CHAPTER – II

CONCEPTUAL FRAMEWORK

The modern electronic interactive technologies employed in learning can provide students with far greater involvement in the process of learning. The interactive technologies allow students to exercise greater control over the learning process than is possible in many of the conventional learning methods. The interactive learning technologies provide opportunities to the learners and those learners must take more responsibility for, and are more active in their learning. The challenge of making content / information more interesting especially for young students can be addressed with the introduction of multimedia approach in learning.

2.1 Technology in / of Education

The term Educational Technology (ET) is misconceived because of the changing nature of its second component, technology. The Basic connotation of Educational Technology does not change. It is using all available human and non-human resources in a systematic manner to make the educational process more effective and find feasible solutions to educational problems. However, as technologies change and newer ones are brought into the field of education, the configuration, structures, and applications of ET will also change. This dynamic and ever-evolving nature
of the discipline needs to be understood. When the term was first coined it referred to “technology in education”, implying the use of a variety of audio-visual aids for teaching purposes.

Later as the concept developed, the term “technology of education” came into vogue. This looked at education in a wider sense, and included various aspects such as entry behaviour of the learner, instructional objectives, content analysis, evaluation, etc. This widened the scope of ET as the teaching-learning process was examined in a holistic manner. The arrival of digital convergent media encouraged interactivity and interconnectivity. While this field continues to evolve, we face the problem of how to help learners to learn in an effective and interactive manner.

2.2 Role of Educational Technology in Learning

Educational Technology (ET) is expected to play a crucial role in improving the quality of learning and in enhancing access to educational resources. First, it is necessary to divest ourselves of the notion that ET means audio-visual aids or computers; no programme that is only equipment-driven works well. We must realize that knowledge springs from many sources, and that whatever is of importance in the learner’s environment and suitable for his/her needs is what we must find and use in any teaching-learning system by employing effective instructional designs. Here considerable experimentation is necessary, and appropriate
technologies for these designs will have to be worked out.

The primary goal has to be an educational one. And to reach it, it might be necessary to tackle it by breaking it down into specific educational objectives. The systems that ET specialists (teachers, parents, and educationalist) should think about would therefore have to be diverse. Efficient teaching-learning systems at every level, which use available resources and appropriate technologies and processes and which are flexible enough to effect changes based on observation and evaluations, are the need of the hour.

The new technologies and the mass media can help, but they must be woven into the system in such a manner that they give good results. Interactive rather than disseminative strategies are desirable. The discipline of ET is an enabling discipline designed to make the teaching/learning of any subject including Science more efficient and effective to meet the goals for which the subject is being taught.

### 2.3 Various Learning Strategies

Educational Technology can enable students to explore areas of knowledge that have not been studied because of inadequate tools and technologies. It has brought about new symbol systems and visualization techniques that enable them to understand not only the complex observable
phenomena but also the phenomena that lie outside of human perception. It helps to visualize the facts and visuals of ancient periods (Scientific Information). Through virtual reality, the scientific facts are experimented on live three dimensional space where physical variables can be controlled. Various technologies deliver different kinds of content and serve different purposes in the classroom.

Marshall (2002) cites the conclusions of Wiman and Mierhenry (1969), extending Edgar Dale’s “Cone of Experience” that people will generally remember; 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear and see.

Classrooms, teachers, desks, paper, and pencil are all part of the traditional teaching-learning environment. The past century has supplemented and enriched this traditional environment with new ways such as charts, models, slides, etc. of presenting content for learning. Today, opportunities abound for learning through multiple media – from pictures, overhead projectors, and filmstrips to moving pictures, videos, and computers. The computer is the dominant tool for learning in the field of Educational Technology. After computers, telecommunications and video conferencing (information technology) are emerging as major media delivery systems for learning.
Technologies available in the classroom today ranges from simple tool-based applications (such as word processors) to online repositories of scientific data and primary historical documents, handheld computers, closed-circuit television channels, and two-way distance learning/virtual classrooms. Even the cell phones that many students now carry with them can be used to learn (Prensky, 2005). Few more learning technologies include e-learning, virtual learning, mobile learning (m-learning), etc., e-learning is a broader concept which may use computers, multiple medium, internet and many other electronic devices and concepts.

2.4 Computers in Indian Schools

Indian experiments in taking computers to schools involved the participation of a large number of institutions for tasks such as the supply of hardware and software, the development of Computer Assisted Learning (CAL) packages, and the training of teachers. a project called Computer Literacy and Studies (CLASS) launched in 1984. The evaluation of the project revealed the need for greater interaction between resource centers and project schools, the need to reduce the time gap between the training of teachers, the installation of systems, and the initiation of activities in schools, the imparting of adequate hands-on-experience to teachers and students, and the provision of computer literacy programmes in the timetable. The
The revised CLASS project during 1993-2004 saw the introduction of Personal Computer machines in keeping with broad global trends. Subsequently, the government initiated the CLASS 2000 programme with the aim of providing computer literacy in 10,000 schools, computer-assisted learning in 1,000 schools, and computer-based learning in 100 schools. These 100 schools were called “Smart Schools”, and were designed to be agents of change seeking to promote the extensive use of computers in the teaching-learning process. This, too, has not yielded the expected results.

Though all these interventions did make some impact, where the schools and teachers went the extra mile to avail of the facilities provided using their own ingenuity, many of these schemes have been half-hearted attempts even at the conceptual level. Computer literacy is not so much about knowing the technical jargon, but rather learning to use computers in a meaningful way, that is, meaningful to children. Given this void, many international corporations, and Indian corporate companies as well, have entered the arena in recent years. But, their programmes have limited objectives, while computer education appears to have been taken quite seriously by many state governments and by certain private sector initiatives, most of these programmes are aimed at preparing students for the job market. A balanced generic curriculum, where computers are related to their
due place as tools, and where they extend the horizons of other subjects, is a must.

In most of the Indian schools, students are not provided with enough computers and not even in their classrooms. Computers are placed in a separate lab and many student are unaware of it. Only the higher secondary students who opt for ‘Computer Science’ as a subject, study about the computers. This scene is changing slowly and now in few schools students are acquainted with computer usage at primary and secondary level itself. But the Government schools are far behind the private school counterparts in this venture. One more thing that should be considered is, these initiatives are software centric, i.e., they emphasis the learning of a specific set of software tools. Otherwise, the students learn ‘about the computers’ and not ‘learn by or with the computers’.

2.5 Need for Developing Multimedia Learning Package

Past surveys (Malhotra, 1989) indicate that most of the instruction in polytechnic is mostly teacher-centered. The teacher uses verbal mode of passing information. The urgent need is to utilize the available infrastructure facilities and human resources for improving teaching effectiveness in polytechnic system.

Introducing new technology to this system can bring changes in the
education system. The multimedia has the power to change the process of learning. The word multimedia refers to the integration of multiple media such as text, sound, video, graphics and animation, which together can multiply, the impact of the message. It can also be defined as a class of computer-driven interactive communication system that creates, stores, transmits and retrieves textual graphic and auditory composite of information. The multimedia notion marks an improvement over the earlier traditional notion of “audio visual” media. Further, interactive multimedia refers to ability of the computer based media to control these components and interact with the user as needed. Multimedia or any other computer based information technology cannot be substituted for a presenter. It provides the presenter with a powerful tool that can greatly enhance communication by delivering multisensory experience.

2.5.1 Middle Level Technicians Training

In our country, Industrial Training Institutes (I.T.I), Polytechnics and Engineering colleges are the three kinds of technical institutions which train people to acquire technical skills. The I.T. I’s train the persons to acquire skill in certain basic technical areas. which include jobs such as wiremen, fitters, turners, linemen, tracers etc. The person acquiring such skill is called a craftsman (Tapas, 1997).

Polytechnics are also technical institutions but they are of a higher
level than the I.T.I’s. They may be called middle – level technical institutions. They offer courses of three year duration. Polytechnics train the students in graded manner and impart knowledge of principles of basic subjects like communication, science, mathematics, mechanics etc. to begin with. The students are also introduced to workshop, drawing room and laboratory. An elementary knowledge is provided of the specific branch of technology which the student has chosen. All these are done in the first year of the course. In the second and third years, advanced knowledge of the selected field is imparted together with necessary supplementary knowledge from relevant fields of study. The students are trained in practical skills also. Thus a diploma indicates that the student has acquired just essential theoretical knowledge combined with practical skill. This skill is of higher level than that provided by an I.T.I. The products of polytechnics are called technicians.

2.5.2 Multimedia and Theory Teaching

In the third semester curriculum of Diploma programme for technicians in Electrical and Electronics Engineering a subject “communication Electronics” is included. The curriculum contains a very important topic namely “fiber optic communication”. Students are required to study the concepts, principles, rules, and laws in this topic which lays theoretical foundation for other subjects, the students will be studying during the rest of the diploma programme.
The topic of fiber optic communication includes a number of concepts such as electromagnetic radiation, laws of reflection, refraction, refractive index, conditions for total internal reflection, propagation of radio waves, etc. They have to be taught by providing practical demonstrations wherever possible in order to understand the concepts clearly.

### 2.5.3 Multimedia and Learner Numbers

In the polytechnics in India, there are many constraints in providing practical experience for individual students. For every teacher, there are around 30 students to be taught and guided amidst limited laboratory resources for practical work. Individual interaction is a causality in theory as well as practical classes. In view of the above, there is a felt need for the development and use of multimedia learning package for facilitating students learning of concepts in electrical and electronics engineering. In general the fiber optic communication is not an exception to this situation.

### 2.5.4 Education System- Preferred Destination

The above considerations show that the educational institutions are the neediest destination for multimedia. Multimedia provokes radical changes in the entire teaching-learning process. Teachers can become facilitators, counselor in the process of learning instead of being primary providers of information; thereby the teacher will become secondary in the core learning
Multimedia learning packages are becoming substitutes for traditional teacher-centered methods.

2.6 Computers in Educational Systems

Computers and related technologies are now in most of the schools in all around the world. Advancements in technology are inevitably reflected in educational systems. In most of the developed countries education has been penetrated by information technologies (IT); schools have computers, a large numbers of teachers use computers and technologies while teaching and more over textbooks have some parts devoted to new technologies.

New technologies are integrated into disciplines and more disciplines are being influenced by the new technologies in an integrated way. Most of the educators and researchers try to use technologies in various subject matters, and this integration changes the nature, concepts and methods of work in each subject. For example, in Biological Science education, the way of teaching and learning the roles and functions of the most concepts have changed with the use of technology.

Although the wide-spread interest in computers as an instructional tool did not occur until the 1980’s, computers were first used in education and training at a much earlier date. Much of the early work which computer introduced in education was done in the 1950’s by researchers at IBM, who
developed the first Computer Assisted Instruction (CAI) author language and designed one of the first CAI programs to be used in public schools. Students followed the commands of the computer screen receiving rewards for correct answers within the framework of behaviourist approaches. In 1959, PLATO, the first large scale project for the use of computers in education was implemented by Donald Bitier at the University of Illinois (Cater, 2003. Atkinson and Suppes, 1959) work led to some earliest applications of computers at both the public school and university levels during the 1960,s. By the early 1980,s many educators were attracted to microcomputers because they were actively expensive, compact enough for desktop use, and could perform many of the functions performed by the large computers that have proceeded them.

The dominant use of computer-based instruction in the 1980’s was typified by the employ of “behavioral-based branching” software that based greatly on drill and practice to teach programmed content and/or skills. The educational software that ran on computers of the early 1980’s were at first based on Skinner’s “methods of branching”; first separating into small sections, rewarding combined responses and teaching connected facts. Although the learning in passive where learners do not work together with problems and content, research studies indicate that learner did advantage from the technology when the learning objectives were behavioral.
During the 1990’s, computers eventually started to have a major impact on instructional practices in schools. With the help of advances in technology and learning, science researchers consider learning with technology as means for construction problem-solving skills and for achieving learner independence. The cognitive approach to instructional technology emphasized “looking at how we know rather than how we respond, and analyzing how we plan and strategize our thinking, remembering, understanding and communicating” (Saettler, 1990, cited in http://www.ncrel.org/tplan/cbtl/toc.htm, 2003). Besides, students would also learn through playing games and simple simulations with the help of cognitive school of thought. The worth of using a word processor has been discovered by writing teachers and almost immediately students were using the advantages of word processor by writing, deleting, formatting and revising with effortlessness. Other subject matter teachers perceived the importance of the computer in creating a rich learning environment by using databases, spreadsheets, presentation and research tools. Since 1995, rapid advances in computer and other digital technology, as well as the Internet, have led to a rapidly increasing interest in and use of these media for instructional purposes (Reiser, 2001). Swiftly there was a volume of information obtainable to students with a network of people all through the world that improved communication and the exchange of thoughts. Additionally, distance education courses are offered and in this way students
in geographically isolated schools have extended learning opportunities in a diversity of subject areas. For example in United Nations, Kalu (2006) states “the proportion of instructional rooms with Internet access increased from 51 percent in 1998 to 93 percent in 2003”. Theoretical explanations could now be demonstrated and manipulated with the help of technology innovations. A complete innovative learning environment became possible.

Since the advent of the personal computers in the mid 1980’s computers have rapidly become one of the key instructional technologies used in both formal and informal. The computer’s role has changed because of two factors: first, it can provide rich learning experience for students and secondly, computer is giving students the power to manipulate depth and way of their learning. Furthermore, teachers can use the computer as an aid to manage classroom activities; it has a multitude of roles to play in the curriculum which can range from tutor to student tools.

Involvement in instructional computing in the school of education until the summer of 1979 can best be described as typical of other large universities. Prior to 1978 most computing in education involved statistical work on a large main frame computer or involved the requiring of computing background for these persons in a new select area in education, typically prospective Biological Science teachers in academic programmes emphasizing statistical analyses of data for research purposes. At the
undergraduate level only students preparing to be secondary Biological Science Teachers would have computing background. These students were required to complete at least one course in “Computing” usually completed by taking the first course in computing science which includes programming in the Pascal language, using batch interactive processing on a large main frame system.

The number of persons completing the secondary science teacher certification programme has varied between five and ten per year and has constituted about five percent of undergraduates in both elementary and secondary teacher education. About 60 percent of graduate students typically would make use of computers but this involvement was almost exclusively statistical analyses for class assignment and to a much lesser degree of research purposes.

2.7 Uses of Computers in Education

Arthur C. Clarke wrote “Development in the field of computers have been so swift that yesterday’s miracle is today’s obsolescent junk”. With increasing versatility of powerful computers, flawless software suites, and improved inter-connectivity, computers have enabled new creative applications in the management of information and communication.

A decade ago, computers in educations primarily meant the use of the
computers to assist and manage instruction, to conduct research, and to administer the school. Today, computers in education mean much more. Computers are interactive story tellers; excellent means to produce and present multimedia programme; vehicles for interactive communication among people; gate ways to the information world ‘electronic publishing medium; tools for managing and assessing instruction; resources for teaching and learning; virtual reality; and the private multimedia tutor.

2.7.1 Multimedia Kits and Package

**Multimedia Learning Kits:** Multimedia kits which incorporated a variety of media focusing on one topic became popular. However, with the advent of computers, the kits recorded to the background. There is growing interest in microcomputers.

The multimedia concept involves using multiple media for a given instructional purpose. It involves synthesizing different media into a structured systematic and wholesome presentation. Each medium in a multimedia system is designed to complement the others so that, ideally, the whole multimedia system becomes greater than the sum of its parts. MM system is multisensory and stimulates learning. The mm kit may include film strips, slides, auto tapes, records, still pictures, study prints, over head transparencies, maps, works sheets, charts, graphs, booklets, real object and models (Mann, 2007).
The multimedia kit clearly states the objectives and supported with suggested teaching strategies for using the materials. MM kits can even be prepared by teachers. It is important that the components of the kit be integrated that is, each component contributes to attainment of the lesson objectives. MM kit should be designed to teach specific knowledge and skills, they should involve the student in the learning process as he handles and manipulates the resource materials. It is used in making learning enjoyable as they are multisensory.

**Multimedia Learning Package (MMLP)**

“A multimedia learning package is self-instructional and contains a set of learning materials presented through suitable media organized in proper sequence to help a learner to achieve certain specific learning objectives”. A multimedia learning package uses more than one medium in presenting information. (Sivakumar, 2005)

**2.7.2 Essential Characteristics of Multimedia Learning Package**

Multimedia learning packages is a self-contained interactive instructional delivering of system consisting many channels of communication designed to fulfill explicitly stated objectives. The learner should be able to assess for himself the extent to which he has achieved the stated objectives through a self administered post test. The self tests within
the lesson are not in the usual sense. These tests are learner scored progressive tests and tell the learner whether he is ready to go ahead or need to repeat.

In order to keep the learner active during the learning process, worksheets, instruments, kits, equipments operate as part of the package.

Multimedia Learning Package Contains step-by-step instructions, purposeful learner activity, provision for self assessment and feedback invariably built in as the learner passes through the course of interaction.

2.7.3 Computer Aided Instruction (CAI)

In computer assisted instruction the student interacts directly with the computer which stores the instructional materials and control its sequence. Computer can facilitate most effectively the methods such as drill and practice, tutorial, gaming, simulation, enquiry and dialogue, discovery and problem solving, intelligent tutoring etc, computers can be used on time shared basis to perform any instructional function presenting materials or problem solving situation guiding a student’s thinking by answering his questions, assessing his performance, managing his path through a course by selecting the material to be presented.

2.7.4 Computer Managed Instruction (CMI)
Computer managed instruction (CMI) refers to use of a computer system to manage information about learner performance and learning resource options in order to prescribe and control individualized learning. It is a known fact that each student has different learning styles; with the help of computer one can solve this management problem by administering diagnostic tests, scoring it, prescribing appropriate next steps, monitoring the progress of student all the way along the learning steps, and maintaining records about student's progress.

2.7.5 Computer Based Instruction (CBI)

Computer based instruction includes a broad range of application that can be divided into the two general categories of direct instruction and instructional management. The computer is not in itself a technology of instruction. It is a tool that can be used to present programmed instruction, programmed tutoring and other instructional formats on demand of individual learners. Computers have extensive capacity to store and manipulate information, and its unmatched ability to serve many individual students simultaneously is widely used in instruction. The computer can also record, analyses, and react to student responses that are typed on a keyboard. There are two orientations of computer base instruction: computer assisted instruction (CAI) and computer managed instruction (CMI). Both the types together make computer based instruction (Kumar, 2003).
2.8 Content and Context for Multimedia Use

2.8.1 Nature of Content and Multimedia Use

Nature of content matters when we develop material for multimedia application. Teaching content where multimedia may be a suitable technology to use are:

1. Content which is difficult to visualize, such as microscopic processes, abstract concepts and events which cannot be repeated.

2. Content which is three dimensional, which is difficult to visualize using traditional two dimensional media such as books, black board and overhead projector.

3. Content which have dynamic processes, which require understanding of the relationship between moving objects. Content which covers broad contexts, where a number of ideas need to be linked to form an understanding of the whole, not just the parts.

5. Content which require simulation of expressive or complex processes, where understanding may be hindered by the mechanical details of performing the process. or where there is no possibility of using the real equipment is called virtual reality. (Philips 2001).

6. Content which has the random access capabilities of new technology are needed in order to give students control over the sequence of audio –visual content.

7. Content which involves concepts or skills that are difficult to teach by other means.
8. Content which has storage and random access capabilities of new technology are needed in order to give students control over a large volume of text.

9. Content where interactive capability of new technology is needed for students to be able to control the sequence of their learning activities.

10. Content which require interactive capability of new technology can be utilized to give students feedback on their actions in such a way that their knowledge or understanding is likely to be improved.

11. Content which require adaptive capability of the computer can be utilized to adjust the teaching to students learning needs. (Drewry, 1999).

2.8.2 Some Contexts for Multimedia Use

Some teaching contexts where multimedia may be a suitable technology to opt are:

1. Context where students need repeated and adaptive practice in processing in their responses events or tasks to enable them to acquire a degree of automaticity in a skill or their access.

2. Context where students need to be motivated to focus an adequate amount of attention, high level of concentration on subject matter content.

3. Context which improves access to instruction.

4. Context which complements a wide variety of learning styles.
5. Context that require non-threatening, allowing participants with varying knowledge and skills to obtain instruction in a more comfortable manner.

6. Context that enables individuals to choose a convenient time and place for learning.

7. Context that increases instructional effectiveness, because learners can review each topic as much as they need to, and do not have to progress to the next topic until they feel ready; that requires individual monitoring, assessment and immediate feedback to participants.

8. Context that results in increased retention because each learner has the same level of participation in the learning process.

9. Context that allows consistent, standardized presentation of material easy updating of materials and reduces training time and costs.

10. Context where there is increased access to education in subject areas a shortage of specialist staff.

11. Context where students have low prior domain knowledge or spatial learning aptitude.

12. Context where multimedia learning package can be used as supplement to existing or traditional methods of instruction.

2.9 Learning through Multimedia

For many, the typical classroom experience is a teacher imparting knowledge through lecture and presentation. This one-way communication
tradition has resulted in transmission of knowledge to the passive learners since the dawn of time. Yet, increasingly, it is being challenged. The present modern Educational technologies have the ability to go beyond this. One such method is Multimedia. Through multimedia, we can prompt the learner to contemplate information, perform tasks, refine thinking, and demonstrate understanding. Multiple modalities (visual, audio and animation) and active learning make this possible.

Most traditional textbook approaches to teach a particular subject favor a linguistic or narrative approach. Such an approach will fail to reach those who may respond better to an artistic or naturalistic depiction of the topic. In addition, it also fails to develop those other neural connections and pathways and enhance those intelligences. This is where technology-based interactive approaches incorporating video and audio (in other words, multimedia) allow education and, in effect, learning to reach more students and provide more opportunities for active learning.

At its best, multimedia presents subject/contents to students in a more memorable, interesting way than books or a single medium can. Multimedia addresses different learning strategies. Researchers have shown that students learn better and retain more when audio-visual aids are added to a lecture. And when they “learn by doing” they retain up to 70% more than they do by simple listening to a lecture.
Multimedia makes learning more active. Active learning involves putting students in situations where they must read, speak, listen, contemplate, think deeply, write, and respond. Bonwell and Eison (1991) have defined the following attributes of active learning:

- Students are involved in more than listening
- Less emphasis is placed on transmitting information, and more emphasis is placed on developing students’ skills
- Students are involved in higher-order thinking (e.g., analysis, synthesis, evaluation)
- Students are engaged in activities (e.g., discussion, writing, kinesthetic activities)
- Greater emphasis is placed on students’ explorations of their own attitudes.

Some of the advantages of interactive multimedia are,

- Interactive instructions are much more effective than conventional instructions.
- It allows practicing of already learnt procedures.
- It allows simulation for expensive or inaccessible equipment.
- Stand alone instructions for dispersed learners.

Multimedia can be defined in a variety of ways, but in the present research the term "multimedia" refers to an educational presentation made using the various media elements such as Text, Still Pictures, Video, Audio,
2.10 Elements of Multimedia

Multimedia processing means creating, importing, integrating, storing, retrieving, editing, deleting and analyzing two or more types of media materials in digital form, such as audio, image, full-motion video, and text information. Among the various elements of multimedia, each has its own influence on learning which was clearly indicated by the Dale’s cone of Experience (Edgar Dale, 1960). The features and characteristics of the multimedia elements are as follows:

Multimedia

Text Visual image Still Pictures Video Animation Audio Interactivity Navigation

2.10.1 Text

Text is the most widely used and flexible means of presenting information on screen and conveying ideas. The designer should not necessarily try to replace textual elements with pictures or sound, but should consider how to present text in an acceptable way based on learning/communication and supplementing it with other media. Text in multimedia presentations may be Fonts, Scanned Writing and hyperlinks etc. Hypertext is currently most commonly represented by electronic texts with cross-referenced, non-sequential links to the various components of a text or
2.10.2 Visual Images

As Kress (2003) observes, describing the difference between print and visual culture, “The world told is different from the world shown”. Visual is a media tactic with which we can learn the concepts/contents especially historical monuments and fronts very interestingly. The development of visual culture through a succession of representational technologies are photography, narrative and documentary film, medical and scientific imaging, television, video, virtual realities, and so forth. Visuals can be in the form of still picture, video or animation and graphics.

2.10.3 Still Pictures

Since the days of the caveman we have proof that ancient people have used pictures to communicate with each other. An image is a powerful tool because it can convey an idea without words. Pictures help to define the content. In presenting the historical concepts, images are extremely useful since they show exactly otherwise the students cannot imagine exactly. The images are not the most important, the content is. But the design drives the user’s experience of the content. It is the responsibility of the multimedia designers to present the content appropriately.

2.10.4 Video
Video is one of the important elements of multimedia presentations. It uses colour, onscreen motion with or without sound. However on a computer it can also help the user interact with the material e.g.,

- The Video can be stopped at any point of time
- Learner can go to various places on the video
- Learner can answer questions that are posed
- Select from various options that are presented by the interactive packages.

Video could be digitized form of live-action and could be enriched with animation. The video elements can combine many technologies such as film, computer-animation and stop-motion animation.

2.10.5 Animation

Wherever it is not possible to produce the real life video, simulations can be done with animations. An animated graphic showing any task may help the learner by adding a visual cue to textual material describing it operation. Animated graphics can be used as backgrounds, pictures, images, graphics, etc. Animation can enhance learning where a concept, incident, skill, etc., is demonstrated to the student.

2.10.6 Audio
Audio usage in the multimedia presentation can be in the form of narrative text, music, sound bits, background music, etc. Without obscuring information, audio can be used to supplement textual or visual information, allow users to use multiple communication channels. Commentary may a sense of the speaker’s personality which humanizes communication /teaching. Non-speech sound effects, or sound bits, are often used to signify the arrival of new information and for providing feedback. They include the often annoying sound that chimes when the user does something wrong. When using audio, however, the most important aspect to pay attention to is the quality of the sound. Good quality sound can substantially enhance the user’s experience; likewise, poor quality sound will affect the learning.

2.10.7 Interactivity

Interactivity is a critical attribute of technology supported educational environments. This term is used quite freely in current descriptions of learning materials but as Reeves (1995) points out, the term seems the unique domain of instructional technologists. The term, interactivity, describes the forms of communication that the medium supports enabling dialogue between the learner and the instructor (Jonassen, 1988).
With multimedia, interactivity is easily observed. As with human dialogue and communication, users are able to communicate with multimedia materials through established modes and the materials. It is an interesting exercise to consider where interactivity sits in the elements of instructional materials. Experience with the diverse forms of interactivity supported by multimedia cause many to consider interactivity as another discrete element of instructional materials. Interactivity refers to the actions by the user and the resulting responses and feedback from the computer. In a learning context, the claim is the higher the level of interactivity the more successful will be the learning experience.

2.10.8 Navigation

Navigation is a critical design issue in the development of multimedia, particularly in a learning context where the transfer of knowledge to the learner takes place. The gaining of such knowledge is closely linked to the student's learning style in a way they access the information available. Consequently, the navigational aspect should cater for a variety of learning styles as each user will have different requirements in the pursuit of knowledge. Brickell (1993) states “These differences may describe how they prefer to interrelate, which mode of navigation they prefer for accessing information, how they recognize new information, or the sequence in which
they prefer to gather the information”. The amounts of information to be presented, as well as the complexity of such information, are critical elements for the design of the navigation system to be employed.

2.11 Influence of Multimedia Elements on Learning

Electronic hypertext avoids the finality of traditional print and makes it possible to depart from the main axis of a text to explore other commentary, definitions, raw data, footnotes, audit trails, and referenced citations. Providing the information textually will improve the reading ability of the learner. In this sense, texts become less authoritative and more contingent and situated.

Researchers posit that explanations presented in words and pictures, as opposed to words or pictures, make for increased comprehension (Mayer, 2001) for the learner. Dale’s “Cone of Experience” (1946, 1996) provides evidence of these phenomena. Dale’s research suggested that increasing the modalities by which content was presented could increase retention rates. Visual learning is a proven method in which ideas, concepts, data and other information are associated with images and represented graphically. Visuals increase clarity of the concept. Visuals are good at gaining attention and usually have very high impact.

The main benefit of audio is that it provides a separate channel
(hearing) of information; different from display. It engages an additional sense of the learner while learning. Audio is very useful in teaching. When textual narration is given, students know how to properly pronounce particular words. For example, a French teacher may place audio on a Web site in order to teach users how to properly pronounce the words in French. The students will know exactly how to pronounce it. There are many situations in which teaching pronunciation is valuable. Audio can also add a sense of realism and draw attention of the learners.

Animations can graphically simplify complicated concepts and convey complex inter-relationships, which are difficult to visualize. Concepts and ideas, which cannot easily be represented in words or even through illustrations, can be easily created and viewed from different angles. Animation captures attention, and the information which is presented as a moving image is retained by the viewer for a longer time and with greater accuracy. Animation can also re-create an scientific event which cannot be seen in real.

The use of multimedia also allows the possibility of user input to make selections and choices. Interactive multimedia is always “learner-centered”. In interactive multimedia, the learner controls the experience of learning the material by being able to select among multiple choices, choosing unique paths and sequences through the materials. One of the key features of
interactive multimedia is the ability to navigate through material in whatever ways are most meaningful for individual users. The interactivity of these multimedia environments is a very important feature for learning. Interactivity makes it easy for students to revisit specific parts of the environments to explore them more fully, to test ideas, and to receive feedback. Non-interactive environments, like linear videotapes, are much less effective for creating contexts that students can explore and re-examine, both individually and collaboratively.

2.12 Significance of the Study

Traditionally, however, schools have not focused on technology as a means to support engaged learning. Several electronic media can be integrated for the sake of curriculum presentation enhancement and improved lecture comprehension. Today, educational researchers are calling for very different uses of technology. They promote classroom learning activities in which students work individually or in small groups rather than as a whole class. The technologies used in the classroom are not those designed explicitly to teach basic skills, but rather are real-world applications that support research, design, analysis, composition, and communication. These new technologies can provide meaningful learning experiences for students. The convergence of multi-media and network technologies aids the student in the completion of learning tasks and in access to educational
resources, both of which raise the effectiveness of learning. Extensive research into learning with technology provides conclusive evidence that people can, and do, learn from educational technologies.

The challenge for education is to design technologies for learning that draw both from knowledge about human cognition and from practical applications of how technology can facilitate complex tasks in the workplace. These designs use technologies to scaffold thinking and activity, much as training wheels allow young bike riders to practice cycling when they would fall without support. Like training wheels, computer scaffolding enables learners to do more advanced activities and to engage in more advanced thinking and problem solving than they could without such help. We used to believe that to know something means to have information about a topic in our own brain. This concept is now being deprecated in favor of a new meaning which states that to know is now equivalent to having access to information about a particular topic and knowing how to use it.

2.13 Need for the Present Study

This is clearly the moment to explore how new information technologies can be used to actively engage students in learning. Research in the area of learning effectiveness followed a predominant ‘paradigm’ by which researchers explained the children’s educational growth over time by variation in learning methodology, new techniques in learning and individual
intellectual and personal attributes.

At present, the science as a subject of study tend to be considered as non-utility subjects and are given importance than the other subjects. In reality, they provide the scientific skills required to adjust to an increasingly interdependent world, and to deal with physical, chemical and biological realities. It is believed that the science merely transmit information and are text centered and in order, lecture method is followed in most schools. Learning of any subject only through lecture method will neither attain the educational objectives nor meet the current challenges of education. This is worse in the case of science especially in Biological Science, since it is perceived as redundant subject. Therefore, this subject needs to focus on a conceptual understanding rather lining up facts to be memorized for examinations. This can be effectively done by the use of educational technology.

Among the vast alternative/supportive learning methods, Computer Based Multimedia will have positive impact on students’ ability to learn. Learning through multimedia is not practiced and not even acquainted in most of the Indian schools. With its newness, interactivity and multi-sensory approach, computer based multimedia will be a suitable alternative/supportive method for learning Science. Regardless of the fact that learning technologies provide many benefits to learning and education in general, there is lack of academic study including research on the
effectiveness of learning through multimedia in education.

2.14 Research Questions

Specifically, the current study attempted to answer the following questions;

i. Whether there is relative effectiveness of computer based multimedia packages on Biological Science in learning among secondary school students?

ii. Whether the effect of various elements of multimedia (text + still pictures, text + still pictures + audio, text+ still pictures + animation, text + still pictures + animation + audio) on learning Biological Science is same or different?

iii. Whether there is influence of certain intervening variables, Intelligence language aptitude, computer awareness, attitude towards science on learning outcome?

iv. Whether the interaction between different treatment groups and different levels of intelligence significantly effect upon achievement gain in Biological Science?

The present study tries to find out the possible solutions to these questions.