Chapter No 1

INTRODUCTION
CHAPTER 1
SECTION 1

INTRODUCTION

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. 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.

According to 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.”

Multimedia is media and content that uses a combination of different content forms. The term can be used as a noun (a medium with multiple content forms) or as an adjective describing a medium as having multiple content forms. The term is used in contrast to media, which only use traditional forms of printed or hand-produced material. Multimedia includes a combination of text, audio, still images, animation, video, and interactivity content forms.

Multimedia is usually recorded and played, displayed or accessed by information content processing devices, such as computerized and electronic devices, but can also be part of a live performance. Multimedia
(as an adjective) also describes electronic media devices used to store and experience multimedia content. Multimedia is distinguished from mixed media in line art; by including audio, for example, it has a broader scope. The term "rich media" is synonymous for interactive multimedia. Hypermedia can be considered one particular multimedia application.

1.101 CATEGORIZATION OF MULTIMEDIA

Multimedia may be broadly divided into linear and non-linear categories. Linear active content progresses without any navigational control for the viewer such as a cinema presentation. Non-linear content offers user interactivity to control progress as used with a computer game or used in self-paced computer based training. Hypermedia is an example of non linear content.

Multimedia presentations can be live or recorded. A recorded presentation may allow interactivity via a navigation system. A live multimedia presentation may allow interactivity via an interaction with the presenter or performer.

1.102 MAJOR CHARACTERISTICS OF MULTIMEDIA

Multimedia presentations may be viewed in person on stage, projected, transmitted, or played locally with a media player. A broadcast may be a live or recorded multimedia presentation. Broadcasts and recordings can be either analog or digital electronic media technology. Digital online multimedia may be downloaded or streamed. Streaming multimedia may be live or on-demand.
Multimedia games and simulations may be used in a physical environment with special effects, with multiple users in an online network, or locally with an offline computer, game system, or simulator.

The various formats of technological or digital multimedia may be intended to enhance the users' experience, for example to make it easier and faster to convey information, alternatively, in entertainment or art, to transcend everyday experience.

A laser show is a live multimedia performance.

Enhanced levels of interactivity are made possible by combining multiple forms of media content. Online multimedia is increasingly becoming object-oriented and data-driven, enabling applications with collaborative end-user innovation and personalization on multiple forms of content over time. Examples of these range from multiple forms of content on Web sites like photo galleries with both images (pictures) and title (text) user-updated, to simulations whose co-efficients, events, illustrations, animations or videos are modifiable, allowing the multimedia "experience" to be altered without reprogramming. In addition to seeing and hearing, haptic technology enables virtual objects to be felt. Emerging technology involving illusions of taste and smell may also enhance the multimedia experience.

1.103 EDUCATION WITH C.B.T

In Education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books like encyclopedia and almanacs. A CBT lets the user go through a series of presentations, text about a particular topic, and associated illustrations in various information formats. Edutainment is an informal term used to
describe combining education with entertainment, especially multimedia entertainment.

Learning theory in the past decade has expanded dramatically because of the introduction of multimedia. Several lines of research have evolved (e.g., Cognitive load, Multimedia learning, and the list goes on). The possibilities for learning and instruction are nearly endless.

The idea of media convergence is also becoming a major factor in education, particularly higher education. Defined as separate technologies such as voice (and telephony features), data (and productivity applications) and video that now share resources and interact with each other, synergistically creating new efficiencies, media convergence is rapidly changing the curriculum in universities all over the world. Likewise, it is changing the availability, or lack thereof, of jobs requiring this savvy technological skill.

1.104 THE HISTORY AND DEVELOPMENT OF MULTIMEDIA:

Today multimedia might be defined as the seamless digital integration of text, graphics, animation, audio, still images and motion video in a way that provides individual users with high levels of control and interaction. The evolution of Multimedia is a story of the emergence and convergence of these technologies.

As these technologies developed along separate paths for disparate purposes, visionaries saw the possibilities for the sum of the parts as well potential personal application in the broader societal context. This chapter highlights visionaries and technological developments from the development of the printing press to the emergence of the WWW.
"The historian, with a vast chronological account of a people, parallels it with a skip trail which stops only at the salient items, and can follow at any time contemporary trails which lead him all over civilization at a particular epoch. There is a new profession of trailblazers, those who find delight in the task of establishing useful trails through the enormous mass of the common record. The inheritance from the master becomes, not only his additions to the world's record, but for his disciples the entire scaffolding by which they were erected." Vannevar Bush (1945).

This chapter is constructed around five themes developed over a time line. Presented within an interactive timeline framework, there is the option to pursue elaboration with a click of the mouse.

**Visionaries:**

From the ingenious idea of the programmable computer, trace the innovations of the outstanding thinkers that had a direct impact on the explosion of the technological age.

**Text, Processing and Software:**

Inventions and innovations, that spawned the development of software enabling computers to move from mathematical processing to technology that creates and delivers multimedia.

**Computers:**

From the printing press through the exclusive military, academic, and corporate worlds trace computer development into the ubiquitous role of the desktop personal computer of today.

**Audio & Communication:**

From the telegraph signal to cellular telephones, follow the development from signal transmission to digital transmission of voice
Video & Animation:

From manually manipulated negative film and hand drawn sketches, video and animation develops to sophisticated digital creation and rendering of motion.

<table>
<thead>
<tr>
<th>TIME &amp; VISION</th>
<th>TEXT, PROCESSING &amp; SOFTWARE</th>
<th>COMPUTERS</th>
<th>AUDIO &amp; TELECOMMUNICATION</th>
<th>VIDEO &amp; ANIMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre20th Century</td>
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<tr>
<td>1455</td>
<td>Printing Press</td>
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<tr>
<td></td>
<td>Gutenberg and</td>
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<tr>
<td></td>
<td>Caxton, movable type</td>
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<tr>
<td></td>
<td>printing</td>
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<tr>
<td>1780</td>
<td></td>
<td></td>
<td>Franklin discovers</td>
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<td></td>
<td></td>
<td></td>
<td>electricity</td>
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<td></td>
<td></td>
<td></td>
<td>Charles</td>
<td></td>
</tr>
<tr>
<td>1822</td>
<td></td>
<td></td>
<td>Babbage designs the</td>
<td></td>
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<td></td>
<td>Difference</td>
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<td></td>
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<td></td>
<td>Engine</td>
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<tr>
<td>1833</td>
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<td></td>
<td>Babbage</td>
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<td></td>
<td></td>
<td></td>
<td>designs</td>
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<tr>
<td>LADY BYRON</td>
<td></td>
<td></td>
<td>Analytical Machine</td>
<td></td>
</tr>
</tbody>
</table>

6
Lady Byron writes programs for the machine

1837
MORSE

1839

Telegraph receiver and transmitter

1854
BOOLE

George Boole develops binary mathematical language of 1's and 0's (Boolean Algebra)

1858

Transatlantic cable laid

Daguerreotype
pc:
photographs produced using a paper negative
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1867</td>
<td>Remington Manual Typewriter</td>
</tr>
<tr>
<td>1876</td>
<td>Telephone</td>
</tr>
<tr>
<td>1879</td>
<td>Granted a phonograph patent</td>
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<tr>
<td>1886</td>
<td>Burroughs: First commercially successful adding machine</td>
</tr>
<tr>
<td>1888</td>
<td>Mood Music for Film: Musical scores sent along for organ accompaniment</td>
</tr>
<tr>
<td></td>
<td>Gramophone: disks manually rotated @ 70 rpm</td>
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<tr>
<td>1890</td>
<td>Tabulating Machine for the U.S. Government Census using punch cards. The tabulating...</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
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<tr>
<td>------</td>
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<tr>
<td>1900-1933</td>
<td>Discovered machine later became IBM.</td>
</tr>
<tr>
<td>1920</td>
<td>Commercial radio: KDKA Pittsburgh</td>
</tr>
<tr>
<td>1925</td>
<td>Electronically recorded sound discs</td>
</tr>
<tr>
<td>1927</td>
<td>AT&amp;T's Bell labs allow recording of whole symphonies</td>
</tr>
<tr>
<td></td>
<td>&quot;Talkies&quot;: The first commercial talkie film using optical sound recording.</td>
</tr>
<tr>
<td>1928</td>
<td>Juke Box: Automatic Music Instrument Company - coin operated phonograph</td>
</tr>
<tr>
<td>1928 DISNEY</td>
<td>Telephone becomes operational between London and New York.</td>
</tr>
<tr>
<td>1931</td>
<td>First calculator: Conrad Zuse</td>
</tr>
<tr>
<td>1932</td>
<td>Magnetic tape: BASF introduces magnetic tape recording</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
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<td>------</td>
<td>-------</td>
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<tr>
<td>1939</td>
<td>ATAMASO</td>
</tr>
<tr>
<td>1937</td>
<td>Turing's Machine</td>
</tr>
<tr>
<td>1945</td>
<td>Dudley Vocoder - voice coder</td>
</tr>
</tbody>
</table>

1933-1934 - 1935: John Atanasoff and Clifford Berry design a prototype of the ABC computer (the first automated digital computer). Turing defined a "computing machine" as any capable of computing any calculable function.

1939: "Snow White and the Seven Dwarfs," the first full-length animation, is released.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>Colossus (computer) was built for the British military from Alan Turing's design.</td>
</tr>
<tr>
<td>1941</td>
<td>Zuse - Z3: First machine to work on a binary system rather than decimal system.</td>
</tr>
<tr>
<td>1943</td>
<td>Memex - As we may think in the Atlantic Monthly.</td>
</tr>
<tr>
<td>1945</td>
<td>ENIAC: Electronic Numerator Integrator and Calculator, the first.</td>
</tr>
<tr>
<td>1946</td>
<td>First colour T.V. broadcast</td>
</tr>
</tbody>
</table>
successful high speed digital computer. However, it used the same concepts that Atanasoff and Berry used to build the ABC computer.

Shockley, Bardeen and Brattain develop the transistor. More reliable and cheaper to run than vacuum tubes.

**1948**

Open reel tape recorder by Magnecord

**1951**

UNIVAC Computer used magnetic tape for buffer memory.

**1952**

IBM 701: First
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>1953</td>
<td>Electric typewriter</td>
</tr>
<tr>
<td>1954</td>
<td>Transistor radio: First commercial use of transistor radio developed in 1947 at Bell labs</td>
</tr>
<tr>
<td>1956</td>
<td>First Transatlantic telephone cable</td>
</tr>
<tr>
<td>1957 - 1964</td>
<td>CBS broadcast First network broadcast using video tape</td>
</tr>
<tr>
<td>1957</td>
<td>Sputnik launched</td>
</tr>
<tr>
<td>1958</td>
<td>CRAY: Builds</td>
</tr>
</tbody>
</table>
the CDC 1604 for Control Data Corporation. The first fully transistorized supercomputer.

Texas Instruments develops the first Integrated Circuit. Solves the problems of speed, size and wiring.

1959

Second-generation computer introduced by IBM. Used transistors instead of vacuum tubes.

Removable disks

1960
Paul Baran sees a communications network different from the traditional point-to-point links. He envisioned a "fishnet network".

1963

1964

McLuhan

"Understanding Media" postulates the global village.

First home video tape recording

Phillips first compact audio cassette

Third generation of computers included the photo printing of conductive circuit boards to eliminate wiring.

Sketchpad uses the first light pen.

CAD (Computer Aided Design)
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>1965</td>
<td>Xanadu hypertext project by NELSON</td>
</tr>
<tr>
<td>1969</td>
<td>Development of hypertext editing system by Van DAM</td>
</tr>
<tr>
<td>1970</td>
<td>Fourth generation computer by IBM uses chips to reduce size and cost.</td>
</tr>
<tr>
<td>1971</td>
<td>Intel 4004 chip developed by Hoff. Computers can now be owned by individuals.</td>
</tr>
<tr>
<td>1972</td>
<td>Dolby labs produces Dolby noise reduction for prerecorded tape</td>
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</tbody>
</table>

Phillips laserdisc playback only deck PONG, first commercial video game
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>Metcalf outlines ideas for Ethernet</td>
</tr>
<tr>
<td>1974</td>
<td>Intel 8080 microprocessor, which was to be used in many PC's.</td>
</tr>
<tr>
<td><strong>1975 - 1979</strong></td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>Microsoft is founded by Bill Gates</td>
</tr>
<tr>
<td>1976</td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>Apple was founded by Steven Jobs and Steve Wozniak</td>
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<tr>
<td>1978</td>
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<tr>
<td>1979</td>
<td>VisiCalc: the first spreadsheet</td>
</tr>
<tr>
<td></td>
<td>WordStar: word processing package is released</td>
</tr>
<tr>
<td></td>
<td>Kahn &amp; Cerf present ideas for structure of Internet</td>
</tr>
<tr>
<td></td>
<td>DND takes over ARP</td>
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<tr>
<td></td>
<td>Email provided to 100 researchers</td>
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<tr>
<td></td>
<td>First commercially available cell phone</td>
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<tr>
<td></td>
<td>Walkman: SONY introduces a portable audio cassette player</td>
</tr>
<tr>
<td></td>
<td>First MUD, MUD1, by Richard Bartle and Roy Trubshaw at U of Essex</td>
</tr>
<tr>
<td></td>
<td>Beginning of on-line services with CompuServe and The</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
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<td>-------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1980</td>
<td>Word Processing Machine</td>
</tr>
<tr>
<td>1981</td>
<td>The MS-DOS, or Microsoft Disk Operating System</td>
</tr>
<tr>
<td>1982</td>
<td>Lotus 1-2-3, software writes directly into the video system of the IBM PC</td>
</tr>
<tr>
<td>1983</td>
<td>First PC clone</td>
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</table>

SONY introduces the consumer camcorder.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>W. Gibson</td>
<td>Neuromancer coins the term &quot;cyberspace.&quot;</td>
</tr>
<tr>
<td></td>
<td>Apple Computers</td>
<td>Introduces the Macintosh with the first mouse driven GUI (Graphical User Interface).</td>
</tr>
<tr>
<td>1985</td>
<td>Desktop publishing</td>
<td>Aldus PageMaker for the Macintosh</td>
</tr>
<tr>
<td>1986</td>
<td>Optical transistor</td>
<td>Patented, a component central to digital optical computing.</td>
</tr>
<tr>
<td></td>
<td>NSFNET</td>
<td>Linking five university supercomputer centers</td>
</tr>
<tr>
<td></td>
<td>Optical</td>
<td>Transmission (550 mg) CD-ROMs evolve from CDs on which music is recorded.</td>
</tr>
<tr>
<td></td>
<td>TCP/IP protocol</td>
<td>3 1/2-inch &quot;microfloppy&quot; diskette</td>
</tr>
<tr>
<td></td>
<td>DNS</td>
<td>Domain name server introduced</td>
</tr>
<tr>
<td></td>
<td>Voicemail</td>
<td>Developed</td>
</tr>
<tr>
<td></td>
<td>SONY</td>
<td>Betamax removed from consumer shelves</td>
</tr>
<tr>
<td>1988</td>
<td>1989</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td></td>
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<tr>
<td>Robert Morris' worm flooded the ARPANET.</td>
<td>Hypermedia (no sequential links to documents) includes authoring system - tool for building interactive documents</td>
<td></td>
</tr>
<tr>
<td>Hypermedia (no sequential links to documents) includes authoring system - tool for building interactive documents</td>
<td>3D (graphics: Pixar's Tin Toy, the first computer-animated film to win an Academy Award)</td>
<td></td>
</tr>
<tr>
<td>Handwriting</td>
<td>Batry Corporation for Maxis</td>
<td>3D Graphic supercomputer</td>
</tr>
<tr>
<td>Handwriting</td>
<td>Batry Corporation for Maxis</td>
<td>3D Graphic supercomputer</td>
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</tbody>
</table>
rccoj^niLion is introduced by grid with a touch sensitive pad on lap top computers.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>1990</td>
<td>IBM, Tandy AT &amp;T, and others announce the software specifications for multimedia platforms.</td>
</tr>
<tr>
<td>1990</td>
<td>ARCHIE</td>
</tr>
<tr>
<td>1991</td>
<td>GOPHER</td>
</tr>
<tr>
<td>1992</td>
<td>VERONICA</td>
</tr>
<tr>
<td>1993</td>
<td>Mosaic</td>
</tr>
</tbody>
</table>

Research and Education Networking (CREN) is formed by merging CSNET into BITNET.

1990- date


National Science Foundation lifts ban on commerce on the Internet.

World Wide Web
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Developed by M. Andreessen</td>
</tr>
<tr>
<td>1995</td>
<td>Internet goes interactive; shopping, banking, live concerts, radio broadcasting, spamming</td>
</tr>
<tr>
<td></td>
<td>Private ISP becomes big business</td>
</tr>
<tr>
<td></td>
<td>Netscape goes public</td>
</tr>
</tbody>
</table>

### 1.105 Educational Aspect of Multimedia:

At the construction of multimedia learning system and mass information system—In case of the technical-systemic points of view—the transported information is in the center of interest. In other paradigms (social, behavior oriented, psychological, didactic ones and so forth), this information is designated as knowledge. Knowledge is here the way people understood and stored information. From the learn-theoretical point of view, the disciplines pedagogy, education and didactics observe the multimedia evolution in part critical.

Knowledge psychology supplies concrete action, instructions from the cognitive point of view. Multimedia is the fusion of computer, television and telephone.

The multimedia technology is meanwhile available on low cost personal computers and is no longer a major problem. The width of the
abilities in order to make and edit all information types, which are necessary, is much more difficult. Therefore, the evolution of multimedia application is, from the beginning, condemned for failing, on the other hand forces the authorized-question on it, whether such massive resource effort has in fact a corresponding benefit?

The answer of this question applies to benefit and this is based again on the scope. Above all, in two fields, multimedia technique is forced: in the field of the mass information media (Electronic, newspaper, pay television, kiosk system, presentations, advertising and so forth) and in the field of (virtual) learning. In the first field, a benefit can easily be found, but in the field of learning systems, this is much more difficult. However, both fields have many common characteristics. In both cases, the objective is to transport information (knowledge) to people and to prepare it in such a way that acquisition and application of this knowledge is supported.

With the evolution of high-powered hardware at small prices, new technical possibilities seemed to balance the shortcomings. The multimedia technique already comes close to the thought of Comenius on using several media. However, regardless of the way of information representation didactic conception stuck to the behaviouristic approach, many multimedia programs are still teaching programs.

1.106 PSYCHOLOGICAL ASPECT OF MULTIMEDIA:

The combination of different representation possibilities in only one system inspired the multimedia euphoria at the end of the eighties. Especially in the case of learning systems, the expectations were particularly high. Such expectations are based on a summation hypothesis. According to that, the memory performance of hearing and
seeing is the sum of the two channels (20% + 30% = 50%), vary according to the motto: "a lot helps a lot!". For this totalization hypothesis, two theories are stated as an argumentation: the dual coding theory of Paivio and the theory of hemisphere specialization. Both theories start from the assumption that information depending on codification is processed by different cognitive systems. However, the summation hypothesis was not confirmed by empirical works but falsified in so far that even further factors like pre-knowledge, order, content and so forth play a decisive role at memory performance.

However, the different ways of information representation advise the suspicion that they are suitable for different purposes. For this purpose, a series of experiments were undertaken, to classify them according to one or several features and to assign them to didactic functions. In this case, the information representations were designated as media. So a number of media taxonomies have been developed with different future categories, those were based on general pedagogic knowledge about direct and indirect and/or media mediated experience processes. Most of the ideas represented today for the use of multimedia information representations are based on origins from the postwar years. If the individual structure of the learner is decisive for the memory, performance it appears only natural that each person experiences the information representations differently and therefore no universal statement can be made. With this, the way of information representation becomes secondary and the instructional method gains importance. The basic setting of the application, the fixing of the user role, of the tasks and of the situation is primarily decisive. Only after these points are determined, the information presentation is important.

How can the information representation be chosen correctly for the instruction method if different persons are to be assigned to very
different learning types? It would be the logical consequence of this to represent each content in all information types and to let the user choose which representation form corresponds best to him. However, this consequence is more a fear scenario for every producer and designer of a multimedia application, because in this way, neither a harmonized screen design can be maintained nor a cost framework can be kept. Only user classes can still be defined and maybe some few sections can be presented in accordance with the user classes. However, the expenditure is enormous because the production of multimedia applications is high-cost.

If there is no unambiguous generalizeable correlation between memory performances, personality structure or pre-knowledge of the learner and the information types, it can now be presumed that it is just in reverse. The individual information types themselves have very specific strengths and weaknesses. If they are combined, they can support mutually themselves either or else destroy the effect.

1.107 ETHICS IN MULTIMEDIA:

Multimedia is the combination of several different technologies. Some of the components of multimedia have extensive research into the ethical ramifications and considerations for instance, ethical issues regarding mass influences (Bandura (2001), Stern (2005), Ziegler (2007)) , fair representation and equality (Babad(1999), Dong and Murrillo (2007) , Maestro and Greenberg (2000), Sherman(1996) ) and deception (Lee, 2005) have been researched in relation to film and television. Ethical issues pertaining to audio, film and software intellectual property right have produced a great deal of research over recent year.
The Association of Computing Machinery (ACM) provides a code of ethics for professionals involved in software development. They provide following principles to ensure a professional commitment to the "health, safety and welfare of the public" relevant to multimedia production:

- **Public**: Software engineers shall act consistently with the public interest.
- **Client and employer**: Software engineers shall act in a manner that is in the best interests of their client and employers consistent with public interest.
- **Product**: Software engineers shall ensure that their products and modifications meet the highest professional standards possible.
- **Judgment**: Software engineers shall maintain integrity and independence of their professional judgment.
- **Management**: Software engineering managers and leaders shall subscribe to and promote ethical approach to management of software development and maintenance.
- **Profession**: Software engineers shall advance the integrity and reputation of the profession consistent with public interest.
- **Colleagues**: Software engineers shall be fair and supportive of their colleagues.
- **Self**: Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote the ethical approach to the practice of the profession.

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The Association of Educational Communication and Technology (AECT) mission is to provide leadership for certain, use and management
of various technologies used in teaching and learning. Their codes of ethics have three major areas:

- Commitment to individual
- Commitment to society
- Commitment to profession

1.108 POLICY OF HARYANA REGARDING USE OF TECHNOLOGY IN EDUCATION:

- Focus on IT literacy of Government employees and common masses preparing youth and students to participate in IT stream and give benefits to all citizens. For this participation of private sector is being sought.
- Introduction of computer literacy from 6th to 10th class as optional and 11th - 12th class compulsory.
- ITI's and, polytechnics to have value added information for employment.
- Colleges to have IT subjects and specialized training.
- Computer Education in Government schools, colleges, ITI and vocational institutions being taken up with private participation by dividing the State into six zones through private service providers on monthly basis. Details provided in Annexure A.
- Government has given permission to private college's undergraduate course in computer applications in IT computer software on self-financing basis.
- Setting up IIT at Gurgaon, which will start in 2001 on industry driven model?

[Source: Director of Higher Education letter no.128 (g)-KW-18/35-2K NPE (5) Part-II dated 12-9-2000.]
Children in today’s technologically advanced society are growing up in an educational environment that is struggling to overcome the teacher centered classroom in which students’ achievement is based on a system of memorization and recitation of material contained in a single content area textbook. In order for students to succeed in today’s competitive society, they must be given the opportunity and the guidance to develop not only knowledge level skills, but the ability to use that knowledge in “real world” situation.

Teachers are slowly realizing that traditional methods of teaching are no longer capable of providing students with an educational foundation that is strong enough to withstand the pressure of such a technological dependent society. Traditionally textbooks have been the focal point for most of the instructions that students incur during class lecture or other related educational activity. Whether listening to classroom discussion or working on class assignment, most students either use their textbooks exclusively and copy words for words or they simply ignore the book because they feel it is too complicated or confusing.

Often time this lack of meaningful integration that teachers expect with textbooks can be attributed to a student’s lack of knowledge on how their textbooks is organized and how they should approach the text when faced with a problem. Another problem with content area is that they after time provided for a more extensive, not intensive, treatment of subject matter. This leads to information that, instead of building a rich context and background for understanding difficult concepts, provides the base minimum essentials necessary for understanding before moving on to another subject.
Many teachers, who feel the pressure of covering a certain amount of specific material in a given amount of time, often view this static one-way instructional system involving textbooks as an efficient way of covering material. However, what teachers make up for in material covered and time saved, their students lose in comprehension and relevance. One way educators are striving to improve instructional teaching methods is by organising classroom activities around central themes or concepts called thematic units.

The idea behind thematic units is to move away from content dependent instructions, and to allow students the opportunity to explore a wide range of diverse material in pursuit of answers to questions that intrigue them about a particular subject. This method of instruction revolves around students centered inquiry where the teachers acts as the facilitator of learning by guiding the students to their own discoveries, rather than providing students with the answer before they even have a chance to develop the questions.

Students of today have been raised in a society that is dependent on television, video games, computer software and most recently, the internet. Everywhere you go, it is almost impossible to find anything that has not either been manufactured by computer and software or that is not dependent on computer technology for its functionality. If classroom-teaching methodology continues to follow the traditional pathway, we are likely to see a continued decline in the academic progress of our children, because the internet technology based learning styles of today's students diverge from the out of date teaching styles of the instructors.

In an effort to reform science education, educators have begun to focus on effective science teaching and learning. Schools and districts all over the US are searching for ways to revise current science curriculums to reflect a more student-centered and meaning approach to science
instruction. Most educators are using views such as the one above to develop a classroom atmosphere that will create a partnership between students, teachers, and technology that will build on students curiosity and creativity, emphasis quality of understanding rather than quantity of information, expose students to concepts in a variety of contents and make students aware of the social and historical influences of science and technology.

Returning to the idea of centering classroom activities around thematic units, many educators are searching for unique ways of integrating diverse arrays of educational as well as instructional material into science classrooms. Recent developments in technology have given teachers a way of providing students with materials that seems to be improving students attitudes, motivation, understanding, transfer, equity and responsibility of one's own learning. The avenue for implementing these instructional and educational ideas has been paved by advancement in multimedia technology.

Speaking generally, multimedia is the use of a variety of resources for obtaining information about the particular topic, however use of multimedia as it relates to technology has a somewhat more computer related applications. Multimedia of 21st century relates to a wide variety of hypermedia technologies consisting of networks of related text, graphics, audio-files, video clips through which users navigate using icons or research strategies. This type of instruction puts students in more control of actual learning processes, because they are able to more tangibly control the types of information that they rely upon when working to solve a given problem.
1.10 STATEMENT OF THE PROBLEM:

A Study of Effectiveness of Self-Learning Multimedia Package in Physics at +2 Level in the Schools of Haryana.

1.11 OBJECTIVES:

Following were the objectives of the study:

1. To identify the new concepts in physics which are presently taught in the schools at Senior Secondary stage.

2. To develop multimedia self-learning instructional material with respect to the selected new concepts in Physics.

3. To find out the effectiveness of multimedia self-learning instructional material on the achievement of students of physics in relation to sex and socio-economic status of the students.

1.12 HYPOTHESES:

Following hypotheses were tested:

1. There will be no significant difference in the achievement of boys and girls in Physics taught through multimedia self-learning instructional material.

2. There will be no significant difference in the achievement of boys and girls in Physics taught through multimedia self-learning instructional material belonging to low socio-economic status.
3. There will be no significant difference in the achievement of boys and girls in Physics taught through multimedia self learning instructional material belonging to high socio-economic status.

4. There will be no significant difference in the achievement of boys in Physics taught through multimedia self learning instructional material belonging to high socio-economic status and low socio-economic status.

5. There will be no significant difference in the achievement of girls in Physics taught through multimedia self learning instructional material belonging to high socio-economic status and low socio-economic status.

6. There will be no significant difference in the achievement of boys belonging to low socio-economic status and girls belonging to high socio-economic status in Physics taught through multimedia self learning instructional material.

7. There will be no significant difference in the achievement of boys belonging to high socio-economic status and girls belonging to low socio-economic status in Physics taught through multimedia self learning instructional material.

### 1.113 PLAN AND PROCEDURE

**Sample:**

20 Co-education Senior Secondary Schools were selected randomly from Ambala and Yamunanagar District. From each school, 20 students
(10 boys and 10 girls) of + 2 level were selected randomly. 4 groups were formed as per $2 \times 2$ factorial design as given below:

**Design:**

2 X 2 Factorial design was used.

\[
\begin{array}{c|c|c|c}
\text{Sex} & \text{Low SES} & \text{High SES} \\
\hline
\text{Male} & (A) & (D) \\
\text{Female} & (B) & (C) \\
\end{array}
\]

**Tools:**

1. Multimedia Package in Physics (Light) developed by the investigator.
2. Criterion Test in Physics (CRT on Light) developed by the investigator.

**Procedure:**

Following were the steps of the procedure:

- The investigator developed a Multimedia Package on the concepts of Light.
- The investigator also developed a Criterion Test to determine the achievement of the concepts by the students.
- The investigator administered a Pre-test on the selected concepts of Physics to the sample to determine the entry behaviour.
The sample was also administered Socio Economic Status Scale by Verma R.P, Sexena P.C, Mishra U.

The teachers teaching Physics to Senior Secondary classes and the students selected in the sample were given orientation as to the proper use of the Multimedia Package on CD-ROM on selected topics of Physics for self-learning.

One copy of Multimedia Package on CD-ROM about the selected topics in Physics was given to each subject of the sample. The subjects were asked to load the multimedia courseware onto the computers in the computer laboratory of the school.

The sample studied the selected topics of Physics with the help of Multimedia Package on CD-ROM for 1 month. The teachers teaching Physics were requested to supervise the students during the study.

After the experiment was over, the sample was administered a post-test to determine the final achievement of students in the selected topics of Physics.

The pre-test and post-test scores were used for final analysis of the data using Analysis and Co-Variance technique.

**Statistical technique:**

The data were analysed using Analysis of Co-Variance technique followed by t-test. Data were also represented graphically.

**Delimitation:**

The study was confined to:

1. Senior Secondary Schools of Ambala and Yamunanagar District.
2. Students from Non-Medical group were included in the sample.
3. Selected topics of Physics of Secondary classes.
4. Tools used for data collection.
SECTION 2

INTRODUCTION

Teaching through Self Learning Material is catching on throughout the world - in the developed as well as the developing countries. This mode of education will continue to flourish as more and more open distance education institutes / universities are coming up to meet a variety of educational needs of the ever-increasing number of learners and fast changing societal conditions. Beside subject based teaching, much professional and industrial training is now imparted through self-learning packages. Such materials are needed for in-service education, lifelong education etc.

Self-learning materials (SLM) are designed for both on site and at a distance learner to use on their own. SLMs include all the material prepared to stimulate independent study / learning. The learners in distance education have less contact with either the institution or the tutor and depend heavily on these specially prepared teaching materials - largely pre-planned, pre-produced and pre-packed.

1.201 SELF-LEARNING MATERIAL vs CONVENTIONAL INSTRUCTIONAL MATERIAL

In the conventional system of education, the students get most of their instruction through face-to-face interaction with a teacher and they attend classes regularly in peer groups. The students under this system use the already existing text materials (Textbooks). No special materials are developed for these students. Self-learning, on other hand, depends on the materials specially prepared or transformed for the target group. In self-study, the learners get very little opportunity to interact with the teachers and peer groups as in the classroom situations. This loss is
compensated by a special kind of self-learning material, which includes all the study materials developed to stimulate independent learning. Other major differences between self-learning and conventional instructions are given in the following table 1.2:

**TABLE 1.2**

**DIFFERENCE BETWEEN TEXT BOOK AND SELF-LEARNING MATERIAL**

<table>
<thead>
<tr>
<th>Text books</th>
<th>Self-learning materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>- assume interest</td>
<td>- arouse interest</td>
</tr>
<tr>
<td>- written mainly for teacher use</td>
<td>- written primarily for learner use</td>
</tr>
<tr>
<td>- do not indicate study time</td>
<td>- give estimates of study time</td>
</tr>
<tr>
<td>- designed for a wider market</td>
<td>- designed for a particular learner group</td>
</tr>
<tr>
<td>- rarely state aims and objectives</td>
<td>- always give aims and objectives</td>
</tr>
<tr>
<td>- structured for teachers and specialists</td>
<td>- structured according to the need of learner</td>
</tr>
<tr>
<td>- little or no self assessment</td>
<td>- major emphasis on self-assessment</td>
</tr>
</tbody>
</table>

1.202 CHARACTERISTICS OF SELF LEARNING MATERIAL

S.L.M. differs from a chapter of textbook or an article of a journal. The chapters of textbooks usually present information in a very compact form. They are closer to reference material than to learning material. They are organized in terms of the subject matter rather than to aid learning. Similarly, an article in a journal is a means of communicating with equals in the profession. On the other hand, SLM's are instruments of learning. The main characteristics of SLMs are as follow:
Self-explanatory:

The content should be presented in a style so that a learner can go through the material without much external support. The content should be self-explanatory and conceptually clear. For this, the content is analyzed logically before it is presented. This order maintained the continuity and the consistency of the content. Thus, the SLM promotes self-learning on the part of the learner.

Self-contained:

Efforts should be made to make the material self-sufficient so that a learner does not hunt for additional sources, or even a teacher. Not that distance learner should not seek external support, or meet a teacher, but many of them are not in a position to receive support due to their geographical, physical and psychological isolation. Considering this factor, the material should be self-sufficient to the possible extent so that the student would not be at a disadvantage to those learners who are having accessibility to additional sources and teachers. For this, the scope of the content of the unit should be visualized in details. While avoiding the non-essential, only the essential details need to be presented so that the unit can cover all information required by the learner and keep away all that is not necessary.

Self-directed:

The study material should aim at providing necessary guidance, hints and suggestions to the learners at each stage of learning. The self-learning material is presented in the each stage of learning. Self-learning material is presented in the form of easy explanations, sequential development, illustrations, learning activities, etc. the material performs the role of a teacher who can guide, instruct, moderate and regulate the learning process in classroom situations. Thus, the course material should direct the entire process of learning. Some teachers in
conventional classroom situation do not perform the activities like guiding, instructing, moderating and regulating the learning process. The reasons may be many, such as time constraints, teacher style, lack of interest in these aspects etc. However, in the context of distance learners, one as a course writer has to take care of these components and direct the learning process in the course material, so that learners can direct their learning process in the absence of a teacher.

**Self-motivation:**

In distance education systems, the learners remain off the campus for most of their study-time. The study materials, like a live-teacher, should arouse curiosity, raise problems, relate knowledge to familiar situations and make the entire learning meaningful for them. It is not easy to create these situations, without an extra effort from the course writer. The sense of reinforcement should be strengthened at every stage of learning and retention.

**Self-evaluation:**

As the learner remains separated from the open and distance institutions and the teachers, the study materials should make provisions for feedback as well. To ensure optimum learning, the learners should know whether they are on the right track. Self-evaluation in the form of self-check questions, activities, exercise etc., provides the learners motivation for learning. The course writer should develop a built-in evaluation system by giving an appropriate number of self-check exercises, activities and check your progress questions.

**Self-learning:**

Self-learning materials are based on the principles of self-learning. Therefore, a unit, besides information, provides the learners study guide-directions, hints, references etc., to facilitate their independent learning.
To make the content comprehensible, it is supported by simple explanations, examples, illustrations, activities, and so on.

1.203 LEARNING ACTIVENESS.

Learning activities are of different forms. In face-to-face classroom situations, a teacher may ask students to answer a question; take notes on his/her lecture, observe and record an experiment or demonstration, or do quick exercises. However, in open and distance education, which uses passive print and other media, we need to build in, these activities deliberately and aim at making them effective and purposeful. There are three types of learning activities:

- Thinking
- Writing
- Doing

**Thinking:**

We know that learning involves interpreting facts and building links between them. We can stimulate thinking by setting questions, which will make the learners attentive and more interactive with the content. The questions will encourage them to stop and think for a while before moving on to the next step. The multiple types of questions motivate them to think and find alternative answer to the question asked. These questions can force the learners to think on the issue being discussed and can draw their attention towards the content. Besides thinking, such questions will assess learner’s relation.

**Writing:**

Writing exercises help the distance learners consolidate what they have learnt in the unit. Writing the points down also makes them attentive and active.
There can be several types of writing exercises:

**Copying or writing from memory:** It is simply a way of strengthening the memory by repetition. For example, list three stages of material production.

**Answering questions:** which involves extending what has just been learnt to other items in the same area? For example: practicing an arithmetical process, formulating aims and objectives in your subject.

**Applying:** What has just been learnt is applied to a new situation. For example: *which one may be better- the course team approach or appointing part-time course writers?* Give at least three reasons to support your answer.

**Answering the questions designed to test comprehension:** For example: *explain the functions of an assignment in distance learning.***

**Doing:**

The third type of learning activity is doing something practically. It is said that one learns best by doing. In the courses such as geography, science etc., in which we wish to develop certain skills, some practical exercises or activities, should be given to the learners. The material can be clubbed with practical exercises.

**Access Devices:**

Access devices are those devices which help the course writer go as close to his/her learners as possible and help the learners come as close to the content as he/she can. These devices also help the learners find their way into the material. There are three main functions of these access devices:
- They enable learners to find what they need to read in the unit, i.e. the means and ways to reach the content.
- They make the content more intimate to learners and help them grasp what is presented in the unit.
- They perform the functions of a live classroom teacher, i.e. build a teacher in the material.
SECTION 3

INTRODUCTION

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 teaching and learning. The multi-sensory input of this media provides possibilities for higher performance rating and higher retention. With effective feedback, this method makes teaching and learning more effective. Students with different learning abilities can work at their own place, time and pace and with interactive and self-assessment, it can make learning a highly personalized, independent and a rewarding experience. A significance 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 world, which do not exist in conventional methods of teaching and learning.

In this section, we will discuss some aspects of ‘how’ of the development of multimedia, especially the component of multimedia and the good practices in preparing text, graphics, audio, video, graphics etc.

1.30 TEXT IN MULTIMEDIA

Text is the most common medium of presenting information. It is also used to communicate a concept and idea. It should effectively complement the other media. Factors that influence the textual communication are typeface, font and style, kerning, ant aliasing,
animation, special effects, special characters and hypertext. While dealing with text in multimedia it is very important to note that, it is not only means of communication. In multimedia, text is most often used for title, headlines, menus, navigation and content. Overcrowding of the text on a single page should be avoided. It is recommended that text should be presented in combination with graphics. Some important concepts in text is discussed in details below:

**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 decoration. Serif fonts are commonly used in the body of the text, while sans-serif fonts are 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 a inch.

In the use of fonts, it is recommended to use as few 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 background. Care should be taken for selecting the appropriate type of the fonts on menus and buttons, symbols and special characters.
Text Animation

Presenting the 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, MA, 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 as in the case of the text presentation. Anti-aliasing is the technique of making the edges smooth. Anti-aliased text is often calling ‘gray-scale’ text. Certain adaptations of anti-aliasing have enhanced both the legibility and aesthetics of on screen type.

Hypertext

The function of the 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. Hypertext system provides both unidirectional and bi-directional navigation. Navigation 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.

1.302 AUDIO IN MULTIMEDIA

Audio is another vital medium in a multimedia presentation. Audio is available in different file formats and the appropriate file format is chosen to 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. Some important concepts in audio is discussed below:

Digital audio

The sound recorder 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

It 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), the most common sampling rate used in multimedia application are 44.1 Kilo Hz, 22.05 Kilo Hz and 11.025 Kilo Hz. Higher rate of 192 Kilo Hz will probably be the professional DVD standards in future. Higher the sample 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 the 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 used, higher is the quality of sound. Multimedia sounds come in 8-bit, 16-bit, 32-bit and 64-bit formats. An 8-bit has 2^8 or 256 possible values; 16-bit has 2^16 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:

\[ \text{File size in disk} = (\text{length of sound}) \times (\text{sample rate}) \times (\text{bit depth}/8 \text{ bit per byte}) \]

**Mono or Stereo**

Opting for mono may be 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 synthesizers or DAT (data 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. In modern recording studios, the recording is done using sound card, mixer, equalizer and compressor.

**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 a number of sound editors used very frequently for multimedia applications like *Sound Forge, Cool Edit, Studio One, and Sound Edit 16*. *Sound Forge* for PC is regarded a good software for audio recording and editing. *Cool editing*, 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. For top quality recording, *Studio One* is a good choice. 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 development by SUN microphones
- **MP3**: compressed file format using MPEG1 layer3 compression
- **QT**: digital audio quick time movies that contain only audio
  Which can be used in multimedia application
- **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.

### 1.303 VIDEO IN MULTIMEDIA

Video in multimedia is an extremely useful communication tool for presentation. 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 or AVI files that can be transformed to MPEG files.

Some important concepts in video are discussed in detail.

**Digital video**

Digital video provides a superior means of communicated images and sound 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 rating**

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 or more.

**Video formats**

AVI: File format developed by Microsoft for windows. It is also known as video for windows (VFW)

MOV, MOOV, and QT: Files belong to Apple Quick Time Movies. Flattened quick time video clips can be viewed on UNIX workstations and on IBM compatible PC with media players.

MPEG, MPG: MPGE file used the MPGE-1 video compression routine. MPGE video clips can be viewed with IBM compatible PC and UNIX workstations.

**Colour Depth for Digital Video**

Digital video set at 24-bit are recommended for windows.

**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 (Coding-Decoding) 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 the video. The inter-frame compression involves cutting out the visual information that is not noticeable to the human eye.

**Video Editors**

The popular software for video editors 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 device and then the appropriate software is used for editing. If a DV camcoder is used for video shooting then the video can be transformed to PC directly for editing. It is very important to note that video takes enormous disk space as much as 200MB per minute. Therefore, 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 230GB hard disk and a minimum of 2 GB RAM and with a good AGP card with 1 GMB VRAM. A powerful CPU is also a must for handling large video data.

**1.304 GRAPHICS IN MULTIMEDIA**

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

The two approaches in designing graphics are:
1. Raster Graphic
2. Vector graphics

Raster graphics, commonly known as bitmap image are based on a grid of pixels. Vector graphics are based on mathematical formulas.

Bitmap images are associated with ‘paint’ and ‘photos’. 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’ and ‘illustration’.

Some important concepts in graphics is discussed in details:

Graphic formats

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

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. 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 of GIF file format. PNG format are of two types: PNG-8 and PNG-24.
PNG-8 format holding 8 bit of color format (Similar to GIF)
PNG-24 format holding 24 bit of color format (Similar to JPEG)
Scanning

The basic purpose of scanning an image is to digitize it i.e. convert it from an analog form 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 'dot per inch' or 'dpi'. In general, high resolution results in better images quality. While images 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.

1.305 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 discussed in details:

Key Frames

Major frames of animation are created first. These frames defined the key frames in which many changes take place. They are the ‘key’
points of animation. Key frames are specified to show how the movies 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 Premiecr, 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, one can have .dir (for Director), .fla (for flash), .max (for 3D Studio max), .dcr (for shockwave animation file), etc.

**Interactivity**

Interactivity can be understood as interplay between different elements of an environment. In human context interaction can be between 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 programme 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.

**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 prototyping 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 and design. For multimedia development, some of the components of 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 interactive and instructional design.
SECTION 4

HOW MULTIMEDIA HELPS IN LEARNING PROCESS?

1.401 STRUCTURE IN HUMAN MEMORY:

A simplified model of memory is shown in Diagram 1

Diagram-1

The scheme shows the ways in which new sensory information can become stored in long term memory through attention and rehearsal, or forgotten through decay, displacement and interference. The model for short term memory has been elaborated to include three subsystems:

- A phonological loop for verbal and auditory processes.
- A visio-spatial sketchpad for non-verbal processes.
- An episodic buffer, for the integration of information from long term memory.

Cognitive psychologists first conceived of two distinct types of memory in 1960's after behaviourism was supplanted by cognitivism as
the dominant ideology. Baddeley (1997) provides a summary of studies that leads to established two component frameworks. Proponents of the working memory model believed it elegantly explained the phenomenon of rapid forgetfulness when participants were prevented from rehearsing recently acquired information. Opponents suggested that forgetting was not due to memory decay but to interference. Strong evidence for the model of working memory came from studies of patients who had suffered significant brain trauma. Case studies showed that individual patients with lesions in different areas of the brain had either unimpaired short-term or long-term memory. For example, one individual could repeat back phone numbers immediately after they were presented but could not remember if he/she had met the researcher before. The other could repeat back only a few digits but displayed normal long-term learning.

1.402 LEARNING FROM WORDS AND PICTURES:

Although the addition of pictures to instruction is acknowledged to improve aesthetics and sometimes student motivation, there is theoretical support for the assertion that images serve an important cognitive function in learning. Dual coding theory is the dominant theory that addresses the role of imagery in human cognition.

The theory proposed that, “There are two classes of phenomena handled cognitively by separate subsystems, one specialized for the representation and processing of information concerning nonverbal objects and events, the other specialized for dealing with language.” Although the nonverbal system is concerned with all experiences independent of language, it is commonly referred to as the visual or ‘imaginal’ system.

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In the dual coding model, the verbal and nonverbal channels possess distinct representational units called 'Logogens' and 'Imagens' respectively. Logogens are linked together through associative connections, building a hierarchical structure within the verbal channel. Similarly, images relate to each other through associative links in the non-verbal system. Thus processes related to associative links can occur in one channel independent of the other. An important difference between the two systems is that processes are said to be sequential in the verbal channel and synchronous or parallel in the nonverbal channel. For example, recalling the layout of one's office is a simple task with items to the left or right of one's desk easily accessible. In contrast, recalling a line from a speech or the national anthem typically requires going through words in sequence to reach the target phrase.

Activity in one system can also trigger activity in the other system in what is called referential processing. The word 'car' for example, might bring to mind the image of the car. It has been found experimentally that images are much more likely to trigger referential processing and therefore be coded in the verbal system than vice-versa. This leads to what some have called 'The picture superiority effect'. The evidence suggests that imaginal and verbal codes are unequal in mnemonic value, perhaps by a 2:1 ratio favoring the image code.

This theory has important implication for the design of multimedia instruction. Memories coded in two channels are more likely to be recalled than those that exist only in one. "The evidence to date suggests that imaginal and verbal codes are functionally independent in the strong sense, activation of both can have additive effects on recall". In addition, the nonverbal system allows memories to be stored and processed synchronously, rather than sequentially as in the verbal system.
The theory was inspired by mnemonic techniques like those used to memorize a numbered list of objects. Researchers found that images were especially well suited as 'conceptual pegs' for other items. Subjects attempting to memorize pairs of adjective and nouns demonstrated better recall when the noun was presented first and when it was concrete rather than abstract. Further studies dispelled a competing hypothesis, that the meaningfulness of nouns increased their efficacy as mnemonic aids. In fact, meaningfulness was found to have a small or even detrimental effect on recall tasks. Later studies uncovered that pictures were more easily recalled than abstracts or even concrete nouns, supporting the central role of imaginary in memory.

Neuropsychological studies provide further support for dual coding theory. It has been known for some time that the left and right hemispheres of the brain are asymmetric in their functions. Although some believe this asymmetry has been exaggerated and distorted in popularized accounts, different parts of the brain are implicated in different cognitive tasks. The left hemisphere seems to play an important role in speech, while the right is more proficient in select nonverbal tasks. Abstract words are better recognized by the left-hemisphere; while concrete words are recognized equally well by both side of the brain.

The results of decades of research indicate that images have unique and beneficial impacts on learning and memory. Whether one accepts dual coding theory or the propositional hypothesis, the advantage of images in instruction is unchanged. Due to extensive empirical support for dual coding theory and its straightforward model, it is particularly applicable to the theory of multimedia learning. Mayer (2001) conducted a series of experiments in which students received either multimedia or verbal only explanation of some physics concepts. In six out of nine studies, students who received the multimedia
presentation demonstrated better recall than their single mode counterparts and all nine experiments, the multimedia group outperformed the single mode group on transfer tests (i.e. tests that required students to use the learned principles in novel contexts.)

1.403 THE COGNITIVE THEORY OF MULTIMEDIA LEARNING:

The cognitive theory of multimedia learning (CTML, Mayer 2001, 2005) is composed of a combination of dual coding, cognitive load and constructivist theories. It builds upon previous research on learning with technologies.

From dual coding theory, the CTML employs the idea that the people have two independent but related channels for processing verbal and nonverbal information. The amount of processing that can occur in each channel is limited by cognitive load theory. By using two channels rather than one for instruction, the theory asserts that learning can occur more effectively and efficiently with multimedia. The CTML also identifies a set of active processes that a learner must undertake in order to learn. From the stimulus material, a learner must select relevant words and relevant pictures, organize these words and pictures separately into coherent mental models with prior knowledge. This set of tasks is a simplification of the cyclic, iterative mental processes proposed by Osborne and Wittrock (1983) in the generative learning model.

Using this theoretical framework, a set of multimedia designed principles has been established and empirically verified (Mayer, 2001). Some significant examples are below:
1.404 MULTIMEDIA PRINCIPLE:

Learning is enhanced when instruction is presented as words and images rather than words alone.

**Spatial contiguity principle**

Learning is enhanced when instruction is presented as words and images in close proximity.

**Temporal contiguity principle**

Learning is enhanced when instruction is presented as words and images simultaneously.

**Coherence principle**

Learning is enhanced when material extraneous to the learning outcomes is excluded.

**Modality principle**

Learning is enhanced when words are presented as narration rather than as on screen text.

**Redundancy principle**

Learning is enhanced when narration is not duplicated as on-screen text when competing with dynamic visuals.
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. 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 the 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 and blend them into a report. Then by adding titles and credits, the students now has a new and original way of communicating his/her own individual perspective.

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 incorporative other audio visual information with text to make the subject 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 classroom 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 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.

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

1.406 REQUIREMENTS FOR MULTIMEDIA PC:

Multimedia Hardware

Hardware is the first thing that one should have to begin one’s quest with multimedia projects. Hardware is necessary to interpret one’s commands, queries and responses into computer activity.

A good multimedia system should have dual core CPU, at least 2Gb RAM, 250 GB onwards hard disk drive, 17” onwards SVGA monitor, 512 MB AGP card, DVD drive, a 32 bit sound card, high wattage sub-woofer speakers, 104 PS/2 keyboard, PS/2 mouse and 56 K fax data voice modem. A CD-Recorder, Scanner, Printer, Digital Camcorder and a Video-capture card may also be added if need be. 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 one’s purpose.
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 provided 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 projects with the minimum possible efforts and maximum possible productivity. Multimedia software have unlimited features. One can choose among several hundred colors, dozens of fonts, and a wide variety of colour-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 project. Table 1.3 shows a reckoner for selecting software:

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usability</td>
<td>Should have capability to deal with a variety of text, images, video and sound formats with precision and ease</td>
</tr>
<tr>
<td>Animations</td>
<td>Should have wide ranging capabilities in terms of interactive simulations, media support, animated buttons, illustrations, maps, etc.</td>
</tr>
<tr>
<td>Smoothness</td>
<td>Should have anti-aliasing feature, meaning that all letter and image edges are smooth</td>
</tr>
<tr>
<td>Integration</td>
<td>Should have integration capabilities with a wide range of software used for different jobs like Real,</td>
</tr>
</tbody>
</table>
### Delivery

ActiveX, Shockwave, Flash, Quick Time, Photoshop and other Applications

Should be able to develop one piece of content for delivery on different media types

### User friendliness

Should be the easiest, most versatile

### Clientele

Should have applications for instructional designers, subject matter experts, training developers and others

### 1.407 PROCEDURE OF DEVELOPING MULTIMEDIA PACKAGE:

Preparation of multimedia package requires a clean understanding of the concept, sub concepts as well as their educational domains (like Cogitative, Cognitive and Psychomotor). After this, a number of specific discussions are to be taken regarding content, learning behaviors and presentations. The most important thing is validation of package. The entire package writing constitutes three distinct stages. These are as under:

- Planning stage
- Development of package
- Try out and evaluation/ validation
Diagram-2

Concepts

Discussion/Brainstorming

Concepts Modified/Redefined

Design with Specification

Production of multimedia

Validation of multimedia

Try-out of Multimedia Package

Package Modification

Usage of Package for Experimentation/Practice

Concepts Rejected
Planning stage

Planning stage is the initial stage in the development of a Package. During the planning stage of the package, the following steps were systematically covered:

- Selection of topic
- Selection of specific content of each topic
- Writing the assumption about the learner by teachers
- Mapping the writing material

There are so many topics prescribed by the board/university in the form of syllabus/curriculum which are being taught and practiced by the teachers in the classroom and the content of each topic is extended by the teacher according to learner’s aptitude and attitude. But teachers are not sure about the understanding of topic (generally assumption bases or imagination bases) by the learner because of individual differences. So in first two steps help the investigator to think broadly about the topic selection and its expansion.

Development of package

After defining the topics and sub topics, the investigator consults the professionals of multimedia for the development of self learning multimedia package. After long discussions, investigator makes first draft of self learning multimedia package.

Try out & Evaluation/Validation

In this section the material are subjected to try out at small group and large group level. At this stage, material developed is tested on
students and is modified in the light of the comments of experts. After editing the first draft of the material, the package is subjected to try out to ensure validity in two phases:

- Small group try-out
- Large group try-out

**Small group try-out**

In small group tryout phase the investigator administered the package to a few students. The purpose is to identify as many inadequacies as possible and to eliminate them in the material.

Here the investigator discusses with the small group and the following verbal instructions are given to the respondents:

- Tell frankly and freely any inadequacy or difficulty regarding the language, content, method/approach and structure comprising the modules.

The students go through the material step by step and the same is corrected, modified, simplified, refined and adjusted. The material is revised on the basis of the following points noted during this try-out.

- Feedback by the respondents on the content.
- Feedback by the respondents on the multimedia presentation.

**Large group try-out**

After having affected the changes on the bases of small group try-out on the similar lines, second try-out is conducted with a larger sample. The self learning multimedia package is finally refined and can be implemented.