

CHAPTER I

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CHAPTER - I

INTRODUCTION

Education implies experience, insight and adjustment on the part of human as he/she is stimulated towards growth and development. It is described as a process of development. Science education gears up the growth of science and technology which, in turn, accelerates national development.

The structure of science education is complex and its development depends on the imagination of science educators and their deep desire to understand the ways in which the subject matter of science can be utilized to provide educative experiences for students.

Teaching is a complex activity, it needs systematization for effective delivery of information; otherwise, the learning may not be effective. To ensure better information delivery, teachers have to understand the dynamics of the teaching - learning process. As yesterday's knowledge becomes obsolete today, new technologies, new methods and practices help the teacher to design the instruction in a systematic way.

Inclusive education is the process of increasing the participation of students in the culture, curricula and communities of local mainstream schools whereas exclusive education is the process of reducing the participation. The study of inclusion and exclusion involves the engagement with and analysis of all students and staff within a school. Inclusive education is concerned with reducing all exclusionary pressures, on the basis of disability, ability, race, gender, class, family, structure, life style or sexuality.

Inclusive education lays stress on accommodating instructions to individual differences. Apart from physical and sociological individual differences, students are bound to manifest differences in learning aspects. Special needs are required to low achievers, medium achievers and high achievers with regards to learning the given concept. To satisfy the needs of different achievers, teachers should take all possible efforts to accommodate his instruction to individual differences. This requires different modes of instruction in the instructional process, which is highly likely to cater to individual differences. This is what this study aims at. To make his instruction cater to individual differences, a teacher should have a thorough knowledge about individual differences in students and how for different modes of instruction reach out to all the learners.

Television, Computers, Internet, Video Cassette, Audio Cassette are the powerful media which have become highly influential in the present day life style. They play a vital role in the teaching learning process also. Multimedia packages help to overcome barriers. They go beyond the four walls of the classrooms. It fulfills the gap in learning. Difficult process can be shown with ease. Inaccessible places can be viewed sitting in cozy classroom. These multimedia packages can penetrate more deeply into human character with immediate excitement than any other single medium. The multieffect of audio, video, animation and graphics strengthens and enrich the understanding the expedites the mastery of the concept. In the Computer Assisted Instruction Programme there is provision for interaction.

Modules are self - contained and auto - instructional material dealing with a single conceptual unit. It caters to individual difference. Each student

can take his own time to complete the module. Here what matters much is the mastery of the subject, not the time. So these modules are very suitable to the students. More over, when we provide multimedia base to the modules, they are more effective, especially to under achievers, low achievers etc.

In the era of expanding knowledge, students can no longer remain passive dependants on teacher for knowledge. Student's need is to learn, to think independently and to adopt a fluid approach to learning. Growth in confidence, self direction, knowledge, skills, initiative, tenacity and motivation have been the characteristics of a typical learner. Students should learn how to go about learning. To find answers, varied attempts have been made and on such is the present investigation in science education.

TECHNOLOGY AND EDUCATION

Science and Technology have become elements of our culture and perhaps the most effective factors of development. Education today aims at elevating itself to the level of a complete and comprehensive science with broader objectives. Such an enlarged view of education involves greater and more sophisticated use of instructional technology.

Technology has entered and enriched every area of human experience or walk of life and has made life comfortable, convenient and in fact worth living. It has helped human beings in achieving their objectives in their respective spheres of life. It is high time that "Education" has made the best use of "Technology" to facilitate and accelerate the realisation of its objectives. Technology is a tool for delivering and transmitting information.

It is a means by which students gain experience of formulating problems deciding on the reasonableness of situations; communicating their thoughts, findings and interpretations; and collaborating with other students in this mission. Technology is a major partner in the process of improving the quality of education with which a student leaves the school. Students should go away from the system with an education that will make them educationally competitive and capable of enjoying educational life to its fullest.

Every technological development has been an extension of some human function. Whether man is mechanized or freed by this extension depends very much on how the technology is used. The role of technology in education is now being invented. Decisions now being made will influence the way in which it will be introduced and used in education.

EDUCATIONAL TECHNOLOGY

The concept of Educational Technology finds a place on the National Policy on Education (1986), by the provision of a separate section entitled 'media and Educational Technology'. The working committee on 'Educational Technology' was appointed to find out the significance of technology in social change and development. Educational Technology, has emerged in the educational scenario as an instrument of 'Total Quality Education' as well as a means for solving education related problems in India.

"Educational Technology" refers to the application of scientific knowledge about learning and the conditions of learning to improve the effectiveness and efficiency of teaching and training. Educational Technology has been viewed in terms of its two interative components viz. Technology

of Education and Technology in Education

Technology of Education includes the systems approach to solve educational problems, through interactive strategies corresponding to the psychology of human learning leading to multi - media approach, the multi - sensory approach and individualisation of instruction, which has to be an instrument of total quality education.

Technology in Education refers to the provision of hardware and hardwares related software provided to support the instructional strategies. In general, it assumes that technology has the power to change the process of learning.

The three underlying trends in the development of Educational Technology (Lydia, Fernandes, 1997) are detailed below.

1. There is a gradual shift towards a more student - centered approach to learning - a shift that is manifesting itself in a steady increase in the use of individualised learning in all its various forms.
2. There is an ever widening realisation that, there is more to education than teaching basic facts and principles and that serious attempt should be made to cultivate the various non - cognitive skills and attitudes that are so important for future oriented life.
3. There is an explosive increase in the use of new information technology, viz. the application of new electronic and other technology to the creation, storage, selection, transformation of information of all kinds of education and training.

Educational Technology promotes the efficiency of learning by improving the quality of teaching. New types of technology intended to accomplish this purpose appear at an ever accelerating pace, paralleling the rapid increase of innovations in the general society. As a result, educationalists face the constant challenge of understanding the nature of technologies, their potential uses and their strengths and weaknesses (Rangaraj, 1995).

DEFINITIONS OF EDUCATIONAL TECHNOLOGY

The systematic way of designing, implementing and educating the students in the total process of learning is Educational Technology.

From the Report of the Meeting of Chief Technical Advisers, National Directors and UNESCO Specialists in Methods and Techniques - Paris, December 1969, "Educational Technology is a communication process resulting from the adaptation of the scientific method to the behavioral science of teaching / learning. It is a communication process which may or may not require the use of extending media (i.e., broadcasting, television, film and other audio - visual media."

The report of the National Center for Programmed Learning, U.K. (1971) 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 training. In the absence of scientifically established principles, E.T. implements techniques of empirically tested what to improve learning situations".

From J.R. Cases of the Educational Technology Division O.E.C.D. In an interview to a Ford Foundation Team - December, 1971, "Educational

Technology has to be seen as a part of a persistent and complex endeavour of bringing pupils, teachers and technical means together in an effective way. Educational Technology is not a bag of technical tricks, but the organized design and implementation of learning systems taking advantage of but not expecting miracles from modern communication methods, visual aids, classroom organization and teaching methods.”

From the report of the Definition and Terminology Committee AECT accepted at the Association’s Minneapolis Convention, 1972, “Educational Technology is a field involved in the facilitation of human learning through the systematic identification, development, organization and utilization of a full range of learning resources, and through the development of these processes, it includes, but it is not limited to the development of instructional systems, the identification of existing resources, the delivery of resources to learners, and the management of these processes and the people who perform them.”

The report of the Technical Working Group for Educational Technology in Asia under APEID (1975) states “Educational Technology is seen both as a means as well as a service to effect and facilitate better and productive learning system. It is an integral part of both formal and non-formal education. One aspect of educational technology is related to the use of specific techniques such as educational television, radio, programmed learning and other audio visual aids. In another aspect, educational technology is seen, as the application of scientific and other organised knowledge to the practical problems of education. In the particular contexts of developing countries, the emphasis is on the application of techniques and knowledge

with a view to mobilizing and optimizing the available human as well as technological resources”.

Hence, Educational Technology is an instrument which may be used for both, development in a narrow sense or reconstruction in a holistic sense. It is the designer of the system of educational technology, who has to formulate the goals very specifically and then build the strategies to achieve these goals.

The growing use of educational technology in present day's schools has helped to release the teacher from the routine role of 'information giving' so that he can devote his time and effort to the more important tasks of planning, arranging and evaluating the learning experiences of their wards.

MULTIMEDIA

Multimedia is media that uses multiple forms of information content and information processing (e.g. text, audio, graphics, animation, video, interactivity) to inform or entertain the (user) audience. Multimedia also refers to the use of electronic media to store and experience multimedia content. Multimedia means that computer info can be represented through audio, graphics, image, video and animation in addition to traditional media (text and graphics).

CATEGORIZATION OF MULTIMEDIA

Multimedia can be broadly divided into linear and non linear categories. Linear active content progresses without any navigation control for the viewer such as a cinema presentation. Non - linear content offers user

interactivity to control progress as used with a computer game or used in self-paced computer based training. Non-linear content is also known as hyper media content. This Non-Linear Category has been used in this study.

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

FEATURES OF MULTIMEDIA

Multimedia presentations can be viewed in person on stage, projected, transmitted, or played locally with a media player. A broadcast can be a live or recorded multimedia presentation. Broadcasts and recordings can be either analog or digital electronic media technology. Digital online multimedia may be down loaded or streamed. Streaming multimedia may be live or on demand.

Multimedia games and simulations can be used in a physical environment with special effects, with multiple users in an online network, or locally with an offline computer, game system, or simulator.

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

MULTIMEDIA - ITS APPLICATIONS

Multimedia finds its application in various areas including, but not limited to, advertisements, art, education, entertainment, engineering, medicine, mathematics, business, scientific research and spatial temporal applications.

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

INTELLIGENCE

Hardworking people may be successful. Hardworking people who are intelligent are always successful. Intelligence is a great property to be acquired by every one. Nobody is born intelligently but everybody can grow intelligently. Intelligence is just not a brain function but also includes all the skills we develop during our life time.

According to David Wechster, intelligence is a global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment.

Linda Gottfredson says in short that it is the ability to deal with cognitive complexity.

In an educational context, one's intelligence is not determined by one's academic performance or things other people have drummed into

one's head. True intelligence is one's knowledge acquired by one's interests, opinions and philosophies. A person's ability to think critically, analytically, rationally and openmindedly is another key ingredient .

THEORIES OF INTELLIGENCE

Howard Gardner's Theory of Multiple Intelligences

This theory was first laid out in Gardner's 1975 book, *Frames of Mind* and has been further refined in subsequent years. This theory is based on studies not only on normal children and adults but also by studies of gifted individuals ('savants'), of persons who have suffered brain damage, of experts and virtuosos, and individuals from diverse cultures. This led Gardner to break intelligence down into atleast eight different components; logical, linguistic, spatial, musical, kinesthetic, naturalist, intrapersonal and interpersonal intelligencies. He argues that psychometric tests address only linguistic and logical plus some aspects of spatial intelligence; other forms have been entirely ignored. Moreover, the paper and pencil format of most tests rules out many kinds of intelligent performance that matter in every day life such as giving an extempoaneous talk (linguistic) or being able to find one's way is a new town (spatial). Gardner believe that tradinal types of intelligence, such as IQ, fail to fully explain cognitive ability. Multiple intelligencies is a psychological and educational theory which suggests that each individual manifests varying levels of eight different components of intelligence given by him.

This theory was proposed in the context of debates about the concept of intelligence, and whether methods which claim to measure intelligence (or aspects there of) are truly scientific. Gardener's theory

argues that intelligence, as it is traditionally defined, does not adequately encompass the wide variety of abilities humans display. In his conception, a child who masters the multiplication table easily is not necessarily more intelligent overall than a child who struggles to do so. The second child may be stronger in another kind of intelligence, and therefore may best learn the given material through a different approach, may excel in a field outside of mathematics, or may even be looking through the multiplication learning process at a fundamentally deeper level that hides a potentially higher mathematical intelligence than in the one who memorizes the concept easily. The theory suggests that, rather than relying on a uniform curriculum, schools should offer "individual-centered education", with curricula tailored to the needs of each child. This includes working to help students develop the intelligencies they are weaker in.

Theory of Emotional Intelligence

Emotional Intelligence (EI) describes an ability, capacity or skill to perceive, assess, and manage the emotions of one's self, of others and of groups. As a relatively new area of psychological research, the definition of EI is constantly changing. The term Emotional intelligence appears to have originated with Charles Darwin's origin of species (1872), which speculated about a broader emotional social intelligence necessary for human survival and adaptation.

Daniel Goleman (1996) published several books and articles describing EI and its application to business. Salovey and Mayor continue to research EI today. They define EI as a type of intelligence. There are numerous models of emotional intelligence, each of which uses different assessment measures.

Some researches believe that EI as a cognitive ability similar to IQ, others believe that it is a combination of perceived abilities and traits, while others consider it to be a quantifiable skill.

Alexithymia (Greek word) is a term used to describe people who appeared to have deficiencies in understanding, processing or describing their emotions. The individual's level of alexithymia can be measured with self-scored questionnaires such as the Toronto Alexithymia (TAS 20) or the Bermond - Vorst Alexithymia Questionnaire (BVAQ) or by observer rated measures such as the observer Alexithymia Scale. (OAS)

Goleman exemplifies more clearly than most the fundamental absurdity of the tendency to class almost any type of behaviour as 'intelligence'. Eysenck writes that Goleman's description of EI contains unsubstantiated assumptions about intelligence in general. One criticism of the works of Mayer and Salovey suggests that the EI is just a measuring conformity. Further concerted criticisms have been offered by Brody, Landy, etc. Over all there has been little acceptance of EI as a mental ability in the scientific literature.

OBJECTIVES OF TEACHING PHYSICS AT HIGHER SECONDARY STAGE

The knowledge gained about the universe is science and this knowledge is so vast that the human mind cannot comprehend it completely. Hence, science has different divisions as physics, chemistry, Biology etc. Among these divisions, "Physics" has greater importance since we apply a number of physical principles in our day to day life. The instruments which we use in the regular life are based on the principles of physics. Hence, Physics teaching becomes a vital aspect in all levels of education.

The objectives of teaching physics at Higher Secondary stage as stated in the Gazette / Teacher's Hand Book published by the Government of Tamil Nadu are as follows :-

- ★ To develop critical thinking.
- ★ To stimulate the pupils to acquire scientific knowledge.
- ★ To develop abilities such as collecting data limitations, classifying etc.
- ★ To spell out the uses, benefits and limitations of science.
- ★ To develop an interest in modern technologies to understand complicated topics in physics like modern physics and electronics.
- ★ To develop the habits of concentration, self- reliance and discovery.
- ★ To develop the powers of thinking and reasoning.
- ★ To develop the power of logical thinking.
- ★ To enable the students to solve the scientific problems of the day today life.

The objectives of physics (Marlow Ediger and Bhaskara Rao, 1996) are as follows :-

- ★ The pupil acquires knowledge of terms, facts, concepts, definitions, fundamental laws, principles and processes in the field of physics.
- ★ The pupil develops understanding of terms, facts, concepts, fundamental laws, principles and processes in the field of physics.
- ★ The pupil applies his knowledge and understanding of physics to unfamiliar situations.

- ★ The pupil develops observing, manipulating, drawing and reporting skills.
- ★ The pupil appreciates the contribution of physics to human happiness.
- ★ The pupil develops interest in the world of physical science.
- ★ The pupil develops scientific attitude through the study of physical science.

The instructional objectives of physics as stated by Srivastava, H.S. and Shoure, J.P. (1989) are as follows :

- ★ To acquire the knowledge of terms, facts, concepts, definitions, fundamental laws, principles and processes in the field of physics.
- ★ To develop an understanding of terms, facts, concepts, definitions, fundamental laws, principles and processes in the field of physics.
- ★ To apply the knowledge and understanding of physics of unfamiliar students.
- ★ To develop skill in the practical aspects of handling apparatus, recording observations and drawing diagrams, graphs etc.
- ★ To appreciate the contributions of physics to scientific and technological developments and human happiness.
- ★ To develop interest in the world of physical science.
- ★ To develop scientific attitude through the study of physical sciences.

NEED FOR ALTERNATIVE STRATEGIES IN TEACHING PHYSICS

The quality of education depends largely upon the quality of teachers and the teaching learning resources available for the system. The main problem in enriching the teaching - learning process, in the developing countries, is the over crowdedness of the classrooms. The number of learners are so large with diverse learning needs and the resources are so meager that the objectives of the system become far reaching goal and require much longer time if, the system depends entirely upon traditional instruction (Deshmukh, 1998)

The expansion of mass media in our informatic age provides more and more varies sources of information to the society. The communication resources available, help the learners to absorb more information and various experiences in many phenomena. The introduction of a wide variety of new instructional methods, techniques and curricula into education has contributed to the growing use of instructional media in the classroom.

The use of multimedia in science instruction has continued to grow as educations have been able to identify and understand the process of the usefulness of the media to develop better understanding of science phenomena among the students. The subject physics is more difficult in nature among all science subjects, it needs high imaginative power with reasoning abilities on the part of the learners to understand.

It is evident that due to poor imaginative power the students found difficulties in understanding some of the phenomenon in physics which require the help of mental pictures (Rangaraj, 1995). Hence it is essential to provide an alternative and most suitable instructional strategy to teach Physics for the better and best understanding among the learners.

The best instructional strategies should fulfill the heterogeneous requirement of the learners. So it is suggested that computers with multimedia techniques be used as a tool for science teaching, especially for physics teaching. Further, it can also be used to study the memory related issues as well. Therefore, computers can be used to provide an alternative teaching method so as to enable the learners to understand the physics subject in a better way.

NEED FOR THE STUDY

Modern society is characterised by rapid development especially in technology. Computers with multimedia technology have a vital role to play in the schools of our nation.

The National Education Policy (1986) emphasised the introduction of technology in education. Computer Assisted Instruction (CAI) is becoming an increasingly popular technique for education. In schools, students and Teachers face a lot of problems in Teaching and learning, particularly in physics. It raises the importance of individualising the instructions and computers with multimedia technology do serve this purpose. Moreover, computers with multimedia in education influence the students way of learning and thinking to a great extent.

Research on academic learning enlighten a new area called as "Self-Regulated Learning" in which the learner manages the complex activities. The ability to manage one's own learning and regulating oneself is very much important to face the multi-facet development in the society.

Instructional strategies are viewed as effective ways to regulate the student's learning which in turn increases their academic achievement. There is considerable body of knowledge, which suggests that - teaching the students with multi - media technique will improve their learning. CAI is proved to be the effective way of providing instructions in physics which increases the achievement as well as the regulatory capacities of the students. Hence it is imperative to find out the effect of computer with multi - media as a tool for delivering instructions and its effect on students achievement.

STATEMENT OF THE PROBLEM

In schools and colleges in a normal class, students with different intelligence ie., Low Achiever (L.A), Medium Achiever (M.A) and High Achiever (H.A) are there. Teachers find difficulty to provide instructions to all the category of students simultaneously. A suitable technique is to be found and adopted for teaching and learning of physics. Current trend is multi - media technique to provide suitable learning situation. Keeping these points in view, the present study on "EFFECTIVENESS OF MULTIMEDIA IN RELATION TO INTELLIGENCE IN THE CONTEXT OF TEACHING AND LEARNING OF PHYSICS AT THE HIGHER SECONDARY STAGE." was taken up.

SCOPE OF THE STUDY

Children of today are the future citizens of the country. The problem that plaques every teacher at all levels of education is how to deal with students who differ in their skills and learning rates. The problems of

accommodating student's differences is so important that many educators have suggested that instructions be completely individualised so that students can work independently at their own pace. Hence, there is a need to assess the impact of different instructional techniques.

An effective instructional techniques should cater to pupil diversities and it should reach out to all learners. The existing mode of instruction ie, the traditional lecture does not rise to the occasion. It does not cater to individual differences and pupil diversities to a great extent. Also, the current trend is learner centred mode of instruction. With these views in mind, self learning computer assisted packages with multimedia techniques have been developed by the investigator to cater, the needs of L.A, M.A., and H.A.

One chapter from +2 physics has been chosen and it was divided into six units. Each and every units have been taught with multimedia techniques as 6 modules.

By conducting Intelligence culture Fair Test, 30 Low Achiever, 30 Medium Achiever and 30 High Achiever students have been selected from two Aided schools as Control Group. Similarly by conducting the above said Test, 30 Low Achiever, 30 Medium Achiever and 30 High Achiever have been selected from another two aided schools as Experimental Group.

Control Group was taught by Traditional Lecture method and Experimental Group by modular computer assisted self learning packages.

OBJECTIVES OF THE STUDY

The objectives of the study are stated as follows:

General Objectives

1. To develop modules of self learning computer Assisted packages of a selected chapter in +2 physics.
2. To find out the efficacy of these modules of instruction in teaching learning physics at +2 level.
3. To assess the advantages of these modules of instructions in an inclusive setting over the traditional lecture method.

Specific Objectives

1. To conduct intelligence test of scale 3 (cattie & cattie) to the random samples choosen from Aided schools to obtain three Groups of samples namely Low achiever (LA), Medium achiever (MA) and High achiever (HA) from two major groups Control Group and Experimental Group.
2. To conduct Pre - Test, prepared by investigator, to both Experimental Group (EG) and Control Group (CG) to test the previons knowledge of the students (samples) to make them to learn the modules by E.G. and C.G.
3. To find out any significant difference among LA, MA, & HA of control group and Experimental Group with respect to

- (i) I.Q. Scores
- (ii) Pre - Test Scores
- (iii) Scores of modules 1 to 6 of Criterion Referenced Test (CRT) (post test)
- (iv) Marks obtained in +2 Public Examination.

4. To assess whether there is any significant differences between

- (i) LA of CG and LA of EG
- (ii) MA of CG and MA of EG
- (iii) HA of CG and HA of EG
- (iv) LA of CG and MA of EG
- (v) LA of CG and HA of EG
- (vi) MA of CG and HA of EG

With respect to

- (i) I.Q Scores
- (ii) Pre - Test Scores
- (iii) Scores of modules 1 to 6 individually
- (iv) Total scores of modules 1 to 6
- (v) Marks obtained in +2 Public Examination

5. To find out the correlation co - efficient between the scores of Criterion Referenced Test and the marks obtained in +2 Public Examination of all the three groups of students namely LA, MA & HA of both CG and EG.

6. To construct correlation matrix individually by calculating Regression Co-efficient for CG and EG of LA, MA & HA with respect to I.Q scores, scores of knowledge level (K), Understanding level (U), Application level (A), Total scores of K, U & A and +2 marks of public examination.
7. To construct correlation matrix for overall performance of CG and EG with respect to I. Q scores, Total scores of K, Total scores of U, Total scores of A, grand total scores of K, U & A and +2 marks of public examination.
8. To findout whether there is a significant difference in connection with difficulty levels of modules experienced by both CG & EG of all the three catagories (LA, MA & HA) and the opinion given by Teachers handling +2 physics.

HYPOTHESES

Hypotheses of the study are stated as follows :-

1. There exists significant difference among three catagories of students (LA, MA & HA) in Control Group (CG) and Experimental Group (EG) with respect to I.Q scores.
2. There is significant difference among three catagories of students in control group and in experimental group with respect to pre - test scores.
3. There is significant difference among three catagories of students in CG and EG with respect to modular studies (modules from 1 to 6)

4. There exists significant differences among three categories of students both in EG and CG with respect to +2 public examination marks.
5. There is significant difference between LA of EG and LA of CG with respect to I.Q scores and pre - test scores.
6. There is significant difference between LA of EG and LA of CG with respect to total scores obtained in
 - (i) Knowledge level (K)
 - (ii) Understanding level (U)
 - (iii) Application level (A) and
 - (iv) +2 Public Examination marks.
7. There is significant difference between MA of EG and MA of CG with respect to I.Q scores and in pre - test scores.
8. There exists significant difference between MA of EG and MA of CG with respect to modular studies (modules from 1 to 6) and +2 public examination marks.
9. There exists significant difference between HA of EG and HA of CG regarding I.Q scores and the scores of pre - test.
10. There is significant difference between HA of EG and HA of CG with respect to modular studies and +2 public examination marks.
11. There exists significant difference between LA of EG and MA of CG pertaining to I.Q scores, pre - test scores, modular studies and +2 public examination marks.

12. There is significant difference between LA of EG and HA of CG regarding I.Q scores, pre-test scores, scores of modular studies and +2 public examination marks.
13. There exists significant difference between MA of EG and HA of CG with respect to I.Q scores, pre -test scores, scores of modular studies and +2 public examination marks.
14. There is significant correlation between scores obtained in Creterian Referenced Test (CRT) and +2 public examination marks of LA, MA & HA of both CG and EG.
15. There exists significant correlation in respect of overall performance among I.Q scores, scores of knowledge level, scores of understanding level, scores of application level, total scores of (K,U & A) and + 2 public examination marks in CG of EG comprising of LA, MA & HA.
16. There is significant difference in connection with the difficulty levels of modules experienced by both CG & EG of all the three catagories (LA, MA & HA) and the opinion by Teachers handling +2 physics.

TOOLS USED IN THE STUDY

Tools used in the study are stated as follows :

A Pre -Test prepared by the Investigator

It is a test to find out the basic knowledge required to study and

understand the chapter called Electrostatics in +2 physics subject. This test contains 20 items with four multiple answer type covering all the basic knowledges required to understand the above said chapter. Time limit for the above said test to answer the 20 items is 15 minutes. This test was conducted to all the samples.

Culture Fair Intelligence Test Scale 3 Form A by Cattell and Cattell

The culture Fair Intelligence test scale - 3 Form A developed by R.B. Cattell and A.K.S. Cattell measures individual intelligence. It was designed to reduce, as much as possible, the influence of verbal fluency, cultural climate and educational level. This test contains four tests which may be conducted individually or in a group. These tests are non-verbal and require only that examinees be able to understand relationships in shapes and figures. These tests can be administered in a single session to all the samples for grouping the samples into required number of categories.

The Criterion Referenced Test (CRT) Prepared by Investigator for Post - Test

Six objective based criterion - referenced tests in the selected content areas were developed by the investigator. The items in the criterion - referenced tests are multiple choice type, testing the cognition of the subjects at different levels viz. Knowledge, Understanding and Application. There are 101 items totally in all the six tests among which 56 items are pertaining to knowledge, 31 items to understanding and 14 items to application.

METHODOLOGY IN BRIEF

Self learning packages (Compact Disc - CD) with multimedia techniques have been developed by the investigator for the Chapter Electrostatics in +2 physics subject by dividing into 6 units as 6 modules.

To select samples of different intelligence groups, intelligence culture Fair Tests have been administered to the random samples selected in four aided schools. One group of sample selected from two schools was considered as experimental group and another group of sample selected from other two schools was considered as control group.

Based on the Raw scores of intelligence test the samples have been classified into three categories namely.

- (i) Low Achiever (LA)
- (ii) Medium Achiever (MA)

and (iii) High Achiever (HA) in both control group and experimental group. As such the investigator has chosen the samples of 30 students in each category. Totally 30 LA, 30 MA, & 30 HA in control group and 30 LA, 30 MA & 30 HA in experimental group.

The pre - test has been conducted to both control group and experimental group. The marks scored by the both groups have been compared in the statistical analysis part.

Modules 1 to 6 have been given to experimental group only to study

at their own pace with the help of computer and CRTs have been conducted to them. Scores obtained in CRTs by experimental group have been analysed. Control group has been taught the same content by traditional chalk and talk method. The same CRTs for control group also have been conducted. The scores obtained by all the category students of C.G & E.G of all the 6 modules have also been analysed.

DELIMITATIONS OF THE STUDY

The delimitations of the study are as follows :

1. To establish homogeneity among the control group and experimental group the scores of pre-test conducted for 12th Std. Students (sample) are alone considered as base. The intervening variables such as anxiety, fatigue, motivation, attitude and personality were not considered while establishing the homogeneity among the control and experimental groups.
2. The investigator has developed six modules of syllabus oriented multimedia based CAI packages for only one chapter (Electrostatics) concerned with 12th standard physics. It was not possible for the investigator to develop the packages for the whole syllabus since, it consumes more time, money and energy.
3. Though there are different moduls of CAI possible, viz tutorial, drill & practice and simulation, the investigator decided to adopt the effectiveness of the tutorial mode only.

4. In this study English Medium was alone considered. Gender wise (Boys & Girls) comparison has not been done.
5. The study was confined to +2 students (12th Std) studied in four Aided Schools only.

A BRIEF RESUME OF THE SUCCEEDING CHAPTERS

The present research study is reported in six chapters followed by bibliography and appendices respectively in accordance with the logical sequence of the study.

Chapter I deals with the statement of the problem and the need for the study has been explained. The importance of science education and educational technology have also been delt.

Chapter II deals with multimedia. A conceptional frame work of the study. Hence an attempt is made to explain about multimedia component, multimedia asset development, computer graphic production, video production, sound production, file format conversion, authoring system of integration animation techniques and computer assisted instruction in detail.

In III chapter, an extensive review of empirical studies related to multimedia based computer animation technology and CAI has been done in this chapter.

Chapter IV explains the development of multimedia self learning packages, procedures adopted in various tests conducted, tools used and statistical techniques used for analising datas.

The V chapter presents a detailed report of the analysis and interpretation of data and the hypotheses testing.

VI - chapter summarizes the findings and conclusions of the study, provides implications of delimitations of the study and suggests for further research studies also.