CHAPTER I

INTRODUCTION
## CHAPTER I

**INTRODUCTION**

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CHAPTER I
INTRODUCTION

IMPORTANCE OF EDUCATION

Education, in one sense or another, appears to be as old as the human race, though in course of time its meaning and objectives have inevitably undergone certain changes. The root meaning of education is given as bringing up or leading out or making manifest the inherent potentialities in a pupil. Broadly speaking, education refers to any act or experience that has a formative effect on the personality of an individual. Education refers to the process by which society, through its different institutions, deliberately transmits its cultural heritage to its young - its accumulated values, knowledge and skills from one generation to another.

Education is often regarded as synonymous with learning, as the acquired experience of any sort-intellectual, emotional or sensory-motor. Education is a product of experience.

Education is a process by which and through which the experience of the race ie., knowledge, skills and attitudes are transmitted to the members of the community. Education helps the manifestation of the personality of an individual. It is also recognised as a means to an end. That is education enables a man to earn his livelihood. If a man is unable to earn his living, he is a parasite on the society. So, education must enable the individual to fulfill at least his/her basic needs like food, clothing and shelter.

"Education is a form of production like a factory and it has three elements, raw materials (people) tools (teaching methods) and product (changed behaviour)". Education is fundamentally concerned with the enhancement of quality of life both at the individual and societal levels. Without education it is rather difficult to bring about an
improvement in the quality of life of people. One of the purposes of education is to help the people acquiring it to behave rationally responsibly and intelligently in their pursuits of enhancing the quality of life.

One of the main tasks of education in a modern society is to keep pace with this advance in knowledge. Knowledge cannot be received passively. It is something that is to be actively discovered. The main account in education should be on the awakening of curiosity, the simulation of creativity, the development of proper interests, attitudes and values and the building of essential skills such as independent study and capacity to think and judge for oneself.

Technology provides the necessary answer to all these problems. Technology of education is being developed with the aim not only of making education more widely available but also of improving the quality of education which is already available. The nature of these emerging educational techniques has been influenced by modern psychology. Skinner's (1954) work on learning and his emphasis on the importance of reinforcement in the learning situation has created a revolution in the field of educational technology. The recent changes in the concept of education resulting from modernisation have also led to the development of newer areas of educational endeavour.

TECHNOLOGY OF EDUCATION

Educational technology is an emotive expression tending to produce an excess of attitude striking.

With the development of speech, of writing, of printing, of photography and sound recording and reproduction and more recently of television and computers, the teaching learning process has first adapted new skills of materials designed in other spheres. Later, their influence becomes so pervasive that the process or system has to adopt the
philosophy of the new in preference to the old. The student could learn via the book, with or without the teacher, before or after meeting him. Information could be stored outside the teacher and transported at will. Now-a-days film, radio, television, language laboratories, teaching machines and more recently computers have appeared, to be adapted in turn to suit the existing classroom teaching-learning situation.

There are selected criteria from the psychology of learning that need emphasis in having pupils work with technology. Technology should capture pupil's interest in learning. Activities should be fascinating to engage pupil interaction. These interests should provide for effort in pupils desiring to achieve, grow and develop. When the students are allowed to use the computers for drill and practice, instead of using a paper pencil, the learners truly show interest and fascination in learning. It is a powerful factor in learning since attention to the task at hand makes for increased achievement.

Technology may assist learners to perceive purpose in learning. If purpose is lacking, there will be little incentive for pupils to learn. Goal centered pupils achieve more than those who fail to perceive objectives in learning. Technology can assist pupils to attach meaning to ongoing lessons and units of study. What pupils learn that should make sense, not be nonsense task. There are numerous programs in computer use which guide pupils to achieve an objective. These numerous ways stress if one procedure is not understood, there are other approaches which will guide pupils to attach meaning. It is so important that pupils understand what is being taught. Computer programs should assist pupils to perceive knowledge as being related, not in isolated bits.

Pupils need to use knowledge to obtain new insights thus connecting what we learn and what we do. There are many key ideas The use of technology such as video-tapes and software programs do assist pupils to relate knowledge inductively and thus retain content for a longer duration of time.
The use of technology can certainly assist to provide for individual differences among pupils in terms of achievement in diverse academic areas. When pupils work on computer programs, they can definitely work at their optimal rate of achievement individually. Technology and its use might well guide pupils to develop wholesome attitudes toward learning. Now-a-days pupils seem to be fascinated interacting with computer technology. Computer instructions show much interest towards learners and truly has its values for pupils.

**EDUCATIONAL TECHNOLOGY**

**Meaning of Educational Technology**

Educational Technology is a system in education in which machines, materials, media, men and methods are interrelated and work together for the fulfillment of educational objectives.

The National Council of Educational Technology Report, U.K. (1969) gives the wider meaning of Educational Technology as "It perhaps needs to be reiterated that the council sees educational technology as having a wider connotation than simply the use of electro-mechanical and other aids in teaching".

**Definitions of Educational Technology**

Commission on Instructional Technology, USA states "Educational Technology is a systematic way of designing, implementing and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication and non-human resources to bring about more effective instruction".

Association for Educational Communication and Technology, USA states that "Educational Technology is a complex, integrated process involving people, procedure ideas, devices and organization for analyzing problems and devising, implementing, evaluating and managing solutions to those problems involved in all aspects of learning".

Some consider educational technology as a branch of educational theory and practice that is concerned "primarily with the design and use of message which control the learning process". According to Ely (1963) Educational Technology is a systematic knowledge derived from scientific research and not the machines or the materials used for instructional presentation. Heinich, et al. (1989) adapted John Kenneth Galbraith's definition of technology as a particular, systematic arrangement of teaching-learning into practice in a predictable, effective manner to attain specific learning objectives.

The Commission on Instructional Technology (1970) defined instructional technology as a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction.

National Centre for Programmed Learning, U.K. states "Educational Technology is the application of scientific knowledge about learning and the conditions of learning to improve the effectiveness and efficiency of teaching and learning. Educational Technology can be considered as the systematic use of scientific methods to plan, realise and evaluate effective teaching and learning process in informal and non-formal situations. The use of computer in education has added a new dimension in teaching learning process".

The present education system is utilizing the mode of audio and video technology for communication. Children are passive learners and are becoming auto learners (self-learning). The child is motivated to learn on his own. Child is forced to set pattern of thinking and learning. They are simulated by the imaginary world of computers. Children are unconsciously thrown into fantasy world. This exposure is making the child to imitate the modes and roles and devoid of thinking.
The concept of education has very much changed. The very rapid rate of advancement of knowledge in the present day could be called knowledge explosion. It is necessary for the teachers of today to know and make use of available sources to impart knowledge easily and accurately to the children. The proper selection and use of computers help the teachers to arrange more effective environment for teaching and learning.

**The Cognitive Concept of Educational Technology**

The cognitive approach to educational technology attempts to understand the internal processes of behaviour and emphasize knowing rather than responding. The cognitive approach to educational technology views the learner not as passive, but as active, constructive and playful. The cognitive theorist believes that any complete theory of human cognition must include an analysis of the plans or strategies that the learner uses for thinking, remembering and understanding and using language.

By the early 1980s, the cognitive model of learning began to replace the behaviorist model in educational technology, particularly in the instructional design process. In a cognitive model of instructional design, the organization, processing and storage of information by the learner constitute vital elements in instructional development. The cognitive science view of educational technology has developed the concept learning strategies, intellectual skills that learners use to control their internal processes of attending, perceiving, encoding and retrieval. Learning strategies may vary in their quality, origin, generality and purpose. From a cognitive view, educational technology should be focused on activating the appropriate learning strategies during the instructional process rather than merely initiating behavioural responses.

Learning strategies selection may become an independent step in the overall design process, or may be a part of the overall plan for selecting instructional events and activities. This may affect such instructional design processes as task analysis and learner strategy.
implementation. Moreover, in order to implement an information processing learning strategy into media such as CAI or television the designer will have to consider the media attributes of the medium as well.

**NEED FOR EDUCATIONAL TECHNOLOGY IN BIOLOGY TEACHING**

Educational Technology has been regarded as an integral part of the whole teaching-learning process. The role of the teacher in a classroom is still significant, but has to acquire and promote new methods to become more relevant and easy. It can also help to overcome the difficulties such as lack of verbalising faced in the classes, to improve the quality of education. The audio-visual aids improve the teaching and make learning more effective.

Educational Technology is a tool at the hands of a teacher in the classroom teaching. With the advent of science and technology the task of the teacher is more easy and the learning is more effective. Due to scientific development and technological improvements a monumental amount of Educational Technology devices have been invented. These devices has changed many activities in classroom teaching especially in Biology. Computers pave a fruitful way for the study of Biology. For effective Biology teaching various colourful diagrams, models etc are needed in classroom. These materials are effectively used by the computer. Teaching through computer makes the learning more effective.

**OBJECTIVES OF SCIENCE TEACHING**

Education Commission (1964-66) stated that science education must become an integral part of school education, and ultimately some study of science should become a part of all courses in the humanities and social sciences. The quality of science teaching is to be developed considerably so as to achieve its proper objectives and purposes. Objectives decide the teaching learning processes and they determine the place of a subject in shaping the content.
The main sources for the formulation of objectives are the needs and capabilities of the learner, the needs of the society, the nature of the subject matter and the nature of the educational system. The objectives have been mainly divided into three domains as cognitive, affective, and psychomotor. The National Council of Educational Research and Training, India has developed the objectives and specifications for Biology.

**Instructional Objectives of Biology**

By the study of Biology:

- The pupil acquires knowledge of biological terms, facts, concepts, principles and processes.
- The pupil develops understanding of biological terms, concepts, principles and processes.
- The pupil applies knowledge and understanding of biology in unfamiliar situations.
- The pupil develops skill in drawings, reporting biological informations, evidence and results using scientific terminology.
- The pupil appreciates the biological phenomena in nature and the role of biology in human welfare.
- The pupil develops interest in the living world.
- The pupil develops scientific attitude towards biological phenomena.

Concept building is an essential goal in teaching of science. In order to make scientific concepts more meaningful, suitable communication media are needed. In bridging the gap between the teacher and the taught, educational technology in the shape of teaching machines, computers plays a vital role now-a-days.

**THE ROLE OF COMPUTERS IN EDUCATION**

Computers play an important role in enhancing the efficiency of teaching - learning process, to make children more creative and provide them with an individualized learning
environment. Computer literacy has become crucial in preparing children to cope with the micro-computer explosion, which has the same essential for social changes as the industrial revolution. Today computers are being used in a big way in many professional educational institutions for teaching-learning purposes.

Proponents of computers in education have presented a picture of an educational system in which instruction is tailored to meet each student's unique needs and learning style. Working with their own personal computer, each student would have the opportunity to learn at his own pace, not only to learn the traditional curriculum more efficiently, but also to engage in unique and previously unattainable learning experiences (Linn, 1984).

Computers in education are used world wide to prepare children for an "Informatics future", by developing an awareness of computers and how they work. As an educational aid to improve students skills in academic subjects at the university development introducing and developing changes in the content and methods of education through informatics. To facilitate software development, certain countries are moving to the standardization of equipment and placement of machines. In the U.S. and France, the trend is to establish computer laboratories in schools, rather than installing individual terminals in each classroom.

The use of computers in education has in the past been supported by the private sector and pilot programs have been launched by public education officials. One of the main obstacles to the introduction and development of informatics in education in most countries is lack of resources. This tends to restrict the use of computers in education in developing countries to experimental applications. The introduction of microcomputers in the last decade has substantially lowered hardware costs. The cost of software development, teacher training and on-going support must not be neglected. In USSR, all secondary students take general courses in computer science. In most countries, computers are used in
secondary and University education and on a limited basis in primary education. The number of computers in use in schools is smaller than number of pupils. In general education, computers are used as an aid in teaching general academic subjects such as mathematics, physical science and language.

At present computer is a new technology in education and finds valid use in education. Even expanding horizons of knowledge have necessitated proper planning of instructional strategies and optimum use of teaching techniques by the teachers of today. The use of computer in education has resulted in a new dimension in the teaching-learning process.

**Educational Implications of Computers**

Computers aid the learning process in the following ways.

- providing information and instruction
- asking questions
- being tirelessly repetitive
- stimulating processes
- selecting the right speed for providing information for individual learning
- providing opportunities to try different things
- displaying data dynamically
- taking away tedious calculations
- doing difficult calculations
- providing information from a large store and
- checking up how well a learner understands a topic through questions.
Advantages of Computers

The advantages of the computer use in education are as follows:

1. It allows students to learn at their own pace produces significant time savings over conventional classroom instruction. Computer-based instruction allows students some control over the rate and sequence of their leaning.

2. High speed personalized responses to learner actions yield a high rate of reinforcement.

3. It provides a positive climate especially for slow learners.

4. Colour, music and animated graphics can add realism and appeal to drill exercises, laboratory activities, simulations, etc.

5. The record-keeping ability of the computer makes individualized instruction feasible; individual reports can be prepared for all students and their progress can be monitored.

6. Memory capacity allows students' past performance to be recorded and used in planning next steps.

7. The teachers 'span of control' is enlarged as more information is put easily at his or her disposal, helping to keep control close to the point of direct contact with the learner.

8. The novelty of working with a computer raises student motivation.

9. The computer provides reliable instruction from learner to learner regardless of the teacher/trainer, the time of the day, or the location.

COMPUTER-ASSISTED INSTRUCTION (CAI)

Computer is included in the hardware approach of educational technology. The computer services take decisions about the instructional material, according to the entry behaviour of the learner. The computer has entered the world wide classroom as a common tool in education. A variety of terms have been used to describe how computers might be used in schools. The most general and oldest term is Computer-Assisted Instruction. Computer-Assisted Instruction (CAI) has a variety of software to facilitate
teaching learning situations. The use of computer directly in teaching and learning is called computer assisted learning (CAL). In U.K. computer managed learning (CML) is the term generally used to refer to the computer in its management of teaching role.

According to Subramanian (1991), Microcomputer applications are all pervading like hypothetical ether medium suggested for transmission of light. One very important aspect of education at schools and colleges is to supply students with the skills which industry and the outside world require. In recent years microcomputers have been installed in most of the educational institutions. The computer can provide learning enhancement in certain areas of Biology teaching. The style of teaching is bound to undergo changes with the advent of computer technology in the realm of education. The inclusion of computers in our curriculum is an inevitable progress towards our cherished objective of learner centered education.

Computer-Assisted Instruction has its roots in the behavioural theories of learning. Learning is defined as a change in an individual caused by experience. Learning takes place in many ways. The students acquire information presented in the classroom, or when they look upon some type of media. There are some differences in learning among the students. To cope up with this computer assisted instruction is the best one for individual learning.

Computer-Assisted Instruction is a natural outgrowth of the application of the principles of the programmed learning. The main objective of programmed learning is to provide individualized instruction to meet the special needs of some individual learners. To accomplish this, it needs an efficient and flexible device that can store a massive amount of organized information and used a select portion to meet the needs of individual learners. The computer is one of such needs of individual learners.

The idea behind computer-assisted instruction is to use the computer as a tutor to give information, give students practice, assess their level of understanding and provide additional extra instruction if needed. A well designed program is nearly perfect, providing
appropriate levels of instruction, as it can analyse student responses immediately. Finally for most of the students computer seems to have a motivating of its own, so that they can work longer and use it then.

The problem of providing all students with appropriate levels of instruction could be completely solved by using Computer-Assisted Instruction. Many programs are being written for educational uses of microcomputers. The four different types of CAI modes are Tutorial, Drill & Practice, Simulation and Instructional Games.

Advantages of CAI

The computer aided instruction offers the following advantages over other systems of instruction.

- Each student receives instruction at his own pace.
- Each student responds continuously as he receives instruction.
- Each student receives rapid feedback for his response.
- All units of learning are broken down into subunits and small elements of learning in accordance with Skinner’s approach of teaching in small steps.
- Immediate reinforcement of learning is achieved.
- Learning sessions are kept manageable by designing the duration of time.
- Lessons from the theories of learning like Skinner’s operant conditioning are taken into account at the stage of instructional design.
- Students can learn in their own styles and ways.
- Students can test their own learning at any time of progress.
- Teacher-time is saved from the routine information - giving activity and employed in innovative instruction-design and student guidance, etc.
- Advantages of different modes of learning are accrued by employing them appropriately, wherever desirable, ie, lesson presentation, tutorial, exercise, simulation, etc.
LEARNING AND PERSONALITY

Learning is an act of acquisition of further knowledge, skills and attitudes and is fundamental to a person's development. An increment in learning is characterized by a corresponding modification of human behaviour. An individual's total behaviour is his personality. Learning is, therefore, defined as a relatively permanent behaviour modification and it is describable, observable and measurable.

The term personality refers to both mind-in-particular and the mind-in-general. The word personality is derived from the word 'persona' which is originally known as 'theatrical mask' worn by various dramatic personae or actors in a drama in the days of ancient Greek Civilization.

The personality of an individual indicates a sum of various aspects of human behaviour. Personality is the total bio-psychological structure of an individual personality persists over time and situations. We expect people to feel in certain ways from day to day situations. Thus, personality is not merely a collection of independent and unrelated habits. No two individuals have the same own characteristics in common, they differ from each other in many ways. The degree to which we exhibit these traits and their inter-relationship vary markedly from person to person and it is the integration of our personality traits.

According to Salvatore (1976) "Personality is a stable set of characteristics and tendencies that determine those commonalities and differences in the psychological behaviour of people that have been easily understood in terms of the social and biological pressures of the immediate situation.

In the words of Allport, (1965) "personality is the dynamic organization within the individual of those psycho-physical systems that determine his characteristic behaviour and thought".
Cattell (1964) states with a general definition of personality. He says that, "personality is that which permits a prediction of what a person will do in a given situation". Personality consists of tendencies and predispositions to respond consistently over time and situation.

Allport's (1965) definition of personality highlights the importances that he attaches to individual uniqueness. He considers trait as the most valid one for representing people like and how they differ from each other psychologically. A trait is a predisposition to respond in an equivalent manner to various kind of stimuli. According to Cattell's (1964) concept the trait is the most important.

Psychologists and researchers do not present a generally agreed definition of personality. All concentrates on different kinds of behaviour and use of different techniques for investigation.

**Personality Types**

Personality types are based purely on psychological characteristics. Many psychologists have classified the personality of human beings into various groups based on their physique, physical characteristics and socio-psychological characteristics.

Carl Jung (1972) divided personalities in to three types based on socio-psychological characteristics as introverts, extroverts and ambiverts. Introverts withdraw themselves, particularly during emotional stress, they tend to be shy, self-conscious to work alone. Extroverts always look for company of others. They are likely to be very social and tend to choose occupations that deal directly with people. Ambiverts have a mixed characteristics of both introverts and extroverts.
Bryant (1966) states that personality denotes the total behavioural pattern of a person and is usually, experimentally divided into traits denoting values, intellect, emotional make up and perceptual motor attributes.

**NEED FOR THE STUDY**

Due to poor imaginative power, some students particularly the average and the slow learners find difficulties in understanding some concepts in Biology which require them to form some mental pictures. 'Cell Division' in Cytology of the Biology syllabus is one such area which challenges to the average and slow learners. Unless some device is made, these pupil cannot comprehend the concept in the said content area. Hence, it is the duty of the Biology teacher to devise an instructional strategy which would support him in realising the envisaged instructional objectives. Here comes the Educational Technology particularly the 'Computer Technology' in teaching to rescue the Biology teacher from the said crisis.

Relatively a few studies measuring the effects of CAI on learning particularly Biology as a subject at school level exist at the international level. Most of these studies concentrate on cognitive effect of pupils as an outcome of computer application in teaching. Some studies show significant gain in problem solving skills, including gains in divergent and reflective thinking. Recent studies suggest that several aspects of modern tutorial software could make the subject matter intrinsically, some other studies indicate that motivation to learn particular subjects can be increased by using computers.

Under these circumstances the present study assumes importance in exploring the unexplored potentialities of computer based instruction in different modes viz. Tutorial, Drill & Practice and Simulation as a tool in solving the problems faced by the Biology teachers and how the media effectiveness is influenced by the learner personality.
STATEMENT OF THE PROBLEM

So far there has been no conclusive evidence that the computer is a positive educational force, worth an enormous investment in hardware, software and teacher training. Research studies suggest that low achievers have greater cognitive and affective gains with computer based application when compared to high achievers. It is unfortunate that there is no conceptual framework existing to evaluate the relevance of results obtained in a computer saturated environment compared to those obtained in computer scarce ones. It is important to ascertain whether CAI is effective in different cultural contexts and in different subjects at different educational levels in the context of different socio-cultural settings. Keeping all these points in mind the present study on "Relative Effectiveness Among Different Modes of Computer Based Instruction in Relation to Students' Personality Traits" was taken up by the investigator.

SCOPE OF THE STUDY

The research in the area of computer based instruction in the teaching-learning process at all the levels of education would help decision makers to face the new challenges arising from the increased use of computers in the modern society. In line with the same sentiments the present study establishes the relative effectiveness among different modes of computer based instruction viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives in teaching Biology at Higher Secondary Stage. In conjunction with other process product studies, this study contributes to the knowledge of computer based instruction. The specially developed CAI packages in teaching Biology would be an eye opener for the practicing teachers so that they can direct their attention with a view to solving the practical difficulties in teaching such a challenging content area like "Cell Division".
OBJECTIVES OF THE STUDY

The objectives of the study are stated as follows:

1. To find out whether there is any significant difference between the Conventional Lecture Method (CLM) and the Computer Assisted Instruction (CAI) as an Individualised Instructional Strategy in terms of their effectiveness in realising the instructional objectives in Biology at Std. XI.

2. To establish the relative effectiveness among the different modes of Computer Based Instruction viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives in Biology at Std. XI.

3. To find out whether there is any significant difference between the Conventional Lecture Method (CLM) and the Computer Assisted Instruction (CAI) as an Individualised Instructional Strategy in terms of their effectiveness in enhancing the retention of cognition as revealed by the learners' performance in the retention test.

4. To find out whether there is any significant difference among the different modes of Computer Based Instruction viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness in enhancing the retention of cognition as revealed by the learners' performance in the retention test.

5. To develop syllabus based Computer Assisted Instructional Packages in different modes viz. Tutorial, Drill & Practice and Simulation for teaching Biology at Std. XI.

6. To validate the developed CAI packages from technical and pedagogical points of view.

7. To develop a Criterion Referenced Test (CRT) in the content areas being instructed to the subjects of Control and Experimental Groups.

8. To assess the personality of the subjects of the Control and Experimental Groups using Cattell's 16 P.F. Inventory with a view to study whether it has any influence on the media effectiveness in realising the instructional objectives.
HYPOTHESES OF THE STUDY

The hypotheses of the study are as follows:

1. There is significant difference between the Conventional Lecture Method and Computer Assisted Instruction as an Individualized Instructional Strategy in terms of their effectiveness in realising the instructional objectives in Biology at Std. XI.

2. There is significant difference among the different modes of Computer Based Instruction viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives in Biology at Std. XI.

3. The effectiveness of different instructional strategies viz. Conventional Lecture Method and Computer Assisted Instruction in different modes viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives is influenced by the learners' personality traits.

4. There is significant difference between the Conventional Lecture Method and Computer Assisted Instruction in different modes viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives in the context of the learners' with varying levels of personality traits.

5. There is significant difference among the different modes of Computer Based Instruction viz. Tutorial, Drill & Practice and Simulation in realising the instructional objectives in the context of the learners' with varying levels of personality traits.

6. There is significant difference between the Conventional Lecture Method and Computer Assisted Instruction in different modes viz. Tutorial, Drill & Practice and Simulation in terms of their effectiveness in enhancing the retention of cognition as measured by the learners' performance in the retention test.

7. There is significant difference among different modes of Computer Based Instruction in terms of their effectiveness in enhancing the retention of cognition as measured by the learners' performance in the retention test.
TOOLS USED IN THE STUDY

The tools used in the study are as follows:

1. Nine syllabus based computer software packages were developed in Visual Basic by the investigator in three different modes of CAI viz. Tutorial, Drill & Practice and Simulation in the content area unit 'CELL DIVISION' viz. (i) Mitosis (ii) Meiosis-I and (iii) Meiosis-II prescribed for Std XI in Biology.

2. A separate pretest was developed by the investigator to assess the cognition of the students in Biology at Std X in order to establish the identity among the control and the experimental groups in terms of the subjects' entry behaviour in Biology.

3. Three objective based objective tests (CRTs) in the selected content areas were developed by the investigator as post-test and retention test to assess the terminal behaviour of the students who formed as the subjects for the experiment. The items in the Criterion Referenced Tests are of multiple choice type testing the cognition of the subjects at different levels viz. Knowledge, Understanding and Application. In total, there are 100 items in all the three tests taken together with a break up of 36 knowledge level items, 45 understanding level items and 19 application level items. The reliability and validity estimates of the tests have also been established using appropriate procedures.

4. 16 P.F. Inventory 'Form D' developed by Raymond B. Cattell was used to assess the personality of the subjects of the control and the experimental groups with a view to study whether it has any influence on the media effectiveness.

METHODOLOGY IN BRIEF

The present study adopts the Quasi Experimental Design. In order to test the hypotheses spelt out "Pre-test, Post-test Non-equivalent Groups Design" was found to be most relevant and appropriate. Four groups each of 35 to 50 students studying at Std XI in four different schools were formed. One of the groups was identified as control group while
the other three groups were treated as experimental groups. Conventional Lecture Method was adopted for the control group, while CAI as individualized instruction in different modes viz. Tutorial, Drill & Practice and Simulation were introduced as experimental interventions to the other three groups.

Nine syllabus-based computer software packages in different modes of CAI viz. Tutorial, Drill & Practice and Simulation in the content area unit "Cell Division", (i) Mitosis (ii) Meiosis-I, (iii) Meiosis-II prescribed in Biology for Std XI had already been developed and evaluated. A separate pre test was developed and administered to control the logistic effects since the experimentation was made in the middle of the academic year. All the four groups were taught the same contents through the respective instructional strategy. Criterion Referenced Tests (CRTs) were developed in the said content areas and were used as post-tests.

To assess the students' personality, Cattells' 16 P.F. Inventory was administered to the control and the experimental groups with a view to establishing the influence of learners' personality on media effectiveness. The same CRTs were once again administered to the control and the experimental groups as retention test one month after the experimentation was over.

The responses made by the subjects of the control and the experimental groups to the different measuring instruments were scored, tabulated and analysed using appropriate statistical techniques.

**DELIMITATIONS OF THE STUDY**

The delimitations of the study are as follows:

1. The homogeneity among the control and the experimental groups was established only with respect to the scores as measured by the pre-test in Biology syllabus prescribed for Std X.
2. Due to vastness of the syllabus, it was not possible for the investigator to develop the packages for the whole syllabus prescribed for XI Std in Biology. Hence, only one unit viz. CELL DIVISION was selected as the instructional content in the present experiment.

3. For want of time and availability of computer facility, the study was confined only to four schools in the Coimbatore city with the sample size ranging from 35 to 50 for each school.

A BRIEF RESUME OF THE SUCCEEDING CHAPTERS

The first chapter introduces the concepts of Educational Technology, Computers in Education and the modes of Computer Assisted Instruction. The need for the study, statement of the problem, objectives and hypotheses, the scope and delimitations of the study are presented in this chapter.

A detailed theoretical framework about Computer Assisted Instructional modes viz. Tutorial, Drill & Practice and Simulation have been presented in the Chapter II.

In chapter III, an account of some of the previous studies related to CAI are abstracted. Based on these studies a conclusion has also been arrived at the end of the chapter.

Chapter IV deals with the methodology of the study. The development and validation of CAI packages in Biology and the development of CRT in Biology have been presented in this chapter. The establishment of reliability and validity of the tools have also been presented. The procedure adopted for conducting the study and the method of data collection have also been discussed in this chapter.

A detailed analysis of data is presented in the Chapter V. Testing of hypotheses and their interpretations are also presented in this chapter.

Chapter VI includes the summary of findings and conclusions arrived. Some suggestions for further research in the area of CAI have also been given in this chapter.