CHAPTER II

REVIEW OF RELATED LITERATURE
2.1.0 Programme Development Technology

Development of learning material that ensures learning through sequential interaction of the learner with it well established practical procedure. The approaches differ and hence differing approaches and preferred have resulted different stages of programmes.

2.1.1 Programmed Instruction and Programming Styles

Programmed instruction is concerned with the selection and arrangement of subject matter for learner interaction. It facilitates understanding and the ability to transfer knowledge to new situations, helps for retention and enhances the motivation of the learner. It is an explicit process which is designed to be self contained and self-sufficient so that the learner can progress through active interaction with the stimulus frames containing learning material. Programmed learning material is learning material organized to enable learning intended in the learner through interaction with the material itself. There are four major styles of programming:
Modern Programmed Instruction (P I) is normally associated with B. F. Skinner, the Harvard behavioral psychologist. While there were a number of programmed precursors to Skinner's method of programming, it was his influence which created the PI phenomenon of the 1950's and 1960's. His involvement is usually traced to his famous 1954 professional address, "The Science of Learning and the Art of Learning," in which he decried the traditional classroom instruction as being too aversive, too large, too negative, and improperly sequenced. His solution to these problems was linear programmed instruction. Unlike Pressey's "adjunct" programming, designed to supplement regular course study, Skinner's linear teaching programs were designed to replace traditional courses of study i.e. to function as an instructor for users with no prior knowledge of a subject. Skinner's Programmed Instruction required the user to construct an answer by filling in a blank with the correct response, rather than to select one of four
options as correct as in Pressey's machine. Filling in a blank is a recall type of learning because the user has to recall the answer from memory rather than merely recognizing it as in multiple choices. After filling in the blank, the user compares his or her answer with the correct one. (Chauhan, 1982)

The characteristics were designed by Skinner to overcome the classroom limitations stated earlier. Specifically, programme users learn without aversive threats, they work one step at a time, from simple to difficult, they work at their own pace, and they are frequently reinforced for their responses. Skinner's ideas regarding PI may not have been taken very seriously had it not been for the acute shortage of teachers in the 1950's in his country. This situation forced many educators to consider using PI as an alternative teaching method. The use of PI grew until the early 1960's, when low-quality programs flooded the educational market and gave many educators a negative impression of PI that lasted until the early 1970's. The most frequent complaints against the Skinnerian form of linear programming were that it was boring and monotonous, especially for capable users and that the level of learning being supported was rote and meaningless. Although many programs were challenging and of high quality, the complaints were
often justified. It is easier to publish poor programs than properly
developed, thoughtful programs as is evidenced by the bulk of drill-
and-practice microcomputer programs being marketed today.
(Ellison, 2001)

2.1.1.2 Crowder's Intrinsic Programming

Norman Crowder, a contemporary of Skinner, was working
independently for the armed services on programmed instruction.
He felt that a program was a form of communication between a
programmer and a user. Like any communication, the program
must be directed to the individual. Unlike Skinner, Crowder was not
working from a psychological perspective, but from a
communications point of view. In an intrinsic or branching program,
each frame presents more text than the average linear frame. After
reading, the user responds to an adjunct question, usually in a
multiple-option format. Unlike Pressey's auto-instructional
approach, which provides only confirmation of the correctness or
incorrectness of that response, branching style optional choices
lead users to optional forms of feedback, most of which is corrective.
If the user makes a correct response, the program asserts the
reasons why she or he was correct and moves on to new material. If
an incorrect response is made, the program, at the very least,
informs the user that an error was made and then branches the
user back to the previous frame for another try.
The primary purpose of feedback is to determine whether the communication was successful, in order that corrective steps be taken. (Crowder, 1960) Depending upon the complexity of the error committed, the program may initiate a remedial sequence of instruction, a practice designed to eliminate the learning deficiency. Branching instruction adapts the sequence of the program to a limited degree to fit the prior learning and processing capabilities of the user. The term intrinsic refers to the fact that all program options are intrinsic to the program and, therefore, not dependent on any external programming device. This approach is especially adapted to machine presentation, which provides for greater levels of adaptability. Branching texts tend to be large and confusing, especially when users try to access them in a manual way.

The primary difference between Skinner's conception of programming and Crowder's is in the function of the response. To Skinner, learning results from making the correct response. Contrary to this response orientation, Crowder believed that learning results from the realignment of the user's knowledge structure, and that the response is simply a means for controlling the program or machine. The larger chunks of information need to be assimilated and integrated with what the user already knows.
The response, he believed, tests the level of integration. This type of programming benefits the higher-ability user, who is more capable of higher-level integration of ideas, more than it does the lower-ability user. (Ellison, 2001)

2.1.1.3 Pressey's Adjunct Programming

The antecedents to 20th century programmed instruction are not well defined. The rhetoricians of democratic Athens in 400 B.C., and later the catechumens of the Middle Ages, approached an early counterpart to the small steps, sequential instruction, and question-and-answer pattern of 20th century programmed instruction. Their teaching procedures included the determination of subsequent instruction as a result of the user's answers to the questions. PI, however, is basically a 20th century phenomenon. In its current forms, its history comprises only 30 years. However, significant contributions were made by Sidney L. Pressey as early as 1915 in his efforts at the Ohio State University to build a simple machine for testing comprehension of material that had been taught. These crude machines presented multiple-choice questions to users while providing immediate knowledge of their results. Only later did Pressey conceive of their usefulness as instructional devices. It is important to note that these early teaching machines represent what Pressey called adjunct auto-instruction i.e. the use of test
questions presented after conventional instruction. This means that the machines were not integrated into the instructional material; rather, they were added to (or adjunct to) traditional instruction (usually text), much the same as adjunct questions. However, the seeds of programmed instruction had been sown.

2.1.1.4 Gilbert's Mathetics Programming

Thomas P. Gilbert (1962) was the originator of the concept of mathetics. According to him "Mathetics is the systematic application of reinforcement theory to the analysis and construction of complex behaviour repertoires usually known as subject matter mastery, knowledge and skills. Mathetics, if applied diligently, produces materials that exceed the efficiency of lessons produced by any known method," (Aggarwal. 1996).

Mathetics Process

In mathetics, an exercise is the technical unit of learning instead of a frame as in linear or branching programming. For example, instead of teaching addition before teaching multiplication, first the student is given a multiplication exercise and made to master the skill of multiplication. Instead of teaching what steering wheel and brakes are first the learner is made to try driving using the steering wheel frames are designed to have discrimination,
chaining and generation processes of learning in sequence. In
Skinnerian programming, the terminal behaviour is reached last. In
Mathetics, terminal behavior is practice first.

2.1.2 The Remediation Concept

Remediation stands for the steps taken to help a learner or
group of learners to remain same or similar diagnosed difficulties or
cure the troubles in learning. Nature of the problem or learning
difficulty and the content area give the remedial measures. Giving
more concrete examples the teacher can solve this difficulty. Thus
remediation becomes part and parcel of ones teaching in the regular
class room (Sharma, 1991).

2.1.2.1 The Context of Remediation

The slow learning pupil or the one who fails to learn basic
essentials creates major problems for the teacher. For the slow
learners remedial work must be such as to give close attention and
guidance in the early trials of any new kind of learning or with new
materials .The remedial program may consider for the slow learners
at some stage. The material Which is used has to be sufficiently
easy to guarantee success and yet it must be so designed as not to
insult the interests and self esteem of the older back child .The
longer backward child is left without remedial teaching the more
awkward does it becomes to span the gulf between his scholastic needs and his chronological interests (McFarland, 1958).

If faulty learning was cause of maladjustment then cures at to be some kind of remedial learning. A habit could be broken by establishing another habit it was this tendency to substitute habits which afforded Guthrie in his theory of therapy (Neel, 1971)

2.1.2.2 Techniques or Approaches to Remediation

There have been general techniques or approaches to remediation. These can be suitably adopted to specific topics or problem of all the techniques, programmed instruction has been the appropriate for variety of contexts requiring remediation. Remedial teaching is not repetition of earlier teaching in the class programmed Instruction, personalized system of instruction, modular approach, mastery learning, audio visual instruction, multimedia approach techniques are useful practice. And effective for remediation of learning difficulties in different subject areas (Sharma, 1990), for students who had not met the mastery on a try at any examination remedial instruction.
Might be provided by following techniques described:

1. Small group study succession in which 2 or 3 students have difficulty get together to go over there errors and help each other and rectifier
2. Individual tutoring
3. Suggestion that the student read the material
4. Provision of alternate learning material such as workbook.

2.1.3 Selecting a Programming Model

There are two key decisions to be made in taking MMLP development. First, opting for a suitable programming model. In other words, should the instructional sequence be essentially linear in structure, or should it employ some form of branching? Let us look at some of the possible structures that are available within these two basic paradigms.

The second key decision that has to be made by any one who is design self-instructional materials of any type, whether these are paper-based, media-based or computer-based, is the type of presentation mode that is to be employed. This decision appears later in this thesis.
Simple Linear Model

Programming in the Skinnerian approach involves small steps, constructed response and overt reinforcement by way of correct response recognition. A hybrid model with provision for branching out at response error prone points can involve linear type, large steps or even adjunct material to help or remedial learning. This has the form shown in Figure 1, the learner starting at frame 1 and working systematically through all the following frames until the end of the programme is reached.

\[
\text{START } 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow \cdots \cdots \cdots \cdots \rightarrow 0 \rightarrow 0 \rightarrow 0 \rightarrow 0 \text{ END}
\]

*Figure 1: A simple linear programme structure*

Skip-Repeat Model

Such instructional programmes are relatively simple to design, but make no allowance for the fact that some learners are capable of mastering material much more quickly than the 'average learner' for whom the programme is probably intended, whereas others are much slower, requiring exposure to far more frames than the average learner before they are capable of mastering a particular set of material.
One way of overcoming the above problems is to incorporate 'wash ahead' and 'wash back' into a simple linear structure. The process known as 'wash ahead' enables fast learners to miss out some of the frames in a linear programme. 'Wash back' is the opposite process, and enables slow learners to be made to repeat part of a programme if they have not succeeded in mastering the material.

**Branching Model**

Even when they incorporate wash ahead and wash back, linear programmes make no allowance for the fact that different learners may require to be exposed to different types of frame in order to master particular material, since people not only learns in different ways, but also make different sorts of mistakes.

Some of the elements that can be incorporated into a linear programme in order to turn it into a simple branching programme are shown in Figure 2.

![Diagram](https://via.placeholder.com/150)

*Figure 2: Some of the basic structural elements that can be built into a simple branching programme.*
Branching Suitable for Remediation

One of the key features of most branching programmes is the use of remedial frames, one method of using which is illustrated by frames A, B, C and D in Figure 2. Here, the gate frame for the group (frame A) sets the learner a task of some sort usually a multiple-choice question. If the answer is correct, the learner is simply directed to the next frame of the programme proper frame B; if the answer is wrong, on the other hand, the learner is directed to an appropriate remedial frame either frame C or frame D in this case, and, after being told why the answer is wrong, is directed back to the gate frame to try again. (Ellington, 1996).

Hybrid Model

There can be variety in learning experience in the branches. Branches may involve linear large step or even adjunct text. Adjunct programme involve reading material that more often than not improved breadth of learning. When combined with a branching programme this can be conveniently employed for remedial purpose in the branches.
2.1.4 Process of Instructional Programme Development

Process of instructional program development involves certain common steps which are followed in all types of programming styles.

Stages of program development are

1. Preparation
2. Program writing
3. Program tryout
4. Program Evaluation

2.1.4.1 Preparation Stage

This is the most important stage in writing a program. This stage has following steps

(a) Selection of the topic/unit
(b) Writing assumptions about the learner
(c) Writing objectives in behavioral terms
(d) Defining prerequisite knowledge and skills in behavioral terms
(e) Preparing criterion referenced test
(f) Developing specific outline of the content to be programmed
a) **Selection of the Topic/Unit:**

Laysaught and Williams have suggested the following to be considered.

1. Field of specialization
2. Ease
3. Length
4. Level of difficulty
5. Logical order of material
6. Special student needs

(b) **Writing Assumptions about the Learner**

Characteristics of the learner have to be specified before writing the program. The general characteristics of the learners are important to the design of the instruction. These characteristics might include special interest, maturation level, attention span and so on. This is essential as the program is meant to help learner with specified characteristic.

1. Age and gender
2. Skills and interests
3. Cultural background
4. Intelligence level
Apart from this, the programmer could use his experience to know the abilities, skills and interests of the learners. Cumulative records, diagnostics tests, intelligence and achievement tests may also be used to write assumptions about the learner.

**c) Writing Objectives in Behavioral Terms**

After identifying objectives it is essential to formulate objectives in behavioral term. According to the Mager (1962) an instructional objective is “an intent communicated by statement describing a proposed change in learning”. Most objectives in the cognitive and all the objectives of the psychomotor domain are amenable for such formulation in terms of behaviour.

Objectives serve as the basis for developing testing instruments used to gauge the effectiveness of the instruction. The objectives guide the designer in selecting content and developing the instructional strategy. Therefore, objectives are critical to the design of instruction.

*Objectives represent and state the terminal behaviours to be reached upon completion of the program.*

**d) Defining Pre-requisite Knowledge and Skills in Behavioral Terms.**

In order to prepare a list of pre-requisite skills, a study on a representative sample of learner for whom the program is being
developed should be conducted. It is necessary to determine not only the specific knowledge and skills students must have in order to use the program. These are stated in the form of entering behaviours.

**e) Developing Criterion Referenced Tests.**

According to Glasser and Nitko (1971) “A criterion referenced test is one that is deliberately constructed to yield measurements that are directly interpretable in terms of specified performance standards”. Based on the objectives written programmer then develops assessment instruments which are parallel to and measure students' ability to achieve the described objectives. The major emphasis is placed on relating the kind of behavior described in the objectives to that which is required in the assessment instruments. The CRT's and the program both should represent the same set of objectives.

**f) Developing a List of Content.**

It is necessary to develop a suitable content sequence, which would go with the program. For this content analysis has to be carried out. The content is analyzed into units are broken down into their elements. These units are arranged in logical sequence taking
into consideration (i) structure of unit or topic (ii) learning types (iii) instructional strategy/condition.

Unless these three factors are specified, the designer will be unable to decide how best to proceed with the presentation and organization of the material to the learner. A task description and behaviorally stated objectives contain important clues to help the learning system designer identify task related concepts, principles, and perceptual motor skills which must be mastered by the learner in order for him to do the task. The task description provides a schematic outline of how a task is performed, but it does not specify all the special content and conditions that will influence how the task will actually be carried out in real life nor can the task description develop all of concepts and principles one will have to know in order to perform the task. The task description tells how a task is performed. The task analysis deals with the question of how it shall be thought to whom when and where once the task deception or the objectives are written. A task analysis is conducted in order to answer such question as these;

1. What types of learning are involved in the objective or the task?
2. What entry skills do the learners already possess?
3. Under what condition will the task have to be performed or the learning demonstrated?

4. What are the characteristics of the learner? Age? Sex?

2.1.4.2 Writing a Program

To write a program appropriate strategy has to be decided. This includes 1) Size of frame 2) Mode of response 3) Types of prompts 4) Provision for correct response.

Apart from these, in writing a program the following factors also have to be considered. (1) Entering behaviors (2) Content structures (3) Strategy of instruction (4) Terminal behavior.

Writing of frame involves selection of suitable stimuli from and sequence of presentation.

The frames are of five types in every chunk of the program.

a) Introducing frames
b) Teaching frames
c) Practice frames
d) Review frames
e) Testing frames
These frames refer to major stages in a lesson or face to face classroom teaching. Once the program is written it has to be revised and edited.

2.1.4.3 Tryout and Modification

Testing of the program is done in three phases namely;

i) Individual tryout

ii) Small group tryout

iii) Field tryout

i) Individual Tryout: - This is a frame by frame. There is a face to face interaction between the learner and the programmer at this tryout stage. It enables the programmer to study the reaction of learner. The programmer can locate the stumbling blocks in the program by asking the learner the difficulty he encountered while responding to the frame.

ii) Small Group Tryout: - In this step the programmer determines whether the program succeeds in bringing desirable gains in learning. The tryout involves pretest, program, and posttest sequence. The programmer statistically analyses the data collected in terms of errors rate, sequence progression, program density and gain percentage.
iii) Field Tryout: Here the program is tested in substantial strong 
the (i.e., on a number of learners). Its utility is measured during the 
stage. The objective of the field testing is to pinpoint the specific 
areas in program which need improvement. The data obtained is 
analyzed in terms of error rate. Program density and logical 
sequence program to improve the quality and logical sequence of 
frames.

2.1.4.4 Programme Evaluation

The data thus collected are analyzed to locate the drawbacks 
or deficiencies or errors in the programme of frames, parts and 
decide on their subsequent retention, modification or rejection.

Analysis of data was done with respect to following:

1. Calculating error rate for all the frames of five modular units
2. Calculating the gain percentages of pre and post tests of the five 
   modular units.

Error Rate of the Programme

Analysis of error rate was done on the basis of responses 
obtained for each frame. if the learner response was wrong or if no
response was provided for a particular frame, then it was considered as an error. The error made by the five individuals on all frames in each module was counted. Total number of errors counted on the responses was divided by total number of responses in the program multiplied by number of individuals to whom the program was administered. This ratio was multiplied by 100, so as to find the percentage error rate.

The formulae is expressed as

\[
\text{Error rate in percentage} = \frac{E_r \times 100}{T_r \times N}
\]

Where  

\( E_r = \) Total number of errors.  
\( T_r = \) Total number of responses in the programme.  
\( N = \) number of individuals.

**Gain Percentages of the Pre and Post test of the Programme**

McGuigan and Peters (1965), suggested that best criterion of a program Effectiveness is the gain ratio between amount of learned and the amount that could possibly be learned As explained in case of small group tryout. Gain ratio is found by dividing mean gain between the pretest and post test scores by the mean possible gain defined as
The difference between the mean full score and pre test scores. This can be expressed in percentage by multiplying by 100, the formula is

\[
\text{Gain percentage} = \frac{\text{Mean}(\text{post test score} - \text{pre test score}) \times 100}{\text{Maximum possible score} - \text{mean pre test score}}
\]

### 2.2.0 MMLP Development Technology

The term multimedia means different things to different people. For some people, multimedia means that a person sits at a computer terminal and receives a presentation consisting of on-screen text, on-screen graphics or animation, and sounds coming from the computer's speakers- as with an on-line multimedia encyclopedia. For some people, multimedia means a “live” presentation in which a group of peoples seated in room views images presented one or more screens and hears music or other sounds presented via speakers. Watching a video on a TV screen can be called a multimedia experience because both images and sounds are presented. Another example of multimedia is a PowerPoint presentation in which someone presents slides from a computer projected onto a larger screen and talks about each one. Even low tech environments allow for multimedia, such as a “chalk and talk” presentation in which someone writes or draws on a
blackboard or uses an overhead projector while presenting a lecture. Finally, the most basic form of multimedia is a text-book lesson consisting of printed text and illustrations.

Is multimedia a noun or an adjective? When used as a noun, multimedia refers to a technology for presenting material in both visual and verbal forms. In this sense, multimedia means "multimedia technology"- devices used to present visual and verbal material. When used as an adjective, multimedia can be used in the following contexts:

Multimedia learning- learning from words and pictures, Multimedia message or multimedia presentation-presentation involving words and pictures, or Multimedia and instructional message or multimedia instructional presentation (or multimedia instruction)- presentation involving words and pictures that is intended to foster learning. (Mayer, 2001)

2.2.1 Multimedia Building Blocks

In this section we will discuss the following multimedia (MM) building blocks.

(1) Text
(2) Sound
When studying each of these elements, think about how they could be integrated into a MM presentation. Their integration however must follow a logical structure based on the psychology of learning.

(1) **Text**

Text is one of the most widely used MM building blocks. The intensity of text usage depends greatly on the purpose of the program we can use and display text in different forms for different purposes. These are some possible features which can be utilized to make texts interactive.

- Titles
- Buttons
- Bullets
- Paragraphs
- Scrolling text

In a multimedia application

- Plain text mainly used in a descriptive or explanatory manner.
- Hot words are used for navigational or other interactive purposes.
Animated text is used to attract the attention to a particular slogan.

Text delivers key information in a MM presentation and helps the audience to navigate amongst topics. Today text and the ability to read it are doorways to power and expected and necessary skills within most modern cultures with the recent explosion of internet and world wide web, text has became more important than ever.

(2) Sound

Sound is perhaps the most sensuous element of multimedia. It is meaningful “speech” in any language from a whisper to a scream. It can provide the listening pleasure of music, the starting accent of special effects, or the ambience of a mood setting background. Some feel good music powerfully fills the heart generating emotions of love and elevating listeners closer to Heaven.

Sound complements a presentation with music sound effects, and narration that add emphasis create a mood communicate a complex ideas on screen graphics or incorporate audible responses into an interactive presentation.
Sound is typically stored in three file formats:

(1) The wave audio format

(2) The musical instrument digital interface (MIDI) format and

(3) The CD audio format.

The sound format we choose depends on the type and quality of the sound we want to play and amount of storage space you can allocate to sound files.

**Wave Audio Files (WAV Files Extension)**

Wave audio is named after the sine waveform in which this type of sound is displayed. Wave audio is used for narration music and sound effects because wave audio files represent an actual recording they may contain any type of sound.

To create a WAV file

- Analog sounds are recorded with a microphone.
- Converted into digital format. The conversion process is called sampling or digitizing.
- Stored on a hard disc, CD-ROM, or floppy disk.

When a WAV file is played, the sound card plays it through the attached speakers or headphones.
Sound Forge 7.0 version is used for recording the sound in computer and microphone is used for recording. The recorded sound will occupies more space in hard disc, these files are edited and sampled i.e., reduced its size, using Music joke box software (MP-3 converter) these sound files are imported into Director Movie and placed into cast and score window.

3. Graphics


An ancient Chinese saying states that a picture is worth of a thousand words. If we apply this saying to the development of multimedia application, it could be as follows. A graphic in a multimedia application can be more appearing and meaningful than a thousand text characters. The selection of the graphic, sound, pictures and text to be integrated in a multimedia application is critical for its success.

People often learn and retain more information from pictures than from other forms of information. This is a function of their learning styles. Learning styles are the various methods individuals
have for perceiving and processing information while reacting to their environment by properly selecting the most appropriate media combination, the message or goals of the application can be effectively accomplished.

Graphics are created using macromedia flash software. Line diagrams and pictures are created using Adobe photo shop software, and animation is created using Flash software these files are published and imported into director movie.

2.2.2 Multimedia Attributes

Multimedia computers are turning to be very efficient. As such, the computer has attracted and integrated with it more attributes than the living being. Manual handling of information today is inferior to computer based multimedia computers can

**Attributes Software Use**

**Text Attribute**

Text used for multimedia can be created using M.S. Word Software than these files are pasted on director screen.

**Graphics**

Graphics like screen colour, texture, visuals are created using director software buttons are created flash and imported into director movie.
Sound Attribute

Sound can be used in multimedia learning package many purpose, Echo, fade-in, fade-out, background music, feedback, motivation purpose, narration of screen text, sound forge software is used for recording of sound.

Voice Attribute

Pre-recorded voice clips can be used in multimedia. Voice of great teacher, play back singer voice can be used in the movie.

Speech Attribute

Narration of frame texts can be played when the frame appears on the screen. Speech is synchronized with text.

Multiple Levels of Engagement

Digital technology has made it possible to collect, process, analyze and store information with astounding speed and allures. Humans are Multimedia Communicators. We experience our world throughout series and express our needs and desires with a complex variety of verbal and visual signals. A study conducted by Dr. Albert Mehrabian, a specialist in interpersonal communications
at university of California, found that word alone (Verbal) account for 7% of the impact of face to face communications. Vocal communication, associated with characteristics of the voice such as tone and inflection, accounts for 38%. Visual Communication including facial expresser and gestures, accounts for 55% of the total impact.

2.2.3 The Strengths of Interactive Multimedia Learning Package (IMM) in Education

1. Mixed Media

By definition multimedia has a mixture of media, including animations and digital video. These affairs advantages in teaching situations over monomedia resources. Such as Black board, Audio cassettes, A particulars advantage is the possibility of using the most appropriate medium for the required message, example, texts for thoughts, graphics for spatial relations and animation for dynamic information. It should be emphasized that video and TV also have mixed media capabilities, but the degree of user control available in IMM.
2. User control

Most IMM has the ability to allow users to take their own path through the material and the potential to build up their own knowledge. A student's control learning approach is becoming increasingly important in the 1990s because the rate of change in technology means that employers will continually need to reskill themselves in a situation of lifelong learning (Philips, 2001).

The potential of user control not realized at present because little is understood about the nature of a user interface which provides the user with control while at the same time encouraging deep learning.

3. Simulation and Visualization

IMM is especially suited to simulation. Many tertiary curriculum areas require understanding of complex, abstract, dynamic and microscopic processes. Simulation allow students to visualize the process and construct mental models. Cognitive scientists use the term "Mental Models" to describe the understanding of such a system and their use in explanation and prediction. Important characteristics of understanding these processor complex processes are especially hard to visualize using
typical education technology, such as black board, OHP transparency, which is two dimensional and static.

4. Different Learning Styles

IMM has the potential to accommodate people with different learning styles. A learning style can be defined as “the individuals’ characteristics ways of processing information, feeling and behaving in learning situations” (Philips, 2001).

Investigating learning styles can be of some value, on matter how different styles are described. Because it is important that we as a learners and as a teachers are able to extend our range of learning strategies, adopting different strategies helps students to become more flexible in their mental processing rather than being limited to their so-called style.

Interactive multimedia has the potential to create a multisensory learning environment which supports specific learning styles and at the same time encourages students to move out of their particular style as much as possible however, much more research needs to be done in this area before this potential is realized.
2.2.4 Advantages of Multimedia

Multimedia directly addresses the problems of information overload and overtaxed attention spans. It confronts bottom-line considerations of productivity and sales revenues, even as it offers above-the-line solutions for enhanced communication, learning and decision making (Lindstron, 1997). The hallmark of effective multimedia is-

- Enhancement of the text material quality and multisensory approach.
- Dynamic, time based information.
- Feedback and interaction.
- Customization and targeting.
- Delivery to remote students.
- Reducing lecture load.
- Flexibility and change ability.
- Creativity and Experimentation.
- Effective evaluation platform.
- No fear of teacher, ridicule or criticism.
- Avoid day dreaming.
Keep in mind from the beginning of our exploration into MM that its power does not stem from the addition of one medium or another. Its power is synergistic. Just as it takes many instruments playing in concert to produce a symphony. The artful combination of media elements characterizes MM as a new and advantageous communication concept.

2.2.5 Principles of Multimedia Message Design

Richard Mayer (2001) states seven research-based principles for the design of multimedia messages:

1. **Multimedia Principle:** Students learn better from words and pictures than from words alone.

2. **Spatial Contiguity Principle:** Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.

3. **Temporal Contiguity Principle:** Students learn better when corresponding words and pictures are presented simultaneously rather than successively.

4. **Coherence Principle:** Students learn better when extraneous words, pictures, and sounds are excluded rather than included.
5. **Modality Principle:** Students better from animation and narration than from animation and on-screen text.

6. **Redundancy Principle:** Students learn better from animation and narration than from animation, narration, and on-screen text.

7. **Individual Differences Principle:** Design effects are stronger for low-knowledge learners than for high-knowledge learners and for high-spatial learners rather than for low-spatial learners.

### 2.3.0 Computerization of Multimedia Learning Package

**Authoring Languages**

Traditionally, programming was related to a small group of technical experts. Now, with more powerful computers, programming is becoming easier for the ordinary computer user. Most multimedia applications are now produced using visual programming languages which allow users to draw graphical objects directly on screen and control them quite simply. This type of authoring language considerably eases the process of developing interactive multimedia applications. All of the popular multimedia development environments like Macromedia Director, Authorware Professional, Allegiant Super Card and Asymetrix Tool Book can be categorized as visual programming languages.
2.3.1 Multimedia Authoring Tools

Multimedia authoring tools provide the important framework need for organizing and editing the elements of multimedia project, including the graphics, sounds, animations and video. Authoring tools are used for designing interactivity and user interface, for presenting project on screen and for assembling multimedia elements into a single, cohesive project.

Authoring software provides an integrated environment for binding together the content and functions of project. Authoring systems typically include the ability to create, edit, and import specific types of data; assemble raw data into a play back sequence or cue sheet; and provides a structured method or language for responding to user input.

2.3.1.1 Types of authoring tools

According to arrangement of various authoring tools based on metaphor used for sequencing or organizing multimedia elements and events (Janatha, 2000).

1) Card or page based tools.

2) Icon based, events driven tools

3) Time based and presentation tools
Card or Page Based Tools

In these authoring systems, elements are organized as pages of a book or a stack of card. Thousands of pages or cards may be available in the book or stack. These tools are best used when the bulk of content consists of elements that can be viewed individually, like the pages of a book or cards in a card file. The authoring system. Let's link these pages or cards into organized sequences. Learner can jump, on command, to any page user can wish in the structured navigation pattern.

Card or page based authoring system allow user to play sound elements and launch animations and digital video, card and page based authoring systems provide a simple and easily understood metaphor for organizing multimedia elements.

Because graphic images typically from the back bone of a project, both as navigation.

Menus and as content, many developers first arrange their images into logical sequences or grouping similar to the chapters and pages of a book or cards in a card catalog. Navigation routines become, then simply directive to go to a page or card that contains appropriate images and text and associated sounds, animations and video clips.
Page based authoring systems contain media objects are buttons, text fields, graphic object, back grounds, pages or cards and even the project itself. The characteristics of objects are defined by proportion. Each object may contain programming script, usually a property of that object that is activated when an event such as a mouse click related to that object occurs. Events cause messages to pass along the hierarchy of objects in the project; for example a mouse click message can be sent from a button to the ground to the page, and them to the project it self. As the message travels, it looks for handlers in the script of each object; if it finds a matching handler, the authoring systems then executes the task specified by the handler.

Most page based authoring systems provide a faculty for linking objects to pages or cards by automatically programming branching go to statements for navigating by mouse clicks, but learning to write your own scripts and understanding the message passing nature of these authoring tools is essential to making them perform well. Following are the some typically object hierarchy of the hyper card, Meta card and tool book authoring system to go to the next card or page when a button is clicked. User would place a message handler into the script of that button. Here is an example in hyper talk and Meta talk;
(i) On mouse up (ii) Go to next card (iii) End mouse up.

Here is an example in open script (Tool book):

(i) To handle button up (ii) Go to next page (iii) End button up.

The handler, if placed in the script of the card or page, will execute its commands upon receiving a "mouse up" or "button up" event message occurring at any location on the card or page - not just while the cursor is within the bounds of a button.

Most card or page based authoring systems require a specified intermediate file that also receives a scripted message handlers and acts as a responding for special routines and resources that are available to all projects being executed by application. Card and page based systems typically provide two separate layers on each card; a background layer that may be shared among many cards, and foreground layer that is specific to a single card.

2) Icon-based authoring tools

In these authoring systems, multimedia elements and interaction cues called events are organized as objects in a structural frame work or process. Icon based, event driven tools simplifying the organization of project and typically display flow diagram of activities along branching paths. In complicated
navigational structures, this charting is particularly useful during development.

Icon based, event driven tools provide a visual programming approach to organizing and presenting multimedia. First build a structure or flowchart of events, tasks and decisions by dragging appropriate icons from a library. These icons can include menu choices, graphic images, sounds and competitions. The flow chart graphically depicts the project's logic. When the structure is built, you can add the content, text, graphics, animations, sounds, and video movies. Then to refine the project, edit the logical structure by rearranging, and fine-tuning the icons and their properties with icon-based authoring tools. Non-technical multimedia authors can build sophisticated applications without scripting. By placing icons on a flow line, you can quickly sequence events and activities, including decisions and user interaction. These tools are useful for storyboarding, as you can change sequences, add options, and restructure interactions by simply dragging and dropping icons. Authorware provides structural and navigational plans of entire projects using icons.
3) Time Based Authoring Tools

In these authoring systems, elements and events are organized along timeline, with resolutions as high or higher than 1/30 sec. Time based tools are best to use when you have a message with a beginning and an end. Sequentially organized graphics frames are played back at a speed that can set. Other elements such as audio events are triggered at a given time or location in the sequence of events. The more powerful time based tools. Let program jumps to any location in a sequence, there by adding navigation and interactive control. In multimedia authoring systems, multimedia elements and events are after treated as objects that live in a hierarchical order of parent and child relationships.

Messages passed among these objects order them to do things according to the properties or modifiers assigned to them. Time based is popular multimedia authoring tools. Each uses its own distinctive approach and user interface for managing events overtime. Many use a visual time line for sequencing the events of a multimedia presentation, after displaying layers of a various media elements or events along the scale in increments as precise as one second. Others arrange along he sequences of graphic frames and
add the time component by adjusting each frame’s duration of play.

2.3.1.2 Macromedia Director

Macromedia’s director is a powerful and complex multimedia-authoring tool from macromedia with a broad set of features to create multimedia presentations, animations, and interactive multimedia applications. It requires a significant learning curve, but once mastered, it is among the most powerful of multimedia development tools. In director you can assemble and sequence the elements of your project using cast window and score windows.

Cast Windows

The cast is a multimedia database containing still images, sound files, text, patterns, Quick Draw shapes, programming scripts, Quick time movies, Flash movies, and even other Director files. Not only can you import a wide range of data types and multimedia elements formats directly into this cast, but you can also create multimedia elements from scratch using Director’s own tools and editors.

Score windows

Once imported or created the multimedia elements for project and placed them into cast window, tie these cast members together
using the score facility. Score is a sequence for displaying, animating, and playing cast members, and it is made up of frames that contain cast members, tempo, a palette, timing, and sound information. Each frame is played back on a stage at rate specified in the tempo channel. The score provides elaborate and complex visual effects and transitions, adjustments of color palettes, and tempo control.

**Lingo scripts**

Director utilizes Lingo script, a full-featured object oriented scripting language, to enable interactivity and programmed control. A built-in script editor offers lingo debugging facilities. Because you can attach scripts to individual elements of the cast, you can copy and paste complete interactive sequences. Lingo also uses Extras, which are special code segments used to control external sound and video devices. Several Extras and extensive examples of their use are shipped with Macromedia Director (Tay Vaughan, 2002).

**2.3.2 Screen Design and Organization**

**2.3.2.1 Screen Design**

Stemler (1997) while making a review of educational properties of multimedia presents a number of implications useful
in screen design. Screen design is an issue of great significance for multimedia design in many different subject areas. Mukhedee and Edmonds (1993) broaden the traditional perception of screen design to include the coordination of textual and graphic elements to present sequenced information in order to facilitate learning. **While specifics of the content may vary from one situation to the next, each instructional screen in a multimedia package must provide effective instruction, appropriate navigation tools, and visual aesthetics, regardless of content.** An environment which accepts to aesthetic principles may do much to increase the learning experience. In addition, the quality of the design of elements on the screen may lead to better performance by retaining the interest of the learner. Screen design plays the same role as "gaining attention" in Gagne's events of instruction model. It serves as the internal cognitive structure that prepares the stage for learning, orienting the learning to the objectives and stimulating the recall of previously learned information.

Screen design has a crucial role in the delivery of information to the learner. Well designed screens should allow for maximum learning from the materials while providing the learner with appropriate control of the learning process. Effective screen design
causes learners to develop and maintain interest in lesson content, promotes the engagement of the learner with the material, and help deep processing of important information. Screen designs should aid the user in the complex process of taking the information out of the program and integrating it into his or her own conceptual knowledge base, providing cognitive benefits in the user’s ability to perceive, organize, and integrate information (Hannafin and Hooper, 1989).

For effective learning, screen design decisions should reflect balance among learner characters, content factors, and processing requirements of the learning task. All visible aspects, including the design and location of text, the graphics frame protocol, and various beautifying application methods are considered relevant screen design factors. The primary recommendation is to keep the screen as simple and uncluttered as possible because presenting too much information at one time can be confusing and overwhelming. Ipek (1995) claims that information in some multimedia software is presented in a format that must be read. Reading speed and reading rate are important learner characteristics to consider in the development of multimedia modules. Hannafin and Hooper (1989) reviewed the literature about
screen design and found that text is read more slowly and understanding is lower when it is read from the computer screen rather than from print based media. People read text on a computer screen at a rate 28% slower than reading from a book. It is recommended that developers utilize as many screens as needed and not fill individual screens with text information.

Many researchers have recommended displaying relevant information in chunks using screen buildup or window overlays and limiting the quantity of information presented to a few items per screen. Chunking separates a sentence into phrases or idea units.

Well designed screens should visually excite, be easy to read, and exhibit no annoying or distracting features. Generally, it is suggested that no more than two or three types and sizes of fonts be used per screen. Highlighting of text helps to control selective perception and focus attention on identified information (Hannafin & Hooper, 1989). Flashing is distracting and, because it makes text difficult to read, should never be used for text presentation. Titles and headings should be centered, while text should be left justified and mixed with upper and lowercase letters for higher readability and faster reading. The use of graphics instead of text is also recommended when possible.
Another important aspect of screen design is the location of various components on each screen and the consistency of those locations throughout a program. Certain parts of the screen should be associated with specific tasks such as titles or headlines, operational instructions (navigation buttons), feedback, input/output, and areas for help or a glossary. In other words, for various purposes within the program there should be consistent, functional screen areas that vary only slightly from one screen to another as a student goes through the module.

Rambally and Rambally (1987) suggest the following guidelines with regard to content of screen information: (a) place questions and important messages in central part of the screen, (b) provide key information at prominent locations, (c) provide critical information at the beginning of a message, and (d) place prompts or navigational buttons at the bottom of the screen.

Macromedia director 8.5 enables screen design expectations suitable for sequential presentation and necessary interactivity. A screenful of organization of matter using Macromedia Director 8.5 incorporates the dynamic operational learner control features.
2.3.2.2 Interaction and Feedback

"Interaction" Stemler (1997), while making a review of educational characteristics of multimedia states, Interaction is commonly viewed as stimulus response reinforcement encounters. Action is an integrated form of between the learner and instruction. Interact two of Gagne's events of instruction, eliciting and assessing performance. Hannafin (1989) promotes cognitive engagement in interactive multimedia through the use of fault free questions, queries, real time responding, note taking, predicting/hypothesizing, hypertext, and cooperative dialogue. Interactivity, actualized through purposeful selection of information, can positively affect learning. This means incorporating strategies that cause the learner to code, organize, integrate, elaborate on, or transform information. Weller (1988) states that an instructional software program should be designed with specific learning outcomes in mind. The instructional events of the lesson, with which the learners must interact, should be based on a model of events of instruction that are related to a known organizer for their thinking similar to Gagne's nine events of instruction. Research has shown that it is important to design as much meaningful interactivity as possible into multimedia software.
Orr, Golas, and Yao (1994) give the following guidelines for increasing interactivity in multimedia programs:

1. Provide opportunities for interaction at least every three or four screens or alternatively about one per minute.

2. Chunk the content into small segments and build in questions (with feedback), periodic reviews, and summaries for each segment.

3. Ask as many questions as possible without interrupting the continuity of the instructional flow. Ask a question after, but not immediately following, the related content. Ask students a question that they can answer based on previously learned knowledge. Ask students to apply what they have learned rather than memorize and repeat answers.

4. Use rhetorical questions during instruction to get students to think about the content, to stimulate student’s curiosity, and as a natural transition between frames.

5. Consider designs where the learner is not presented with information in a linear format, but rather discovers information through active exploration in the program.
Feedback is information about the appropriateness of the learner's response that is given to the learner by the courseware. Feedback is an important variable that is often ignored in multimedia software. Feedback can be defined as output, usually displayed on a screen; to tell students how successful they have been in solving problems or to provide information about the quality of their response to a test like event. Gagne described his seventh event of learning as "providing feedback about performance correctness" to establish reinforcement of relevant performance and prevent further inappropriate performance. Several factors can determine the effectiveness of feedback. Examples include the type of feedback given, the frequency of the feedback, and the delay between the feedback and the instruction. Feedback should provide occasional motivational messages, as well as information about the correctness and/or appropriateness of the response. The challenge is to try to anticipate typical mistakes the learner might make and then create a feedback segment which mimics how a good instructor would respond in each case.

Feedback is a method to reinforce, explainfully, and clarify. However, Hannafin (1993) state that feedback can narrow the learner's focus to only the content covered in the question feedback
cycle. Feedback needs to emphasize information that is conceptually relevant than explicitly or absolutely "correct." Orr, Golas, and Yao (1994) give the following guidelines for feedback:

1. Keep feedback on the same screen with the question and student response.
2. Provide feedback immediately following a student response.
3. Provide feedback to verify the correctness. For incorrect responses, give the student a hint and ask the student to try again.
4. Tailor the feedback to each learner’s response.
5. Provide encouraging feedback; however, do not provide the type of feedback that may encourage a student to make an incorrect response on purpose just to see the feedback.
6. If possible, allow students to print out their feedback.

Macromedia director 8.5 enables learner interaction with learning content on the screen like filling up blank space with response, checking the response, and moving forward and backward in the programme.
Storing programme responses, pre-test and post-test data and retrieving performance data. Whenever the learner needs can be easily done using macromedia director.

The director provides immediate feedback on whether students response is correct or incorrect, the learner goes to remedial branching frames.

2.3.2.3 Navigational Methods

"Navigational Methods" Stemler (1997) in his review of educational characteristics of multimedia states. Learners become easily confused and disoriented in complex interactive multimedia modules. Search (1993) indicates a need to develop interfaces with orientation cues that help users navigate through large multimedia information. Navigation and management features serve to enhance learning and make an interactive multimedia module easy to use. Navigational elements give a program structure, perform housekeeping chores in the program, and provide the learner some control over events. Clearly defined procedures for navigation should be provided within the system and for accessing on line support. **Navigational item location should be consistent throughout a program so a student does not have to search for**
the buttons. A screen design template should be established and used consistently. Kensworthy (1993) stated that keeping the keys in the same locations throughout a program helps to build confidence in the learner.

While specific options can vary significantly from one program to the next, an effective screen design often includes buttons or hot spots to quit the program or to access the next screen, previous screen, help screens, glossary, and main menu. A navigational control panel can be a useful device. This often appears as a small control panel positioned at the bottom of a screen display. To give more complete control of the program to the learner, carefully selected words or icons should be used with navigational keys in the program. Universal icons like play, stop, and pause for video or audio clips should be used when possible. Users recognize these icons and associate them with something they already know, rather than having to learn new, abstract concepts. Within an interactive multimedia module, one button is often used to access a progress chart or map showing a student's location in the program. This map serves as a table of contents for the entire program and provides an opportunity for students to jump to new sections or revisit information from an earlier screen. A representation of the map is
usually in the form of a tree structure, showing the current location of the learner and its hierarchical association with the rest of the program. A very useful control device for interactive programs is a global escape routine or exit button. The escape routine is designed to allow the learner to exit the program at almost any point. Help segments offer additional information which enriches ideas originally presented in the core instruction. They include some background or detail that most learners will not need. By clicking or touching a target, the learner is given access to elaborative or tangential material, permitting the learner to follow interests and construct his or her own learning experience.

Macromedia Director 8.5 provides several navigational methods such as linear, hierarchical, and mixed hierarchical. Buttons are used for navigational purpose, Home, Next, check, back, and Quit buttons are used. Menus are also used for selection of sub units, and user response data is used for conditional branching.

There are a number of possible navigational schemes in multimedia, as well as different techniques to implement them. Each has its advantages and disadvantages. In practice, several of these schemes may be mixed in a single project (1) linear (2)
Hierarchical 3) mixed Hierarchical.

1. Linear Structure

The linear structure of information is the easiest conceptually and in some ways the most natural, gives that this the structure in which most other types of presentations, such as lectures, books and videos are prepared and used. One advantages of the linear structure is that content can buildup by piece by piece. In some cases the limited control over navigation may be desirable, but material, which has to be presented linearly like this is probably better, treated in a medium to which it is suited, such as a book or video. The linear structure is most commonly implemented through a page turning metaphor.

2. Hierarchical

One of the most significant advantages of using computers to present information is that it is relatively easy to set up a structure to access rapidly any piece of available information at will. This is usually achieved through a hierarchical structure, with topics, sub topics and sub-sub-topics etc.
The hierarchical structure is relatively easy for content providers to conceptualize, because it is something regularly done in organizing content for presentation. It is common to divide the subject matter into subtopics, to reduce the complexity of the content into digestible chunks. A hierarchical structure is often implemented through menus and submenus. An advantage of the hierarchical structure paradoxically encourages a linear progression, through the content, because the user tends to start at the top menu and follows each branch of the hierarchically sequentially.

3. Mixed Hierarchical

The most common navigational scheme mixes the linear and hierarchical modes. In this way, the user can quickly get to a given topic, and then linearly move through the topics. This structure mimics that of a book, with chapters and sections which are read sequentially. The mixed hierarchical structure has some of the advantages of its component structures. The content provider can build up an argument and user and the user can readily access the information. However, there is little user control, other than being able to go to different topics at will. The user still has to view the material as the designer dictates, and the usual menu structure
encourages the user to start at the beginning and keep going. Another problem is that if the hierarchy has too many levels, it becomes difficult to know where you are within the program, which can hinder understanding (Philips, 2001).

2.3.2.4 Learner Control

Stemler (1997), discussed issue of learner control in his review of educational characteristics of Multimedia. The topic of learner control is central to the design of interactive in instruction. The term learner control has been defined and used in a number of ways in the literature, including content to learn, context within which to learn, method of presentation, provision of additional content, sequence in which to learn, amount of practice to undertake and or the amount of time devoted to practice items, and the level of difficulty of the instruction and or exercises. Greater control over the learning event promotes satisfaction. Consequently, students feel more responsible for their own learning process.

Guided Vs. Lesson Control

Prior knowledge, learner ability, the use of structural guidance, and procedures for monitoring lessons all influence the effectiveness of learner control environments. Although the findings
are inconsistent, learner age and ability have been found to affect the extent to which learner control strategies can be effectively applied (Hannafin, 1984). Older students and more able students perform more effectively under guided learner control; younger and less capable students perform best under lesson control Hannifin stated,

"Guided learner control is demonstrated in lessons where individuals control the path, pace, and/or contingencies of the instruction, typically by specifying choices among a range of designer embedded options. Lesson learner control is defined as instruction in which all learners follow a predetermined path established by the designer without exercising individual judgements as to the appropriateness of the path."

Low ability students are especially confused when control depends on a wide range of options. They do not have the mental models and schema necessary to investigate a program efficiently and effectively. Laurillard (1987) suggests that learners should be given more control over the content, access to the content, and interaction with the multimedia content. One way multimedia can
give control to the learner is by providing the ability to navigate through programs at the learner's own pace and ability level. One student may learn all the intended information rapidly and never need to branch for review or remediation), where others will want to review previously presented material. It is suggested that complex programs should advise students about the sequencing and provide some form of coaching to assist learners in making informed decisions. Litchfield (1993) states that students feel more confident with advice about control selections because it helps them make better choices. Instructional components should be clearly identified and separated to facilitate learners' selection and sequencing according to their needs and interest. One way this can be achieved is by the use of menus. A menu offers several choices for instructional segments, and the viewer is permitted to select topics for presentation or skip over topics. Limiting the number of choices on the screen helps direct the learner to the appropriate path. Orr, Golas, and Yao (1994) have compiled the following learner control guidelines:

1. Provide the learner control of the sequence when (a) lengthy instructional sequences must be completed by the student in no specific order, (b) students are familiar with
a topic and are able to make appropriate sequence choices, and (c) the training is for cognitive strategies or higher order problem solving tasks.

2. Do not provide sequence control to students in a situation where the materials have a specific prerequisite order.

3. Provide learner control of content when (a) students have significant

4. previous knowledge of the content; (b) students have higher ability; (c) there is a high probability that students will succeed in learning the content regardless of the chosen content; (d) cognitive strategies and higher order problem solving are being taught; (e) the skills are not critical, the training is optional, and student motivation is high. Do not provide full learner control of content when all topics in the instructional presentation are required for successful completion of the program and there is a hierarchical order to the materials.

Jones provides the following guidelines for browsing:

1. Provide selectable areas to allow users to access information.

2. Allow users to access information in a user determined order.
3. Provide maps so that users can find where they are and allow provisions to jump to other information of interest from the map.

4. Provide users with feedback to let them know that they must wait when significant time delays are required for the program to access information.

5. Provide users with information that lets them know that they are making progress.

6. Arrange information in a non threatening manner so that users are not overwhelmed by the amount of information contained in a program.

7. Provide visual effects to give users visual feedback that their choices have been made and registered by the program. Exploration and discovery learning approaches have demonstrated educational worth in certain circumstances. However, multimedia researchers contend that very little learning occurs when students are left to explore information on their own with no guidance.

2.3.2.5 Color

The use of color in multimedia modules can be effective, but also should be considered carefully. Color should be used scantly,
because the more color that is used, the less effective it becomes. Color is most effective when used consistently for cueing and highlighting; it direct student attention to important points or relationships. A consistent color scheme should be used for the entire presentation. A number of authors; Orr et al., 1994) have recommended specific guidelines for using color. These recommendations include (a) using a maximum of three to six colors per screen; (b) being consistent in color choices within a program; (c) using the brightest colors for the most important information; (d) using a neutral gray or pastels as a background, since it recedes optically; (e) using significant contrast between text and a background color to provide a higher degree of text readability; (f) always using dark letters on a light background for text; (g) avoiding the use of complementary colors (e.g., blue/orange, red/green, violet/yellow); and (h) using commonly accepted colors for particular actions (e.g., red for stop or warning, yellow for pause or consider, green for go or proceed). Very hot colors (such as pink and magenta) should be avoided since they may appear to beat on the screen.

2.3.2.6 Graphics

Multimedia software can easily present information in either text mode or graphics mode, but, when possible, both should be
used. Students who do not understand information delivered by text quite often will understand it if it is presented or augmented by various visuals. In particular, difficult topics sometimes become easier to understand when augmented by graphic displays. Photos and scanned images can be used to illustrate almost any fact, concept, or procedure. Learning tends to be strongest when pictures supply excessive information, supplement information that is unclear or incomplete, or supply additional coding stimuli. Information presented in text is often better recalled and retained when supplemented with pictures. Graphic icons or still photos can enhance menu screens by illustrating the menu choices. Kensworthy (1993), indicates that text based instructional strategies from books often reappear in the form of pictures or graphics in multimedia training. When freed from the constraints of text, questions often become more simulation oriented and focus on what the learner should be able to do with the information. Caution should be exercised when using graphics for decoration or cute effects; used in this manner, graphics can become tiresome and/or interrupt the flow of the lesson. Graphics are also used to represent icons and indicate to the user that a choice is available. Left and right arrows indicate that users may go to the "next" and "previous" pages; hooked arrows indicate that a return to the previous menu
is possible; question marks may represent the availability of on line help; and directional arrows may offer users the chance to see a map to help decide where they want to go.

2.3.2.7 Animation

Most graphics or pictures can be animated to illustrate points, teach facts or concepts, motivate students, and demonstrate procedures. Animation can serve motivational and attention getting functions, but no extra learning effects can be attributed to the use of animation. Animation is use, however, both for the explanation of dynamic processes and for increasing the impact of presentation. While research has shown no significant difference in the use of static graphics versus animation, it is generally recognized that the use of animation can offer many subtle benefits such as highlighting key information, heightening student interest, and facilitating recall. When the animation is congruent to the learning task, it can offer instructional benefits to the learners.

2.3.2.8 Audio

Many multimedia programs rely on text as a critical instructional component which poses difficulties for poor readers. Text based information is easy and inexpensive to develop and has
minimal computer memory requirements. Nugent (1982) found research that pointed out that audio has obvious advantages for presenting simple material to younger children with undeveloped reading skills. Orr, Golas, and Yao (1994) state that research data indicate that students find it easier to complete lessons which use audio extensively to present information. The combination of visual presentation with audio explanation delivers information in an easily understood format. For example, audio can be used to explain icon choices with the choices highlighted as they are explained. Audio could also be used to explain further the findings from x statistics screens that present a range of data in bar charts and pie graphs. Audio should be designed so that the learner can interrupt the audio at any time and continue the program. Whenever audio is used to support text, it is important to provide a way for the learner to pause or repeat the sound. Poor readers may want to go through a text passage more than once, or may want to pause the audio to study an unfamiliar word. Research reviewed by Ipek (1995) found that prerecorded readings of teacher-directed instructions in multimedia modules were effective because (a) they focused only on the most important information necessary for understanding the text, (b) they included direct and explicit instruction, and (c) students were familiar with this type of traditional. Orr, Golas, and

86
Yao (1994) list the following recommendations for audio use in multimedia software:

1. Use audio for the primary presentation of the program content when the message is short, simple, and requires immediate student response or if the target audience has poor reading skills.

2. Do not allow audio to interfere with reading from the text and vice versa.

3. Do not let audio compete with video presentation.

4. Do not put a lot of text on a single screen. Research data indicates that students find it easier to complete lessons which use audio extensively to present information. Students generally prefer not to have to read long text passages on a screen.

5. If audio is used, provide students with headphones.

6. Tell the student only what is relevant. If the message is too long, break it into chunks separated by instructional activities.

Orr, Golas, and Yao (1994) also suggest the following techniques for creating scripting narrations:
1. Visualize the images that will be presented on the screen during the narration.

2. Use style and tone appropriate to students' language ability, subject matter, and knowledge and vocabulary.

3. Write the script for the ear and not for the eye.

4. Keep the language simple, use the active voice and be direct.

5. Watch out for acronyms, technical jargon, and unfamiliar terms.

6. Make the transition from one concept to another clear.

7. When possible, provide a corresponding visual for every piece of narration.

8. When using visuals, avoid long pauses in visuals while waiting for extended narration to finish.

9. Alternate male and female voices to provide variety and maintain audience attention.

2.3.3 Preparation of Story Board

Screen design discussed earlier section is typically referred to as story board in macromedia Director 8.5 terminology. Once the selection of authoring software has been completed, work begins with the content of the program that is related to what actually goes into screen. The story board defines all the resources required for
each screen. As discussed earlier text, sound, pictures and animation. Story board developed on drawing sheet and textual program frames can be cut and pasted. Story boards for each unit, sub-units have to be prepared. Such a story board requires to keep what is presented is free from content, grammatical and technical errors. The following are the important features of a story board.

a) **Key graphics:** the graphics that shows the layout the screen.

b) **Frame number:** a unique number for the frame.

c) **Media lists:** a listing of each media element to be used in the frame and its corresponding file name.

d) **Interactivity:** a description of the interactive options to be available for the frame.

e) **Scripts:** voice scripts and video scripts to be used for the frame may be shown.

f) **Speaker notes:** a script or outline of what the speaker will say as the frame appears.

2.3.4 Computer Based Management of Data during the Program

One important facility is to gather and use data on student interactions, in the form of mouse clicks, topic visits and use of navigational tools, as the students use the multimedia package. The
data can be logged to a file with a date and time. They can be replayed to replicate the students learning process. They can be analyzed via some other utility to show what actually occurred. Using this facility can give valuable insights into how the students learn in the multimedia environment. For example, this might show that student never used help facility, or that some key topic areas were never visited by students because the navigation environment was unclear, or that students repeatedly clicked the mouse because the system response was too slow and they were not sure if their first mouse click was recorded.

Clearly, it is important to identify what questions are being addressed when designing data collection. There is little point in collecting large volumes of data and then trying to decide what to do so them fishing for an answer is not an effective approach.

The carbohydrates program contained a novel, built in auditing facility. Student progress was recorded as they moved from screen to screen. The navigation method they used and the time spent on the screen were recorded in text file. (Srinivasan, 2002).

The carbohydrate program was managed using Author ware, which provided for recording and management of student
interactions during the programme. Likewise, Macromedia Director 8.5 also has such provision to record, maintain and manage student data by creating output files for storing the students’ performance data in text files.

2.4.0 Research on the Effectiveness of Multimedia Learning Package

Major trends in multimedia research

In multimedia research, the latest trend is to view all isolated media together in a computer based environment available with the advent of multimedia computers and internet. Mona Massood (2004), reviewing the status of adoption and use of instructional technology cited Molenda et. al. to suggest major trends of research and development in the field: (a) incorporation traditional audiovisual media into instructional mainstream, (b) incorporation of computer-based media into instructional mainstream, (c) application of advanced interactive technologies, and (d) growing interest in learner – centered, inquiry –based instruction. In studying effectiveness, Molenda recognizes a shift. The shift is towards patterns of use and their consequences. Molenda et al. (1998, 2000, 2001, and 2002) have attempted to track the diffusion and use of instructional
technology in various sectors using quantitative data. Their study was a continuing project and an ongoing survey of activities in the field. Molenda et al. (1998) examined trends related to media and technology in the realms of formal education and corporate training and development. Among the issues discussed was incorporation of traditional audiovisual media into the instructional mainstream, incorporation of computer-based media into the instructional mainstream, application of advanced interactive technologies, and growing interest in learner-centered, inquiry-based instruction.

As a follow up to the 1998 survey, Molenda and Harris (2000) reported that the rapid emergence of new technological developments, the convergence of previously distinguishable media into digital format, and accompanying changes in the affected businesses, made it increasingly difficult to be sure what the issues were and what entities should be measured. The shift was towards patterns of use and the consequences of those patterns of use. (Masood, 2004).

2.4.1 Multimedia Learning Package Development Studies

Fu-Jen (2007) conducted the study on “teaching in a multimedia computer environment to study of the effects of learning
multimedia in enhancing divergent analytical thinking skills. **Zahide** (1999) conducted research on “Comparison of hypermedia and traditional instruction on knowledge acquisition and retention”.

**Srinath** (2005) conducted research on the topic “Development and validation of computer assisted self learning package on pedagogical competencies for teachers of computer applications programme”.

**Gyselinck** (2000) conducted research on visuospatial working memory in learning from multimedia systems”. **Daniels, H. L.** (1996) conducted research on “Interaction of cognitive style of learner control presentation mode in hypermedia environment”.

**Sivakumar** (2005) conducted research on “Development and validation of computer based multimedia learning package on electromagnetism”.

### 2.4.2 Multimedia Learning Package Comparative Studies

**Fu-Jen** (2007) investigated the presentation effects of texts, oral narration and computer animation implemented in an instructional lesson, and to examine individual difference which affect students learning in a multimedia computer environment. For this purpose, four courseware versions, namely, animation +Text, animation + voice, animation +Text +voice, and free choice versions
were developed to study the interface effects. Hwa et. al. (2007) in his developmental study, examined the different types of feedback in language multimedia courseware in English “subject verb” agreement. Investigator incorporated three types of feedback namely, knowledge of results (KOR), knowledge of correct response (KCR), and elaborated feedback, (EF). The moderator variable for this study was student’s locus of control, which comprised two levels, namely, internal and external locus of control. Haddan (1995) compared the learning effects of 16 second year chemistry students studying a six week course. He developed multimedia courseware on molecular spectroscopy and compared learning from multimedia and conventional lectures through the examination of academic ability and learning; and assessed the attitudes, motivations and criticisms of students towards both conventional and multimedia teaching methods.

Antonious et. al. (2004) make a study to evaluate learning of badminton low serve through the use of multimedia learning package and traditional lecture method in physical education. In his Experimental study, Jones (2001) studied the effectiveness of multimedia learning package on historic French passage using multimedia modules. Students used key word annotation and verbal
annotation to lookup helpful information to accompany the aural text. Depending on their treatment type, students received no annotation, visual annotation, verbal annotation, or both. Lawis (2002) studied the effectiveness of multimedia learning package on human relation course. The experimental group was taught using animated Power Point Presentation Lectures, while the control group was taught using traditional lecture method. Fear and Hirscbuhal (1997) studied the effectiveness of multimedia learning package on environmental science. The treatment group received the instruction using interactive multimedia learning package, while control group received the instruction used by traditional lecture method. Aly et. al. (2004) studied comparison of the two methods of teaching - One group is taught by interactive multimedia and other group is by lecture method regarding knowledge, understanding and transfer of content as well as problem solving skills in orthodontics. Sukoor, M (2001) focussed on the effectiveness of interactive multimedia learning package based on students design preferences in non academic domain content with an aim of enhancing student’s divergent, analytical thinking skills in a collaborative learning environment. Yildirim (1999) in his study, compared hypermedia learning with traditional instruction on knowledge acquisition and retention. Gyselinck (2000) conducted a study on the integration of
verbal and pictorial information both presented visually. The investigation looked at the comprehension and memory processes of student-learning on a series of physics concepts static electricity, gas pressure etc. through the computer assisted presentation of text associated with illustrations. Daniels, H. L. (1996) conducted research to examine the relationship between cognitive style and the provision of learner control of presentation mode in an educational hypermedia environment. In order to provide two versions of hypermedia program necessary for this study “The 88 vote” was reconfigured to contain all necessary multimedia resource from videodisc as a part of the hyper card stack. The program control version of “The 88 vote” contained the original multimedia presentations from the video disc and the multiple-channel presentation from the originally contained in super card stack. The multimedia presentation in the learner control version was broken down in to separate single-cannel messages and store along with the multiple channel messages. In the treatment version of “The 88 vote” the user was able to select a single or multiple channel message presentation whenever user clicked on a topic button.
2.4.3 Samples Employed in the Past Studies

Fu-Jen (2007), while studying the effects of learning style, Gender and Mathematics achievement, employed a sample of 175 seventh grade students of eighth class of rural junior high schools. Among the 175 students, 89 students were in the field independent (FI) group and 86 students were in the field dependent group.

Hwa et.al. (2007) studied different types of feedback in a language multimedia course. He employed the samples of 134 students of mechanical Engineering branch in Malaysian Polytechnics. The students were randomly assigned to three treatments groups.

Haddan (1996) while studying the effectiveness of multimedia learning package on topic in chemistry employed a sample of 16 second year chemistry undergraduates of a six week course in molecular spectroscopy. The 16 students were randomly allocated to two equal groups. A control group (taught via conventional lectures) and an experimental group (used package developed by the investigator). While studying web based intelligent multimedia tutorial for high stakes achievements tests, Arroy et. al. (2004) employed a sample of 190 students. In the first study 95 students
were involved in rural area school. And in the second study, 95 students were involved in an urban area high school.

Antonious et. al. (2005) employed a sample of 45 students of physical education in his study - “Using multimedia as instructional tool in physical education”. Group one (G1) and Group two (G2) consisted of 16 students and Group three (G3) consisted of 15 students. The Group (G1) had been taught low badminton serve only with use of multimedia through computers, while the second group (G2) taught with traditional method of teaching with the use of multimedia through computer. And the third group (G3) had been taught low badminton serve with the traditionally on the badminton court.

Daniels (1996), while studying “integration of cognitive style of learner control of presentation mode in hypermedia environments”, employed a sample of 122 high school students studying in three different schools.

Zywno et. al. (2003), while studying “hyper media instruction and learning outcomes at different levels of Bloom’s taxonomy of cognitive domain” had a sample of 159 Electrical Engg. Graduate course students taught by conventional lecture method and another

Jones (2001), employed the 171 students studying in second semester B.A. French

Lewis (2002), employed 50 under graduate students, enrolled in two-sections of a human relations course. A coin toss was used to determine, which class would be the experimental group ( ) and which class would be the control group ( ). (Animated power point presentation) (traditional method). Frear and Hirsembuhl (1997) selected a sample of 152 students studying in an Environmental Science course at a Mid-western university. There were 133 students in the control group and 39 students in the experimental group. Aly et.al. (2004) selected a sample of 26 students in final year dental course while studying “Instructional multimedia program versus standard lecture: a comparison of two methods for the undergraduate orthodontic curriculum”.

100
Sukor (2001), selected a sample of 233 students in experimental group, and 81 students in control group in a study on “An evaluation of the effectiveness of interactive multimedia to enhance divergent analytical thinking skills.

Sanjeevkumar (2001) in a study on “Effectiveness of modular curriculum in the subject of science in relation to classroom environment” had a sample of 300 students of class IX students of Government model senior secondary schools of Chandigarh. 135 students were taught traditional curriculum and another students were taught the modular curriculum.

Chouhan (2006) while studying “Coping strategies for stress and adjustment among diabetics” used a purposive random sampling technique to get 90 subjects for his study.

Sharma and Sansanwal (2001) while studying “Comparison among video based instructional strategies for teaching science at IX level in terms of achievement”, employed 115 students studying in IX class CBSE Kendriya Vidyalaya, Indore

Sivakumar (2005) while studying the “Development and validation of computer based multimedia learning package on Electromagnetism”, employed a sample of 461 of third semester
Electrical and Electronics Engg. from three different types of polytechnics.

2.4.4 ANOVA as a Method of Analysis

In a good number of media studies ANOVA has been employed to make effective comparisons.

Fu-Jen (2007) employed ANOVA in his analysis on “Teaching in a multimedia computer environment- A study of the effects of learning style, gender and math’s achievement”. Hwa et. al. (2007) employed (3×2) quasi experimental factorial design in his study on “A study on different types of feedback in a language multimedia course”.

Daniels H. L. (1996) employed (3×2) ANOVA in his study on the interaction between field dependency and learner control of presentation mode.

Arroyo et. al. (2004), comparing web based intelligent multimedia tutoring system and lecture method employed 2×2×2 design to study the interaction effect. ANOVA was used for analysis of data.
Antonious et. al. (2005) in his developmental study in physical education using multimedia employed ANOVA.

Lewis et. al. (2005) making an analysis of “the impact of teaching with technology on student learning, multimedia self-efficacy and teacher evaluation”, used ANOVA to compare the experimental and control classes to examine the hypothesized changes.

Sukor (2001) while comparing the experimental group and control group in his study on “An evaluation of the effectiveness of interactive multimedia to enhance divergent analytical thinking skills used ANOVA with non-randomized control group, pre-test and post-test.

Susan Walsh (2004), employed ANOVA in his study on “Effectiveness of audio in screen captures on software application instruments”.

McCann (2006) conducted an ANOVA based study on the relationship between learning style, learning environments and students success. A (4x3) factorial design ANOVA was used this study using post-test only control group design.
Gyselinck et. al. (2000) while comparing “visuospatial working memory in learning multimedia system”. ANOVA was used for analysis the data.

Srinath (2005) while studying “Development and validation of computer assisted self learning package on pedagogical competencies for teachers of MCA programs” used ANOVA for analysis of data.

Sanjeevkumar (2001) while studying “Effectiveness of modular curriculum in the subject of science in relation to classroom environment”, used through pre-test, post-test experimental design. Two way (2X3) ANOVA and t-test were used for analysis of data.


Sharma and Sansanwal (2001) studied to Compare video based instructional strategies for teaching science at IX level in terms of achievement. ANOVA was used for analysis of data based on post test only control group design. The data were further analyzed through Duncan’s Multiple range test in order to know
which group mean of achievement in science is significantly higher than other.


2.4.5 Findings in respect of Programming and Multimedia Attributes

Fu-Jen (2007) in his study, developed four courseware versions on the topic of “Forces and the results of forces” in physics. These involved the concepts of motion and trajectory. The lesson material was divided into five major parts (1) Force equilibrium, (2) Motion of forces, (3) Calculation of the results of forces, (4) Introduction of resultant forces through parallelogram, and (5) Review and practice questions. The four courseware versions were created for the purposes of this study. These four versions were: 1) Animation + text, 2) Animation + voice, 3) Animation + text + voice, and 4) A free choice version. The instructional content was the same for all versions. Only the presentation media differed.
The present study examined three media factors: text, voice and computer animation, because using the media in combination is more consistent with current presentation strategies applied in today’s computer assisted instruction.

The results indicated that the subjects in the animation with text and with voice version got the highest post test scores. Furthermore, field independent students performed better than the field dependent students.

Hwa et. al. (2007) studied three versions of a “subject verb agreement” courseware, which is one of the topics in the English language grammar course. The versions which were identical except for the types of feedback embedded in the practice were developed and used in this study. There are three types of feedback in computer based instruction (1) Knowledge of results (KOR)-this feedback informs the learner whether the response is correct or incorrect. (2) Knowledge of correct response (KCR)-this feedback informs the learner what the correct response to a question should be. (3) Elaborated feedback (EF)-This feedback provides and explanation as to why the learners response is correct or incorrect. There are two types of locus of control namely the internal locus of control and the external locus of control. Students with the internal
locus of control exercise control over their life by the choices they make. The external locus of control in the other hand are characterized by belief that their destiny is controlled by powerful others. Forces outside their control, luck and other unpredictable forces. It was found that there was a significant difference in the performance of students who received EF, KCR and KOR feedback. Students who received EF performed significantly better then students who received KCR feedback as well as those who received the KOR feed back. The finding of this study also revealed that students with the internal locus of control achieved better scores then the students with an external locus of control.

Daniel H. L. (1996) This study examined the relationship between cognitive style and the provision of learner control of presentation mode in an educational hyper media environment. "The 88 vote", is published by ABC news interactive and addresses various aspects of presidential elections using the 1988 presidential election as a back drop for the concepts involved. The program consisted of hyper card computer program which contained text and graphics. It controls a videodisc which contains the multimedia resources for the program. In order to provide two versions of the hyper media program used necessary multimedia resources from
the videodisc as a part of the hyper card stack. The program control version of "the 88 vote", contained original multimedia presentation from the video disc and the multiple channel presentations originally contained in the hyper card stack. The MM presentations in the learner control version were broken down into separate single channel messages and stored along with the multiple channel messages. In the treatment version of "The vote 88", the user was able to select a single channel or multiple channel message presentation, whenever he or she clicked on a topic button.

Data analysis revealed no correlation between field dependency and frequency of MM selections. This study found no significant interaction field dependency and control (Program or learner) of presentation mode as measured by the post test, separate analysis of the recall and problem solving questions also revealed no significant interaction.

Kamlaskar (2007) examined the effect of interactive computer simulation to impart complex educational content enables students to experience phenomena related to abstract scientific concepts and principles. Also, it allows students to explore change in the simulated model before making changes in real world situations. The objective of this research is to "design and create" an interactive
simulation to ensure student preparedness to perform basic electronics lab activities in a real laboratory and observe circuit behavior by manipulating variables such as power supply voltage, component values, etc. This computer simulation presents a step-by-step procedure of a simulated laboratory practice.

\[ \text{'Wien Bridge Oscillator' from Basic electronics course was chosen for study. For creating animations Macromedia Flash MX 2004 version was used. Wien bridge oscillator circuit behavior for various components values could be shown through animation and also through video programme. However, Multimedia is used as it offers interactivity. Learners could actually observe and feel sustain or over damped or under damped oscillations which were generated as per the component values provided by them; like an actual experiment. Similarly, to build oscillator circuit on breadboard; a step by step activity is animated using different media, text, photographs, images to make instruction effective.}\]

\[ \text{Results indicate that the use of multimedia increased the involvement of learner. A active participation of learner helps to better understand content. The post test mean score is greater than pre test mean score which is an indicative of significant increase in the students performance level and usefulness of product in}\]

109
communicating the content. This indicated that the learners understand the content presented with the help of the state of the art of MM technology. Hence, product provides an enhanced learning at low cost.

Haddon et. al. (1995) compared the learning of 16 second year chemistry undergraduates studying in 6 week course on molecular spectroscopy. Authorware professional 2.1 was used for developing multimedia learning package. Sound was recorded and played using sound blaster pro 16 software. 3D animations were developing using with Autodesk 3D studio software. Graphics were constructed using CorelDraw 4.0 for 2-D animations. Multimedia learning package contained all of the information given in the parallel lecture course. The software was designed to foster flexible learning and to allow the users freedom to interact with the information. The results show multimedia learning package was as effective as parallel lecture course. Use of and attitude towards the package were generally positive, students using the package liked its flexibility and developed individual learning patterns. There was a significant correlation between students' ability and degree of improvement in multimedia group. Lower the ability of the student, greater the degree of improvement. The results show that MMLP is a
popular and effective method of teaching and more successful than conventional methods for students of below average ability.

**Frear** (1999) in this study, examines the effects of interactive multimedia instruction upon the variables of achievement and problem solving skills in Environmental science course. The topics of the eight units of interactive multimedia are 1) introduction to environmental science 2) energy from coal 3) geology of home site selection 4) minerals for society 5) legal control of environment 6) stream pollution 7) streams and floods and 8) radiation in environment. All modules have a consistent screen design and each consists of an introduction to problem to be addressed, role that the student must play in the investigation. From menu page a student can access any one of the eight modules. For the treatment group five weeks of class room instruction were replaced with eight units of environmental science interactive multimedia sessions in computer lab. This study substantiates the effectiveness of the IMM treatment in significantly increasing student achievement and problem solving skills in environmental science.

**Chun et. al.** (1994) studied the effectiveness of multimedia in language learning software”. The effectiveness of a “CyberBuch”, a multimedia program for reading authentic German texts is assessed
in three areas. First, based on user evaluation of the visual interface design, the usability of the program is assessed in particular to user reaction to multimedia components of the program. Second, learner behavior while using the program is tracked, and the types multimedia links chosen were tracked. Third, the effectiveness of the program for two levels of language learning is assessed, short-term recall of vocabulary items and overall reading comprehension. Based on answers to questionnaires, users felt overwhelmingly that seeing a photograph or movie helped reinforce learning, but that the text and audio links were not as helpful. The user logs indicated that a greater proportion of picture and movie links were chosen than text links. The vocabulary tests show that vocabulary words were learned and recalled better when defined with figures.

Pearson and Michael (1994) in his study on “The relationship between student perceptions of the multimedia classroom and learning styles”, explored the extent to which students learning was facilitated by the use of computerized multimedia presentations in a large lecture course. Students numbering 168 at a midsize eastern university who enrolled in an introductory mass communication course used computer assisted media presentations. Results indicated that :1) learning styles and multimedia presentations were
not related, 2) two-thirds of the students reported that they learned more when multimedia was used, 3) virtually all of the remaining one third of the student were neutral and were evenly distributed across all four learning styles and 4) 94% of the students reported that the use of multimedia presentation made the class entertaining. Finding suggest that the pedagogical benefits of computer based presentations are equally available to students of all learning styles.

Richard A. (1994) In his study investigated “Multimedia design principles for constructing prescriptive, democratic, and cybernetic learning environments.” The quality of multimedia based instruction is more the product of the way instruction is designed, and less the result of the system on which it is delivered. To fully exploit the capabilities of more powerful instructional technologies designers must also re-examine the assumptions and expand the strategies employed in instructional design. Prescriptive, democratic, and cybernetic learning environments have been identified for individualized instruction and have subsequently been adapted to interactive multimedia learning. Prescriptive environments specify learning objectives and the instructional system is used as a primary delivery media. In most cases, it is the
learner’s role to receive and master the given content. Democratic environments emphasize the learner’s role in defining what is learned, how it is learned, and the sequence in which it is learned, navigation, motivation and access supersede objectives and evaluation. In cybernetic environments, a complete system allows the learner to interact freely and naturally with instruction in a process of mutual exchange. Control is negotiated but design issues to each of these environment control, practice, feedback, cooperation and metacognition and considers how each of these notions might be expressed in difference multimedia environments.

Wells et al. (1994) in his research on “Enhancing teaching and learning in higher education with a total multimedia approach”. studied multimedia technology. The complete power of multimedia includes high quality graphics and images, sophisticated navigational techniques and transitional effects, appropriate music and sound, animation and increasingly, 3-D modeling and virtual reality, two multimedia-biased software tools to enhance MIS (management information system) and higher education in general were developed by faculty at the MIS program in the college of business administration at Tennessee technological university. “the interactive presenter” is a multimedia classroom software program
designed to provide a high level of interaction between instructor and students with in the context of multimedia presentation. “the intelligent tutor” is a CD-ROM supplement to a MIS textbook which incorporates artificial intelligence with multimedia to provide students with a personal tutor and progress tracking capability, in addition to a virtual classroom environment.

Research on note taking as a learning strategy and on the related techniques of outlining and concept mapping is reviewed. The effectiveness of these techniques in helping the learner encode new information and their usefulness in interactive multimedia instruction are explored. Research strongly supports an external-storage function of note taking and suggests that note taking supports encoding. Outlining has been shown to result in improved recall of facts, although significant training is required for successful use. Research also supports the usefulness of concept mapping. Integrating these strategies into interactive multimedia instruction can be done in several ways. Note book approaches seem to be among the most effective. The complexity of note books can vary from simple copying through a hierarchy of sophistication from spatial mapping to the creation of multimedia presentation by the students. Regardless of the complexity of the note book
incorporated, there is a need of teach how to use learning strategy. Unless the strategies are used and understood, they will be considered burdensome and will probably not be used.

In an engineering on line degree, VICENT (2006) noted contents are usually given in a few different modalities; text, hyper text, video chips and simulators or virtual laboratories. The aim of his study was to find out about their appropriateness for electrical engineer course. To study it, Instructor had planned in which students were divided in to two homogeneous groups. Students in each group studied with a different modality of contents. The study had been done in electromagnetic propagation, antenna theory and digital image processing subjects, all from the electrical and electronics engineering degree

Results obtained had evidence showing that multimedia contents are more efficient then texts in the learning of certain concepts. Interaction and multimedia have a very high value in understanding of engineering concepts.

Cann (2006) this study was investigated the relationship between extension employees’ learning styles and their performance in three different types learning environments; traditional face to
face interaction, minimally interactive on line instruction and highly interactive multimedia rich on line interaction results indicated that the minimally interaction on line environment group was statistically significantly lower than the face to face environment and multimedia rich highly interactive on line environment.

Mushak (2005) Studied the presentation of software instruction has been supported by manuals and textbooks consisting of screen captures, but a multimedia approach may increase learning outcomes.

This study investigated the effects of modality. That is text, audio and dual, on the achievement and attitudes of college students leaning software applications through the computer. The multimedia lesson of 82 slides, which were created a flash animated presentation, had the lesson objectives at the beginning of the program with an introduction slide for each function in software access:

The studies presented so far are those selected to cater to narrow band relating only to the investigation of this study. More multimedia studies have become available in the recent years. The
studies indicated that multimedia use improves learning environments. In the recent years ANOVA as a method of analysis in comparison experiment on multimedia has been amply employed. The sample size varied depending on the availability. The trend was to take the incidental class as a whole and use such a class for creating control and treatment groups. Variations in the responding style and controls over presentation and getting feedback have at times attracted more attention of the researchers. Media technology development such as in the area of using graphics and animation navigational methods, sound, music and/or voice, 3-D modeling and virtual reality and innovations involving the application of computers have been often in the focus. The studies substantiate the investigator's intentions to pursue development and evaluation of multimedia package on topics in science of which a large number are rather origin topics which not only need to be attempted first time but also explored for effectiveness. Replication to establish the consistence of findings did not find place at all in the studies.