of a frog can be shown through animation and also through a video programme. But as multimedia offers interactivity, learners can actually feel the dissection if it is animated and the multimedia programme runs like an actual dissection. Similarly, for language learning through multimedia, audio is very important.

Evaluation Options: evaluation is part of instructional design. Without evaluation, one would rarely, if ever, understand the achievement of objectives, which is the primary goal of instructional design. Evaluation options must include both summative and formative evaluation. However, in both the cases of formative and summative evaluation, we can choose from online, offline, paper and pencil versus performance tests, etc.

In this section, we have dealt initially with fundamental issues of learning theories, and concept, theory and models of instructional design. We then have followed it up with our conceptualization of educational multimedia. In the final section, our challenge was to build up the synthesis of our learning in designing instruction for multimedia.

The challenge is in the synthesis of the three dimensions of media option and content with reference to the learning objectives. Depending upon the purpose and actual application of the multimedia instructional system, this design can be used for designing teacher as well as the learner-guided designs. The learner-guided designs (Banathy, 1991; Mukhopadhyay, 2001) can lead to differentiate instructional design that suits individual learner.

Finally, instructional design for multimedia learning system must be a document indicating the stated goals, choice of content with specifications of levels of difficulties, the choice of instructional methods and media, and strategies of evaluation. The documented design must incorporate instructional design of the micro components of the multimedia learning system as well.

In the next section we will discuss the process of scriptwriting for multimedia.

Scripting for Multimedia

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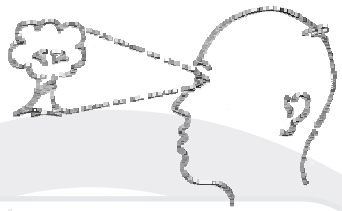
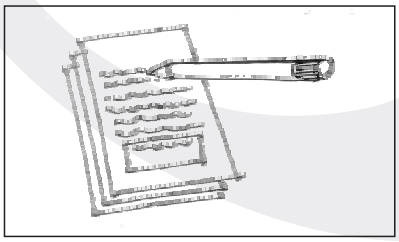


Objectives

At the end of the section, you will be able to

- Identify various components of a script for multimedia;
- Use a systematic approach to scripting for multimedia; and
- Prepare all the multimedia components (and or their description) in cards.



The script -- sometimes also called a storyboard -- is the basic building block of multimedia courseware development. The storyboard is a sequence of simply drawn pictures that visually depict a programme. In preparing interactive multimedia, normally the script is a storyboard. As such, both the terms -- script and storyboard -- are used in interchangeably, though they have their differences. The differences being that a script can also be written without visuals at all, whereas a storyboard is always a visually illustrated script. In this section we will describe a process for developing visual scripts or storyboard for multimedia. The script in practice becomes the blueprint for action. We present to you in this section a simple method for representing hypermedia-based information in 2-dimensional format.

Visual Thinking

Preparation for a multimedia script is a process of visual thinking or visualization. The dictum is -- "Think Visually". In order to think visually, you need to create an overall conceptual design of the programme that you are planning to make. Creation of mind maps of the content area is a good first step. However, the words in the mind map must synchronize graphically. When you have an idea, consider relating it to some graphics and see how the idea can be represented graphically.

The process of visualization is basically section, creation, and editing of images into a meaningful sequence. In reality it takes a lot of practice to "see" the programmes to be developed successfully.

Scriptwriting Process

The script writing process has the following stages:

i) ***Programme idea:*** The programme idea needs to be discussed vis-à-vis the strength of multimedia. You must ask at this stage: why is it necessary to have a multimedia programme for this particular idea?

ii) ***Programme brief :*** At this stage, the programme idea needs to be expanded to include the title, target audience, objectives of the programme, content outline, etc. A rationale for the multimedia programme and project beneficiaries is useful, if included in the programme brief.

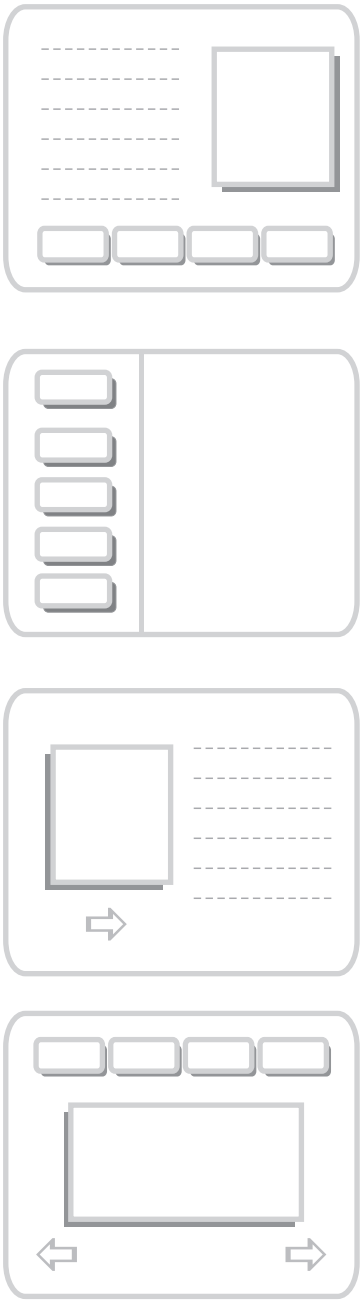


Figure 1: Examples of layout design

iii) ***Research :*** Planning and carrying out a thorough research on the topic of the programme idea and the target audience will be useful in designing the multimedia. Identifying relevant graphics content and experts on the programme will be useful to consult and select appropriate content.

iv) ***Identify and select content elements :*** Having done the research, it is appropriate to develop the best way or a sequence to deliver the message. Though multimedia provides the user with a hypermedia navigation opportunity, it is important to have a 'default' sequence. The content elements can be visualized in terms of text, audio, video, graphics animation, etc.

v) ***Interface design and layout :*** The interface design is one of the most creative stages of scripting for multimedia. Here, the look and feel of the programme needs to be decided. While deciding on this, it is important to keep in mind the target audience's choice and the nature of the topic. Some of the possible layouts that can be prepared on the computer screen are given in fig. 1.

There can be so many ways of designing the interface depending on the creativity of the designer. However, it is essential to decide on one layout design in the beginning and stick to that for uniformity and also for the reason that the learners will not appreciate a different layout for all the different screens of the multimedia programme.

vi) ***Preparing the storyboard:*** The storyboard is a detailed shot-by-shot or screen-by-screen description of the programme on a sheet of paper or card. The storyboard forces the scriptwriter to think in terms of multiple media use in a multimedia programme. It is also a blueprint for action that can be given to a multimedia designer to execute as depicted in the storyboard. It allows working of different groups of people in the same project developing different components of it with similar design and compatibility. We will now present to you a systematic approach to prepare storyboard for multimedia.

Though we recommend the systematic approach suggested in this section, it is important to say here that it is one of the many ways of preparing multimedia storyboard, and therefore, we would not like to be very prescriptive.

Storyboard Development

Before we start developing a storyboard, let us look at the various media components of a multimedia programme. The multimedia being an integrated platform it can deliver text, audio, visuals (video and graphics), animation and also the interactive feature, which is called navigation. So the storyboard should

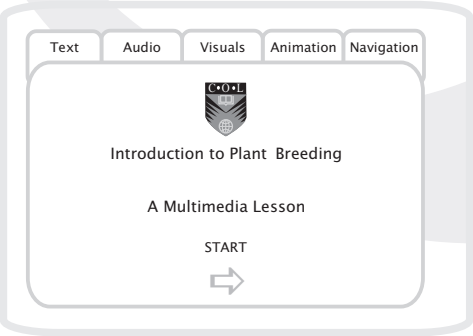
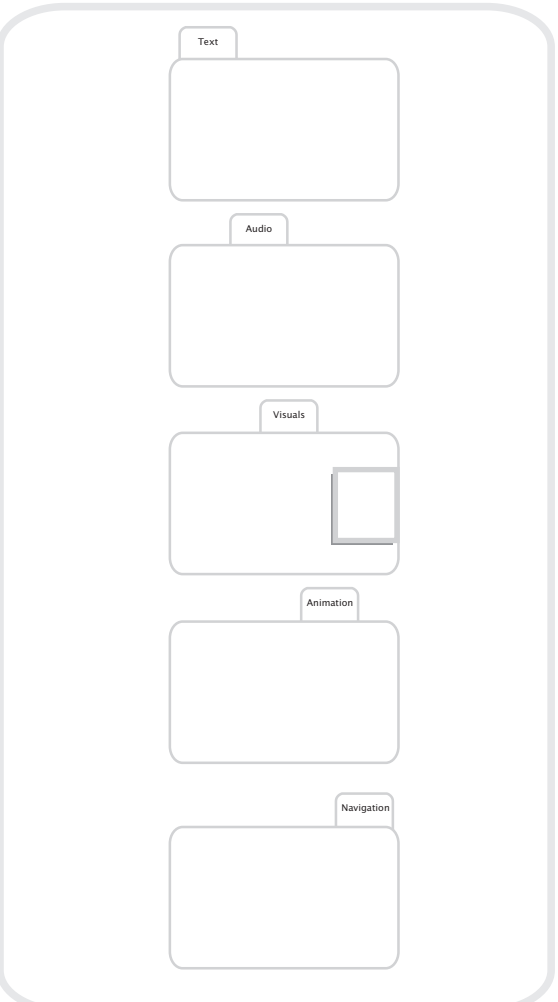


Figure 2: Screen shot of a multimedia prototype

represent all the five components in a 2-dimensional page or card. Since, multimedia is a hypermedia-based system, in figure 2 we represent five different cards placed over one another to depict a single screen/shot of a programme.

In figure 2, we see a screen shot that has some visible texts, graphic visual (which may be animated or static), and a navigation button. This frame might have some audio. But, in the storyboard here, it is not visible. When we separate the stack of cards, we will see how various components are depicted in each card. It is not necessary that all the components are present in every shots/screens. For example, figure 2 do not have a video. Interestingly, if you use a transparency sheet for each of these cards, the storyboard can be represented as one integrated screen shot. The illustration in figure 2 depicts that for each screen shot you need to prepare five cards.



Let us see each of the five cards.

Text: Write down the text that you expect to go in the screen. Suggest any specific design feature, including font size, style and colour that you need. Also suggest the placement of the text in small chunks of less than 200 words. This is important for presentation of the text in readable way. If it is essential to have more text, multiple shots can be used in continuation.

Audio: Audio is of three types -- Narration or Voice Over (VO), Music (M) and Sound Effects (SFX). In this card, you have to specify the types of audio to be used. As you can have two audio channels in one shot, it is important that you specify both audio channels. If required, use two cards for audio. Specify the kinds of music you want and the kind of sound effects required. If you have voice over, prepare the script of the voice and write it on the card.

Visual: A visual can be of two types -- static and motion, the former is called **graphics** and the later **video**. In the visual card you have to specify the kind of visual and its placement on the screen. Also it is very important to give a description of the graphics or video used. Then a description of what it will show, its purpose etc are required in the storyboard.

Animation: There are various kinds of animation activities. For example, you can animate a text or graphics or you can have a spcialised animation programme itself in the multimedia lesson. The nature and purpose of animation needs to be explained in this card with specific movements (fade in, fade out; zoom in, zoom out, etc.) of different elements.

Navigation: The navigation is the mechanism through which a multimedia programme moves from one shot to another. Being hypermedia based, the

navigation actually enables the user of the multimedia to navigate from one shot of the multimedia to any other shot (provided it is designed so). The navigation plan can be designed through hyperlink from a word/ sentence / phrase or from or graphics or button for navigation. Some of the important navigation buttons are start/begin/, end, next, previous /back, home, etc. In the navigation card you have to specify the type of navigation button and its action (what will happen, if it is clicked, e.g. Go to S-3). The placement of the buttons and/or hyperlinks also needs to be specified.

A multimedia programme will have a number of screens/ shots, and therefore organizing the cards is very imported. So we suggest you to name these cards as S-1/T (for text of shot 1), S-1/A (for Audio of shot 1), S-1/V (for visual of shot 1), S-1/ An (for animation of shot 1), S-1/N (for navigation of shot 1) S-2/T (for Text of shot 2) and so on.

The number of shots in a storyboard will depend on the content that you have and how you are presenting the multimedia. For an educational multimedia lesson, we can suggest below few standard shots. However, the multimedia based lesson is also dependent on the instructional design that you follow for the programme. Some of the standard screens/shots are:

- Title (normally referred as the home), which welcomes the learner;
- Introduction, which depicts the context and sets the tone of the programme;
- Objectives
- Contents/ Structure / Index
- Glossary
- References
- Self- Assessment Questions

Apart from all these, the content of the lesson will also have a number of shots. Depending upon the requirements, the above shots can be depicted on more than one shot.

Scripting for multimedia and preparation of storyboard is a highly systematic process and requires a certain amount of discipline to organize the cards. Analyses and breaking of the contents into smaller, manageable chunks or objects will fasten development of the storyboard as well as the multimedia. A clear storyboard is the key to a successful and effective multimedia lesson. The storyboard should be reviewed by experts and surrogate users of the multimedia, especially for the navigation part to see the smooth flow of the multimedia programme.

In the next section we will discuss about various components of multimedia.

Development of Multimedia

7

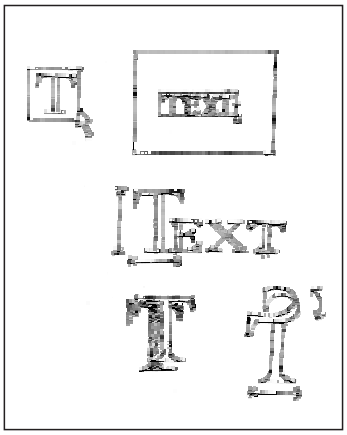
Multimedia technology is becoming increasingly popular in the field of education. Interactive multimedia courseware in particular, developed on a CD is adding a new and interesting dimension to both teaching and learning. This new approach can effectively complement the conventional methods of learning and teaching. The multi-sensory input of this media provides possibilities for higher performance ratings and higher retention. With effective feedback, this method makes learning and teaching more meaningful. Students with different learning abilities can work at their own place, time and pace; and with interactivity and self-assessment it can make learning a highly personalized, independent and a rewarding experience. The learner can also set her/his own "view" of the information available to him/her. A significant aspect of multimedia in education is related to authoring or developing multimedia. Multimedia authoring as a form of computing has made it possible for students and teachers to construct knowledge and discover worlds which do not exist in conventional methods of learning or teaching. Above all, this new experience has defined a new concept of edutainment -- a combination of education and entertainment.

In this section, we will discuss some aspects of the 'how' of developing the multimedia, especially the components of multimedia, and the good practices in preparing text, graphics, audio, video, graphics, etc. for including in a multimedia programme.

Objectives

At the end of the section, you will be able to

- Design text and graphics according to the principles of text and graphics design;
- Prepare audio and video components using appropriate software and standards for use in multimedia;
- Discuss interactivity in multimedia courseware development; and
- Explain the importance of prototype preparation in multimedia development



Text in Multimedia

Text is the most common medium of presenting information. It is also used to communicate a concept or an idea. It should effectively complement the other media. Factors that influence the textual communication are typeface, font and style, kerning, antialiasing, animation, special effects, special characters and hypertext .While dealing with text in multimedia it is very important to note that it is not the only means of communication. In multimedia, text is most often used for titles, headlines, menus, navigation and content. Overcrowding of text on a single page should be avoided.

It is recommended that text should be presented in combination with graphics.

Typeface: Typefaces are broadly categorized into two types - 'serif' and "sans-serif". Serif is the small decoration at the end of the letter stroke while sans serif is the letter without a decoration. Serif fonts are commonly used in the body of the text,

while sans-serif fonts are used for headlines and bold statements.

Fonts: A font is a collection of characters of single size belonging to particular typeface family. Style and size are the main attributes of a font. Common font styles are bold and italic. Font sizes are expressed in points. A point is approximately 1/72 of an inch.

In the usage of fonts, it is recommended to vary as few number fonts as possible on the same page. The style, size and kerning may be adjusted as and when necessary. Anti-aliased text may be used for titles and headlines. Bold text may be more suitable to convey an idea or a concept. Text can be made attractive and pleasing to the eye by choosing the combination of colors for the font and background. Care should be taken for selecting the appropriate type of fonts on menus and buttons, symbols and special characters.

Serif
Sans-Serif

Arial
Times New Roman
Book Antiqua
Comic Sans MS
Bookman Old Style
Courier New
Verdana

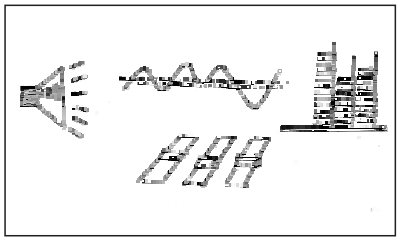

72 point size

Text Animation: Presentation of text can be more fun and interesting through animation. A wide variety of methods are available to animate the text. Some of the methods are: scrolling (vertical and horizontal), zoom-in and zoom-out, fade-in and fade-out, dissolve etc. 3D text also has an impressive look. Care should be taken to introduce animation only at selected places where the presentation is most impressive. Authoring Programmes like Macromedia's Director have built in tools to animate text.

Kerning: It refers to adjustment of the space between two characters. Kerning makes certain combinations of letters, such as WA, MW, TA, and VA, look better. Only the most sophisticated word processors and desktop publishing systems perform kerning. Normally, you can activate or deactivate kerning for particular fonts.

Anti-aliasing: Aliasing is the well-known effect on computer screens, in fact, on all pixel devices where distortions occur at the edges of letters, in the case of text presentation. Anti-aliasing is the technique of making the edges smooth. Anti-aliased text is often called "grey-scale" text. Certain adaptations of anti-aliasing have enhanced both the legibility and aesthetics of on-screen type.

Hypertext: The function of hypertext is to build links and generate an index of words. The index helps to find and group words as per user's search criteria. Hypertext systems are very useful in multimedia interactive education courseware. Hypertext systems provide both unidirectional and bi-directional navigation. Navigations can be through buttons or through simple, plain text. The simple and easy navigation is through linear hypertext where information is organized in linear fashion. Non-linear hypertext, however, is the ultimate goal of effective navigation.



Audio in Multimedia

Audio is another vital media in a multimedia presentation. Audio is available in different file formats and the appropriate file format is chosen to maximize its performance. Sound editors play an important role for converting file formats and also for enhancing the quality of sound. In most cases sound files are imported and edited for a multimedia application.

Digital Audio: The Sound recorded on an audio tape through a microphone or from other sources is in an analog (continuous) form. The analog format must be converted to a digital format for storage in a computer. This process is called 'Digitizing'. The method used for digitizing sound is called sampling.

Sampling Rate: Sampling rate is defined as the number of times the analog sound is sampled during each period and converted into digital information. Sampling rates are measured in Hertz (HZ or Kilo HZ). The most common sampling rates used in multimedia applications are 44.1KHZ, 22.05JHZ and 11.025KHZ. Higher rates of 192KHZ will probably be the professional DVD standards in future. Higher the sampling rate, higher is the quality of sound. A higher sampling rate however occupies more disk space. One can convert from a higher sampling rate to a lower rate (Down Sampling) when required.

Sound Bit Depth: Sampling rate and sound bit depth are the audio equivalent of resolution and color depth of a graphic image. Bit depth depends on the amount of space in bytes used for storing a given piece of audio information. Higher the number of bytes higher is the quality of sound. Multimedia sound comes in 8-bit, 16-bit, 32-bit and 64-bit formats. An 8-bit has 28 or 256 possible values; a 16-bit has 216 or 65,536 possible values. A single bit rate and single sampling rate are recommended throughout the work. An audio file size can be calculated with the simple formula:

File Size in Disk = (length in seconds) x (sample rate) x (bit depth /8 bits per byte).

Mono or Stereo: Opting for mono may be a good choice as the file size is doubled for stereo. However stereo may be used only at those places where the requirement is a must.

Digital Recording: Digital sound can be recorded through microphone, keyboard or synthesizer or DAT (Digital Audio Tape) .Recording through a microphone connected to a sound card directly is not recommended as it is difficult to control the recording consistency and also to avoid amplification of noise. A better practice would be to record on a tape recorder after making all the changes required and then record it through sound card.

Sound Editors: Sound editors are very useful in creating sound, transforming file formats, and enhancing the quality of sound by cutting the noise. There are 3 sound editors used very frequently for multimedia applications. *Sound Forge*, *Cool Edit* and *Sound Edit 16*. Sound Forge for PC is regarded as probably the best software for audio recording and editing. Cool Edit, a low cost software, is easy to use giving a fairly good quality of sound. Sound Edit 16 allows you to record, edit and transform digital audio easily and quickly. It can be used to produce a variety of digital speech, sound effects and music clips.

Sound File Formats: The most common sound file formats are:

WAV	Window wave format
AIFF	Audio Interchange File Format -(wave form for use on MAC)
AU	Wave format developed by SUN Microsystems
MP3	Compressed file format using MPEG1 Layer3 compression
QT	Digital audio quick time movies that contain only audio can be used in multimedia applications.
SWA	Shock Wave audio files compressed up to a ratio 176:1

The choice of the right format to use depends upon the file size, the nature of application and the operating system.

Video in Multimedia

Video in multimedia is an extremely useful communication tool for presentations. It illustrates ideas and concepts besides capturing real world events. Video files occupy enormous space and so there are two choices to recommend:

1) Use very short video clips (not exceeding a minute or two)

2) Use highly compressed video files like MPEG. AVI files that can be transformed to MPEG files.

Digital Video: Digital video provides a superior means of communicating images and sounds of real world. Digital video has many more controls than digital audio, although both of them deal with time-based medium in the midst of a frame based medium.

Frame Rate: It is the number of frames per second that are displayed on the screen. A rate of 15 frames per second (fps) is recommended for most computers, although it cannot match the high quality of 30 fps.

Video Formats: The most commonly used video formats are:

AVI	File format developed by Microsoft for windows. It is also known as video for windows (VFW).
MOV, MOOV, QT	Files belong to Apple Quick Time Movie. Flattened quick time video clips can be viewed on Unix workstations and on IBM compatible PC with media players.
MPEG,MPG	MPEG files use the MPEG-1 video compression routine. MPEG video clips can be viewed with IBM compatible PC and on Unix workstations.

Colour Depth for Digital Video: Digital video set at 24-bit are recommended for windows for an 8-bit or 16-bit images video performances through video editing.

Video Compression: As digital video files occupy a large bandwidth and extremely large space as compared to audio and graphics file formats, reducing the file size is of utmost importance. A number of CODEC methods are available to meet this requirement. The MPEG format for example uses inter-frame compression to get compression up to 200:1. This large compression is achieved at the expense of the quality of video. The inter-frame compression involves cutting out the visual information that is not noticeable to the human eye.

Video Editors: The popular softwares for video editing are Adobe Premiere 6.0, Pinnacle systems, Studio DV, Apple's Movie 2.0.1 and CoolEdit. For editing the analog video is first digitized through a video capture and then the appropriate software is used for editing. If a DV camcorder is used for video shooting then the video can be transferred to PC directly for editing. It is very important to note that video takes enormous disk space as much as 200MB per minute. So preview of the video and editing are done separately to suit one's requirement. The safest rule is to keep the video file size to absolute minimum.

The PC must be adequately equipped with a minimum of 20GB hard disk and a minimum of 128 MB RAM and with a good AGP card with 32 MB VRAM.

iMovie

Apples iMovie for MAC is regarded as the most powerful and also extremely easy to use making it the right choice for both amateurs and professionals. The output of iMovie is a fast creation of quick time video. The software also includes a number of special effects.

Studio DV

PC counterpart of iMovie is studio DV of Pinnacle systems. This edition is also good for beginners and the package includes a video capture card. It auto detects and capture individual scenes within a video tape. The final movie can be exported to Quick time.

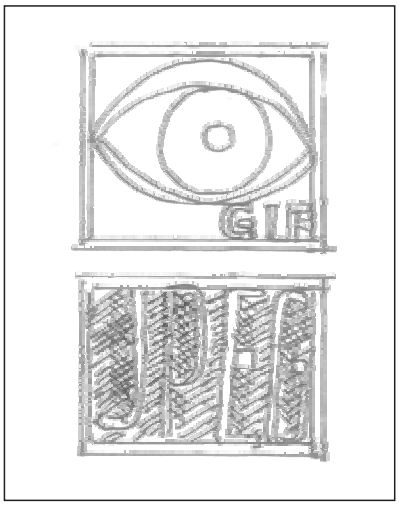
Adobe Premiere

Premiere is often referred to as a best video editing option for PC. It has a highly customizable interface with a precise timeline editor and with great special effects tools. The package includes a Total Training CDROM. The output movie can be exported to a variety of video formats including windows media player

Graphics in Multimedia

Graphics is the most commonly used element of multimedia. The richness of multimedia and the effective communication are through graphic presentations. The attributes of color, texture, pattern and animation enrich a multimedia presentation.

Types of graphics: The two approaches in designing graphics are: a) Rastor graphics; and b) Vector graphics. Rastor graphics, commonly known as bitmap images are based on a grid of pixels; vector graphics are based on mathematical formulas. Bitmap images are associated with 'paint' or 'photo'. Vector graphics occupy lesser memory and are easily 'scalable' i.e there is no loss of resolution when the image size is changed. Vector graphics are associated with 'drawing' or 'illustratation'.

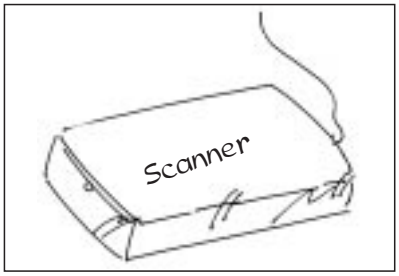


Graphics formats: Some of the commonly used graphic formats are:

GIF GIF stands for Graphics Interchange Format. GIF images are very small in size and so load faster than other formats. GIF make the file size small without losing or blurring any part of the image (lossless compression). GIF also supports transparency i.e they can be pasted on the top of a background image. GIF further supports animation. GIF supports only up to 256 colours.

JPEG JPEG stands for Joint Photographic Experts Group. This format is used to display photographic images. The advantage of using JPEG over GIF is that JPEG can display up to 16 million colors (True-color). Main disadvantage of JPEG is the loss of quality. JPEG does not support transparency or animation.

PNG PNG stands for Portable Network Graphics. It was designed to be an alternative to GIF file format. PNG formats are of two types: PNG-8 format holding 8 bits of color information (Similar to GIF) and PNG-24 format which holds 24 bits of color (similar to JPEG). PNG 24 is loss less. PNG also support transparency, but not animation.



Scanning: The basic purpose of scanning an image is to digitize it i.e convert it from an analog from into a digital form. Images are typically scanned at resolutions between 50 to 1200 Dots per Inch (DPI). Image resolution refers to number of Pixels per Square Inch. This is commonly called “dots per inch” or “dpi”. In general, high resolution results in better image quality. While image resolution can always be reduced after scanning, increasing resolution after scanning will not improve image quality.

Image Editing: Digitized images can be edited by any image editing software like Adobe Photoshop or JASC's Paint Shop programme. The software can be used to enhance the image quality, and do several manipulations like crop, duplicate, fill, rotate and flip the image. Deleting and adding images to another image is also one of the interesting manipulations of the editing software.

Animation in Multimedia

A very popular and a chief element of multimedia is animation. Animation is designed as a simulation of movement created by displaying a series of pictures or frames. Animation strictly is a visual illusion. It builds dynamism, energy and motion to inanimate objects. It also adds the dimension of time to graphics .Computer animation is relevant to multimedia as all the presentations are developed on the computer. The key concepts of computer animation are: key frames and tweening.

Key frames: Major frames of animation are created first. These frames define the key frames in which many changes take place. They are the 'key' points of animation. Key frames are specified to show how the moving objects will behave with time.

Tweening: Tweening is the process of generating intermediate frames between two images to give the appearance that the first image evolves smoothly into the second image. Tweening is a key process in computer animation. A software programme can automatically generate the in between frames.

Software Tools: Software used for animation determines the quality of computer animation produced. Some very popular animation software packages for windows are 3D Studio Max, Adobe Premiere, SoftImage, Animator Studio, Flash, etc. Software packages for Mac include Adobe Premiere, Elastic Reality, Strata Studio pro, etc.

Animation File Formats: The file formats for animation depends on the nature of software used. Based on this, you will have .dir (for Director), .fla (for flash), .max (for 3d studio max), .dcr (for shockwave animation file), etc.

Director

Macromedia Director is a leading multimedia software package, specially suited for animation. Director is regarded by many as the first choice for multimedia course development. It has several built in tools for animation. It also includes a programming language called Lingo which enhances the performance of the presentations.

Flash

Earlier known as animator, Flash is based on vector graphics. It is a very popular package with its main attribute -- scalability. Flash uses multiple instances of the same object moving simultaneously in different points and directories to create impressive effects in the minimum bandwidth. Flash graphics have a pleasing softness and finish. Over all animation requires the combination of several tools blended creatively for maximizing the performance.

Interactivity

Interactivity can be understood as interplay between different elements of an environment. In human context, interaction can be between people to people or between people to objects. Multimedia itself is not inherently Interactive. It can be made interactive through authoring software. In interactive multimedia, it is the user's interaction with the programmme that is explored. According to Crawford (1990) a good program establishes an interaction circuit through which the user and the computer are apparently in a continuous communication. Researches into learning styles show that students learn better through specific modalities such as visual, oral and kinetic. The goal of interactive multimedia is to provide to the student the choice of these modalities in a learning environment. Rhodes and Azbell (1985) have identified three levels of interactivity:

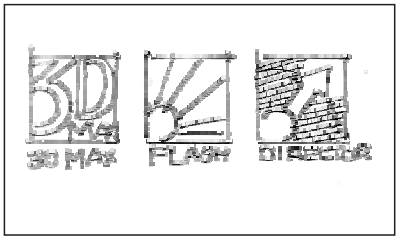
- **Reactive** There is little learner control of content structure
- **Coactive** Providing learner control for sequence, pace and style
- **Proactive** Learner controls both structure and content

Prototyping

A prototype is a miniature version of the final product. It is an incomplete product with either a reduced functionality or with a reduced set of features or both. Prototyping is a well established technique for arriving at a high quality finished product. Prototype is just the subsystem of the whole system. At any given time different subsystems are in different stages of production.

Prototype design: Prototyping forms a part of user-centered design in which the user is involved at all stages of system development process of requirements specification, design, evaluation and revision. Solution is arrived at by successive approximation and iterative design. For multimedia development, some of the components of the multimedia lesson are prepared to integrate them and demonstrate a prototype of what the final product would look like. It is at this stage that suggestions and critical feedback are received to improve the design of the programme in terms of interactivity and instructional design.

The development of multimedia courseware is a complex process of Integration and Interaction. It is an integration of a technology with learning; it is an interaction of the technology with the learner and the teacher. Both integration and interaction require planning, design and implementation. Planning involves the identification of goals, the end users and the available resources. In this section we have discussed the various components of multimedia, and have given some tips on how to prepare them, especially about their types and quality in multimedia programmes.



The multimedia technology is changing rapidly -- increasing in performance and decreasing in price. With better design of prototypes and with new or improved insights into the learning process the role of multimedia in education becomes more relevant and exciting.

In the next section we discuss how multimedia can be delivered to the learners.

Delivery of Multimedia

8

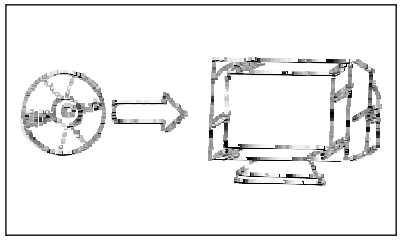
The delivery of the learning content is very important, especially when it is for self-learning. We need to consider the ways through which multimedia can be deployed effectively in a particular teaching-learning environment for effective self-learning. In order to decide the most useful delivery option, we need to take some systematic steps, and also have to understand the unique features of each of the options available to us.

In this section, we will discuss all about the multimedia delivery options available to us, and how we could decide about the options that suit our requirements.

Objectives

At the end of the section, you will be able to

- Identify various options of delivering multimedia to learners; and
- Decide the use of the best possible options available to a specific target group.



Text	650,000 Pages
Audio	Five hours of FM-stereo quality sound or 22 hours of near AM quality mono or 44 hours near AM
Stills Pictures	5,000 very high resolution or 10000 high resolution or 40,000 medium resolution
Motion Video	72 minutes of full screen, full motion resolution at 30 frames per second
Mix and Match Example	20 minutes of full motion video with 5,000 high resolution stills with six hours of audio with 15,000 pages of text

Delivery Options for Multimedia

Multimedia lessons can be delivered in multiple ways, including through stand-alone CD-ROM. With the fast development of Internet and its bandwidth, it is also possible to place multimedia lessons on the World Wide Web as a part of an e-Learning programme. Another option still available and used most effectively is as supplement or complement to the printed lessons. Thus we have two basic approaches to deliver multimedia lessons -- independent approach and Blended-approach. Independent approach has two different modes -- web delivery and CD-delivery. The blended approach has two strategies -- Supplementary and Complementary. Let us see each of these delivery options available to us.

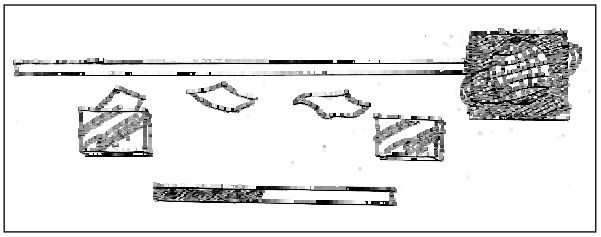
CD-Based delivery of Content

The CD-ROM drive has become a standard component of computers these days, and therefore it is one of the best options available. Moreover, the sizes of multimedia lessons are normally big, and the high-density storage capacity of the CD suits the technical requirements. How much a normal CD can hold is given the box.

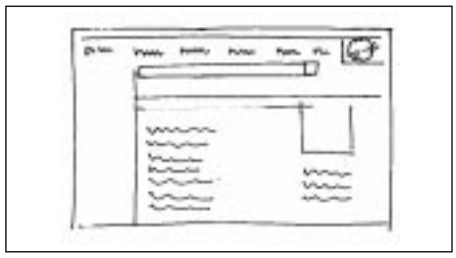
Web-Based Delivery of Content

Since multimedia files are normally very big in size, they are not recommended for web-based delivery because of the poor bandwidth at the user's end. However, with the emergence of Shockwave, the delivery of multimedia on the web has become

easier. Still you can't expect a multimedia to be downloaded as quickly as it runs from a CD. Shockwave is a standard format for displaying media element. It is also an extension or plug-in for the browser. Essentially, it is a compression technique that allows you to play Director, Flash or Authorware files over the net. However, if you plan to deliver multimedia over the net, you need to do the following:



- Minimize the number of cast members
- Use low- resolution images and sound
- Use images that can be compressed
- Do not use loops continuously.



Blended Delivery Strategy

A blended strategy means that you can mix different delivery media in to a package. For example a self-learning programme can be delivered in a package of content in print, multimedia CD and the Web versions. In a supplementary strategy, the multimedia CD or Web version becomes supplement to the print version of learning materials. This strategy is useful, if there is a need to strengthen the learning process by providing multiple points of view. On the other hand, a complementary strategy defines the limits of print medium to some areas of the content and the others for multimedia delivery. In this way both the media approaches become complementary to each other, forming an integrated approach.

Analyzing the Delivery Media

The factors that determine how you want to deliver your multimedia package are related to the reach, and to the inherent characteristics of each medium. The choice of using multimedia for delivery of a lesson is an important decision that needs to be taken very carefully at the beginning. Once it is decided that a particular content area is good for delivery through multimedia, it is important to consider how to reach the target learner. At this stage we need to consider the learner's access to the Internet and computing facilities. In most of the developing countries, where the cost of Internet access is still on the higher side, the CD-based delivery of multimedia would be the better option.

In the next section we will discuss how we can evaluate multimedia lessons, and various approaches to evaluation.

Evaluation of Multimedia

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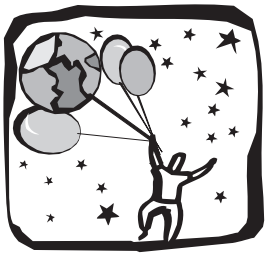


There is a remarkable growth in the interest and use of multimedia programmes besides the growth in skill in developing multimedia programmes. There is an ocean of content on the Internet, developed without really worrying about the quality of it. To design and develop a quality programme, we must spend some time to understand the qualities of a good multimedia programme and a website. As we discuss the evaluation of multimedia programmes below, we shall limit our discussion to the educational software, because the objective of evaluation and the process of evaluation of various multimedia programmes shall vary substantially.

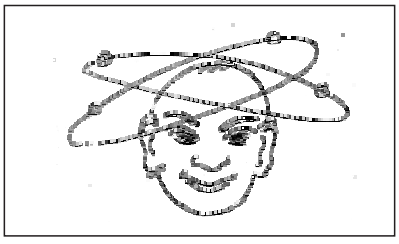
Objectives

At the end of this section, you will be able to

- Describe both formative and summative evaluation of multimedia;
- Use appropriate evaluation methods and techniques;
- Undertake evaluation of prototype lessons; and
- Build a case for continuous evaluation for product improvement.

Evaluation: Test of the Pudding

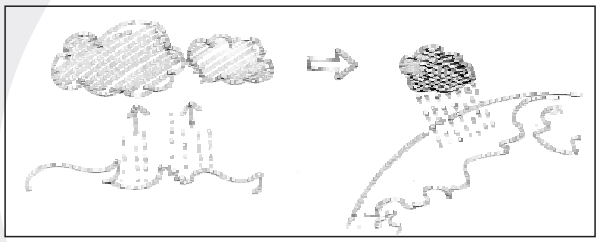
Evaluation is testing whether a multimedia programme fulfills the objectives set, and suggesting improvements it requires to make the programme useful for its target audience. Evaluation is not a uniform process and evaluation cannot be identical for all programmes. Evaluation invariably will have to be made of the objectives that the multimedia software wishes to fulfill. For our purpose, we may say, evaluation will involve testing of the content it transacts vis-à-vis the target learners, keeping in view the prime objective of the expected learning which may take place in the learners after they go through the programme.



At the broadest level, evaluation of a programme should be done at two levels: at the level of *content* and at the level of *technology* employed. Technology plays the role of only the means to attain the identified objectives. Optimal use of technology is desirable and in evaluating multimedia software it needs to be kept in mind that the technology itself should not become too cumbersome for the users, because the competence level of individuals using technology varies a lot.

Computers today can provide unlimited facilities for search, navigation, print etc. but it is dangerous to employ all the facilities without proper understanding and navigating skills because the learners may have to spend more or most of the time learning about these. Ease of use of the technology and its optimal use should be paramount on the developers' mind. Developers should refrain from using all that they know or have ever used and should primarily focus on the feasible and practical aspects from the points of view of the course objectives and the learner competence in using the technology.

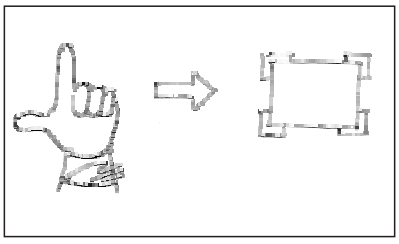
In this section we will explore how we may conduct evaluation of multimedia programmes.



Inherent Nature of Multimedia

As we know, a multimedia programme is a single platform presentation for developers and access for users of various media like the text, picture, sound, video, animation etc. But, just putting all these in one CD would not qualify it to become a multimedia programme. If a software stores information in two media like the text and the picture, it is no different from a printed book, or if a software stores information in picture and sound forms, it is no different from a film. We cannot call programmes with information in just two media a multimedia programme. The facility to store information in various media is innate to technology. It is quite often noticed that software developers cannot resist the temptation to employ every facility that the system provides or of which they are aware.

Media communicates through its own 'symbol system'. Sound may communicate the same message, either through radio broadcast or through a cassette tape or through a CD, but the sound, in conjunction with a picture and text displayed on the screen of a computer, may acquire a different 'symbol system' or meaning. The impact of the sound, in conjunction with any other medium, must be seen in conveying much more than what both the media (i.e. sound and picture) could have done independently. The inherent strength of multimedia lies in the power of integration. Moreover, a television/video programme can also have all the components of multimedia like the text, pictures, graphics, audio, movies etc. What is special to multimedia is its *interactivity*, which is limited or mostly absent in video.



Understanding Learning and Learner

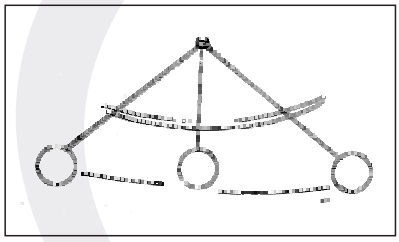
Every learner has his/her own way of learning; pace varies, timing varies and so do various other habits. Computers have provided us the facility to adapt these facilities according to one's own needs and liking. A major quality of multimedia is interaction, which the machine performs with the learners. So, while designing multimedia software it has to be paramount on our minds that the learner should be able to interact with the programme and make it suitable to his/her requirements and liking.

A major tenet of multimedia education is the acceptance of the fact that no single method or medium is appropriate and perfect for all individuals. Every individual has his/her own preferred methods of information reception and processing. The ideal

condition would be to provide numerous options to learners. However, if numerous options cannot be made available, a number of alternative instructional options based on various learning approaches must be given. This is what a multimedia programme offers.

Types of Evaluation: Formative and Summative

There are certain decisions, which need to be taken before starting the process of software development. These decisions guide the process of software development. In fact these decisions become the guiding principles and the software developers have to keep asking the questions, if they are fulfilling the objectives decided upon in the planning process. Once the prototype of the software is ready, it is tested and once again the objectives can be re-examined and reformulated on the basis of feedback and evaluation. Evaluation is basically of two types: formative and summative. We shall discuss them below:



Formative Evaluation

Formative evaluation is done as a continuous process in the development of multimedia and even before the development process actually starts. Decisions taken at the beginning of the process of software development affect various aspects of the software. Answers to questions like who, why, where, and how become the guidelines for the development of the software. Depending upon the time and resources, both quantitative and qualitative methods of feedback are utilized in formative evaluation. No programme can fulfill all requirements of all learners. In fact, if a single programme can provide all the information, and answer all queries on a single topic, it should be considered successful. So, every software developer must decide and delimit the scope of the software beforehand. In other words, we have to spell out the objectives of the programme. Some questions like the following ones need to be answered because these will affect the content and the selection of technology.

(i) Who are the target users of this software and what is the level of the target users?

(ii) What is the level of computer familiarity expected of the learners?

(iii) What would be the objective (in terms of content) to be covered by the programme?

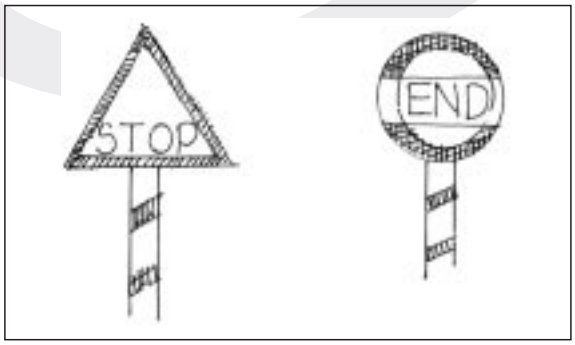
(iv) How will the programme be used?

   a. as supplementary to classroom teaching?

   b. as independent programme providing complete courseware?

Once decisions on the above are made, the cognitive aspects of learning are to be considered. The socio-cultural background of the target users will affect content selection and treatment of the topic. In arranging the content, the learning habits of the users would influence the decision about sequencing of information, quality of information (through various media) provided through every screen, and supplementary information to be provided through links.

It is often mentioned that no programme should aspire to be complete or self sufficient, but it should lead the users to relevant information. The software developer should provide relevant links and the content expert should word the text and place other relevant media material in a manner that they raise more inquisitiveness in the learners and they go for further search and self study.



Summative Evaluation

After the completion of the development of the programme, the software is released for use. The actual users, then, make suggestions and these suggestions form the basis of summative evaluation. Summative evaluation is the end of the project evaluation. Some programmes involve a number of teams to develop various components of larger software, which finally integrate into the end product. While working with Microsoft Office you must have used the numerous facilities it offers. For example if you click on the Accessories it provides Calculator, Games, etc. These must have been developed by different groups separately and then finally joined to make a final product. Summative evaluation, as mentioned earlier, should be conducted for each of the components and also for the final product.

As summative evaluation is targeted at the end-users, in educational software a major focus of study is the software's *pedagogic effectiveness*. The teaching-learning objectives identified during the needs analysis become the base of summative evaluation of academic software. Evaluation should keep the educational, entertainment, ease of use or design features in mind while conducting summative evaluation of these and then overall impact on learning.

Suggestions on the basis of summative evaluation may be for (i) short-term and (ii) long-term changes in the programme. Short-term changes may be based on your own observations and the feedback from the users and the long-term changes may be made on the basis of the decisions of the curricular design and on the basis of suggestions given by the development agencies and the organisations using your software, if it is being used outside your institution.

Issues in Evaluation

Development of educational multimedia can be viewed at two levels: conceptual and presentation levels. Conceptual design involves unifying the scattered knowledge on the selected area/topic, and creating a learning web. Presentation design deals with the realization of conceptual framework into a multimedia programme, which runs on a computer.

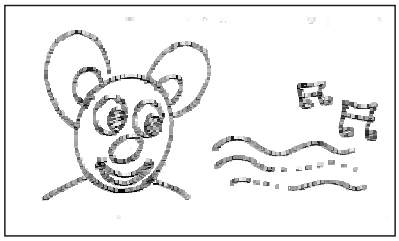
As we have a number of media available for presenting our content, it is often noticed that designers get tempted to use as many of the facilities like screen layout, color schemes and the detailed use of individual media like the moving pictures, audio, text etc. The objective of the whole effort should be to integrate elements of multimedia into a deep learning architecture.

Although the design of interactive multimedia material should be consistent with theories of both learning and teaching (already discussed in Section 4) there is a wide range of opinions on what constitutes 'good' interactive learning material, and consequently there is room for subjective judgment and for creativity and innovation. Rather than taking a prescriptive approach to design content, presentation and interaction, we consider the issues involved. There are four basic issues namely (i) educational effectiveness (ii) entertainment value (iii) user friendliness of technology and (iv) design features, which must be taken care of while designing multimedia software.

Educational Effectiveness

You would agree that the goal of all educational programmes is to have high academic or pedagogic value. Some of the questions that should be asked are:

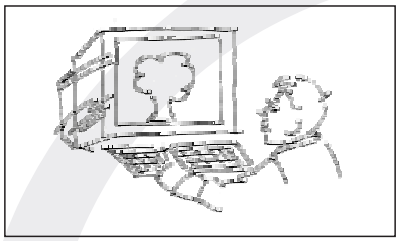
- Will the software meet the educational objectives and offer good presentation of the content areas?
- Is the software sound in terms of teaching principles and visuals to enhance the achievement of the programme's educational objectives?
- Does the software provide higher order thinking skills?
- Is the content presented in simple and neutral of gender, without ethnic and religious biases?
- Does the software offer simple, precise directions accompanied by picture choices and voice responds to the learner's own rate of learning?



Entertainment Value

One of the major objectives of teaching through multimedia programme is to provide edutainment to the learner. And, also the main reason why multimedia is popular is its capacity to enable learning without slogging. As you design your software, you must be careful and see that the programme offers learning opportunities in a 'fun-learn' environment. Ask yourself the following questions to satisfy yourself whether your programme fulfills the criteria:

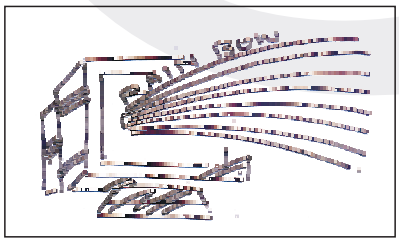
- Does the programme (in sound and graphics) provide learning in an enjoyable environment to the target learners?
- Does the programme provide adequate flexibility to 'surf' i.e. move around and learn at one's own pace and convenience?



User Friendliness of Technology

In teaching-learning activities dependent on technology, the main hurdle faced by the participants is the lack of or limited familiarity with the technology. It should be our endeavor to visualize all the queries that users may have, and provide icon-based information for ease of use. Target users can develop the skills to use the programme within reasonable time and independently use it after the first use. We may ask the following questions to test, if our programme provides the ease of use:

- Is the selected platform commonly available and easy to use?
- Can the learners review the sections they have read/viewed and take a test on these?
- Can learners print/save desired information?
- Can 'last action' be cancelled?



Design Features

Let us be aware and conscious that we use facilities not because they are available but because they are essentially required for communicating the concept. For example, most softwares these days provide the facility to include moving objects and sound. These can be used for conveying information but such technologies are viewed by some as distractions which may be dispensed with. However, we can find concepts and information for which these features may be crucially required.

- Are the pages pleasing to eyes and also contain no items which may offend any user?

- Does the design have icon-based features?
- Can sound and video be played smoothly and adjusted or muted at will?

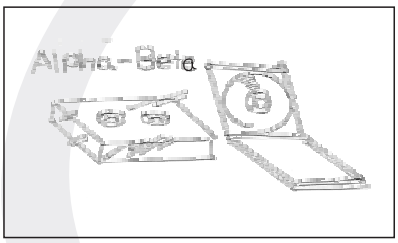
Developmental Testing or Alpha and Beta Testing

Unlike the terms 'formative' and 'summative' evaluation, which are borrowed from the educational research, the terms commonly used by software developers are 'Alpha testing' and 'Beta testing'. These are frequently used terms with standardized procedure and meaning. Also, there is no 'wrong way' of using a software and the testers/users should be left to use it in the manner they find most suitable. During the testing procedure we may try to track the most favorite or natural way of browsing followed by the users. Anything that they may be doing 'incorrectly' would help us identify areas which need redesigning. We shall explain what these terms denote in the process of software development.

Alpha testing

Alpha testing is conducted when the prototype of the software is ready and the software can take inputs and generate outputs. At this stage the software is not fully functional and so the software is normally not sent to the end users but tested inside the organization, in our context, on the peer group. The software is run on a different machine within the organization so that, if there are some bugs, they can be detected and eliminated. The software is tested for aspects like *navigation*, look, and *fee*l of the software. Alpha test informs us about the tools that worked and tools that did not work. We get the perspective of the content experts and the designers (in this case both may be you) and the learners.

Alpha testing becomes particularly relevant when a number of developers are involved in developing various modules and when these are integrated; it becomes important that they work in conjunction. Sometimes, various modules developed by various developers do not integrate. In developing software single handed the objective of alpha testing should be to find if text, voice, picture etc. integrate well and pop-up as and when desired, and do not interfere with learning.

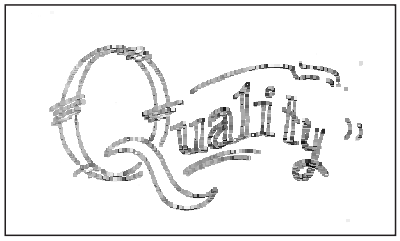


Beta testing

It is very important to eliminate defects as soon as they are detected. However, it is always boring to eliminate defects and developers often enjoy adding new features. The proverb 'a mend in time saves nine' is never more true than in this case. Every

time problem elimination is postponed, the problem is slightly increased because it would not be fresh in mind the next time. Precisely, the functional specifications and the source code are reviewed at the earliest with the objective of eliminating defects before they start to waste cycles.

The software is sent to people outside the organisation or end-user for their review. Outside reviewers will be able to reflect on the requirement of the software at this point and make relevant suggestions. At this stage testing for software reliability, installation and documentation are done as well.



Evaluation as Continuous Process of Quality Improvement

Evaluation of multimedia software cannot be and should not be a terminal or one-time activity. It has to be an on-going and continuous process. As new information get generated and demand for information is made, provision for incorporating new information may be a condition for evaluating a multimedia software. Multimedia software, which is rated highly today, may be rated poorly after only a few months, if it is not continuously updated. This would be particularly true in the case of growing disciplines.

Developments in technology is also an important issue. As a new technology comes up and people start using it, any programme not providing such a facility would not be appreciated. To keep a programme floating and popular new options and facilities need to be incorporated. Sometimes, some of the basic design concepts and the architecture of these older programmes may well appear to have been superceded by recent developments. Users who may be familiar with the features that are being replaced, and so, replacing them may demand users to learn new features and unlearn the old ones. New features do not always result in improved functionality. For the sake of simplicity and elegance of design, older features could be resuscitated.

For the above reasons multimedia software needs to be update at short intervals with the help of content experts and software engineers.

It is said 'practice brings perfection' and this is entirely true of multimedia development. In this section, we have mentioned under different sub-sections the various issues in software evaluation, including formative evaluation, summative evaluation, beta testing, alpha testing and the need for continuous improvement in multimedia development.

A suggestive instrument for evaluation for Multimedia

Questions	Very useful	Useful	Not useful
Did you find the information that you wanted?			
Do you think the time spent in processing the information was worth it?			
How useful is the programme for learners using it in isolation?			
How useful is the programme for group learning?			
How easy was the use of the programme after the first demonstration session?			
Did the programme provide helpful on-line information when required?			
Were navigation tools provided through menus and icons readily available?			
How easy was it to cancel the last move?			
How easy was it to 'fly' or print or save selected items?			

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Evaluation of a Multimedia project

Content Expert Questionnaire

The purpose of this questionnaire is to evaluate the extent to which the multimedia lesson has achieved its objectives. We request you to answer the questions after using the lesson. Your response will be used to improve the lesson. We therefore request you to be as free and frank as possible. All your responses will be kept confidential.

1. For what age/developmental level is the lesson best suited? _____

2. Which is instructional model/strategy provides the basic structure for the software programme? Is it _____
   a. tutorial
   b. drill and practice
   c. simulation
   d. games

3. Does the software support academic expectations? _____

4. Does the product encourage performance-based learning? _____

5. Does the software adapt to various learning abilities? _____

6. Does the product provide accurate and current information? _____

7. Does the application successfully integrate technology and instruction? _____

8. Does the software increase student understanding of the topic? _____

9. Does the software show any bias (social, religious, gender, etc.)? _____

10. Does the software effectively organize these materials? _____

11. Does the lesson present easy to follow on screen instructions? _____

12. Does the application contain FAQs (frequently asked questions) and SAQs (self assessment questions)? _____

13. Is the content presented in an appropriate format? _____

14. Is the text accurate? _____

15. Is the text easy to read? _____

16. Are the graphics clear and relevant to the subject matter? _____

17. Are the sounds easy to hear and understand? _____

18. Is the software adaptable to individual needs? _____

EVALUATION PARAMETERS

Given below are some statements about the lesson you just used on the computer. Please tick (✓) your response to the items. Rate the various aspects of the lesson on a scale of 1 to 4, where 1 equals "strongly disagree" and 4 equals "strongly agree". 1 represents the lowest and most negative impression on the scale and 4 represent the highest and most positive impression.

Your frank feedback will be greatly appreciated.

Statements	1	2	3	4
The subject being taught is already being covered through face-to-face teaching				
The lesson objectives are clear				
The lesson activities help students learn				
The activities in this lesson give enough practice and feedback				
The tests in this lesson were accurate and fair				
The lesson was not difficult at all				
The information contained in this lesson is accurate				
The theories, principles and procedures are explained well				
Doubts are cleared up easily through the online help				
The content is broken down into units that are small enough to be readily learned				
Long, complex sentences are avoided				
The text is organized into short, easy to read paragraphs				
The audio narration was clear and easily heard				
The video helps the student to learn				
The video was clear				
The various media used complement each other				
Graphics, fonts, and other visual elements are legible, functional and attractive				
After going through the lesson, the student should have learned more than before				
This lesson cannot be learned without the use of the computer				
The student could learn in any way he/she wanted (Interaction)				
The lesson is easy to use				
To learn this way, the student does not need a teacher's help				
The student can learn on his/her own now				
There was novelty in this way of learning				
Problems shown are those from the real world				
I like the use of humour in the lesson				
The examples and illustrations helped the student learn better				
The lesson helps to solve and apply to problems relating to the lesson				
Some technical knowledge is needed to operate the multimedia lesson				
The lessons includes tests, which help the student learn				
If possible, I would recommend that this lesson be used in my classroom to teach the subject				
ANY OTHER COMMENTS :				

Learner Questionnaire

The purpose of this questionnaire is to evaluate the extent to which the multimedia lesson has achieved its objectives. We request you to answer the questions after using the lesson. Your responses will be used to improve the lesson. We therefore request you to be as free and frank as possible. All your responses will be kept confidential.

Your Name: _____

Your Age: Below 15 ☐ 15-20 ☐ 21-25 ☐ 26-30 ☐ Above 30 ☐ Gender: Male ☐ Female ☐

Your Mother tongue: _____ Your Medium of Instruction/learning: _____

Your Level of English Competence : _____ Class of Study: _____

Subjects of study: _____ Name of your school/college: _____

MEDIA EXPOSURE AND USE

Which statement of the following best describes your use of computers (tick (✓) relevant ones).

Access to computers

I have no access to a computer, whether at home or at a kiosk ☐
I use the computer at a kiosk/cyber café ☐
I have a computer at home ☐
I have access to the Internet at a cyber café ☐
I have access to the Internet at home ☐

Familiarity with computers

I have never seen a computer ☐
I have never used a computer ☐
I have used a computer but only to type a page ☐
I use the computer to play games ☐
I am familiar with computers and packages ☐
I am familiar with Windows ☐
I know what the Internet is ☐
I have an e-mail address ☐
I use e-mail to communicate with friends ☐

Familiarity with use of computers for education/learning

I use the Internet often ☐
I use the computer to help with my homework/college/school projects ☐
I use the Internet to help with my homework/school/college projects ☐
I use CD ROMs to learn ☐
I am a subscriber to a learning site ☐

EVALUATION PARAMETERS

Given below are some statements about the lesson you just used on the computer. Please tick (✓) your response to the items. Rate the various aspects of the lesson on a scale of 1 to 4, where 1 equals "strongly disagree" and 4 equals "strongly agree". 1 represents the lowest and most negative impression on the scale and 4 represent the highest and most positive impression.

Your frank feedback will be greatly appreciated.

Statements				
I already know the subject being taught				
The course/lesson objectives are clear to me				
The course/lesson activities helped me learn				
The activities in this course gave me enough practice and feedback				
The tests in this course were accurate and fair				
The course was not difficult at all				
The information contained in this lesson is accurate				
The theories, principles and procedures are explained well				
I could get my doubts cleared up easily through the online help				
The content is broken down into units that are small enough to be readily learned				
Long, complex sentences are avoided				
The text is organized into short, easy to read paragraphs				
The audio narration was clear and easily heard				
The video helped me to learn				
The video was clear				
The various media used complement each other				
Graphics, fonts, and other visual elements are legible, functional and attractive				
After going through the lesson, I feel I have learned more than I knew before				
I could not have learned this lesson without the use of the computer				
I could learn in any way I wanted (interactivity and navigation)				
I found the lesson easy to use				
I would like to learn more in this way				
To learn this way, I do not need a teacher's help				
I can learn on my own now				
There was novelty in this way of learning				
Problems shown are those from the real world				
I like the use of humour in the lesson				
The examples and illustrations helped me learn better				
The lesson helped me to solve and apply to problems relating to the lesson				
Some technical knowledge to operate the multimedia lesson				
ANY OTHER COMMENTS :				

The Commonwealth of Learning (COL), Vancouver, Canada established The Commonwealth Educational Media Centre for Asia (CEMCA), New Delhi in 1994. The Commonwealth of Learning (COL) is an intergovernmental organisation created by Commonwealth Heads of Government to encourage the development and sharing of open learning/distance education knowledge, resources and technologies. COL works with Commonwealth nations to improve access to quality education and training.

COL Mission

Recognising KNOWLEDGE as key to cultural, social and economic development, The Commonwealth of Learning is committed to assisting Commonwealth member governments to take full advantage of open, distance and technology-mediated learning strategies to provide increased and equitable access to education and training for all their citizens.

CEMCA Mission

In consonance with the mission of the Commonwealth of Learning, the Commonwealth Educational Media Centre for Asia promotes the meaningful, relevant, and appropriate use of information and communication technologies to serve the educational and training needs of Commonwealth member states of Asia.

THE COMMONWEALTH *of* LEARNING

Commonwealth Educational Media Centre for Asia

IGNOU's Regional Centre Building,
52, Tughlakabad Institutional Area, New Delhi-110 062 (India)
Telephone: +91-11-26096730, 26076965, Fax: +91-11-26085208
E-mail: cemca@nda.vsnl.net.in Website: www.cemca.org

ISBN : 81-88770-00-0