## CHAPTER - VI

**AN OVERVIEW OF THE STUDY**

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CHAPTER - VI

AN OVERVIEW OF THE STUDY

INTRODUCTION

It is the essential work of the investigator to recall and reproduce what was done in the previous chapters and to give a summary of the findings. It is also possible to the investigator to register his suggestions for further research study with recommendations in this chapter.

EDUCATIONAL TECHNOLOGY

"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 interactive components viz. Technology of Education and Technology in Education.

Technology of Education includes the system approach to solve educational problems, through interactive strategies corresponding to the psychology of human learning leading to multimedia 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 primary role of Educational Technology is to increase both efficiency and effectiveness of teaching-learning process and that a systems approach is employed to achieve this purpose.

**MULTIMEDIA**

Multimedia is the use of a computer to present and combine text, graphics, audio and video with links and tools that let the user navigate, interact, create and communicate.

Multimedia are of two categories which are linear and non-linear types. The Non-linear category has been used in this study. Multimedia presentations and multimedia games and simulations are the features of multimedia. Multimedia presentations can be viewed in person on stage, projected, transmitted, or played locally with a media player. 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.

**MULTIMEDIA MODULE COMPONENTS**

It has been dealt in details about the following Components of Multimedia Chapter II.

**Content**: Suitable content area (i.e.) Electrostatics chapter in +2 Physics has been selected. This electrostatics chapter has more abstract concepts in which students often have difficulty integration into their intuition. Since, Multimedia Tutorials present information through graphics, animations, video and sound, educational multimedia modules may appeal to some students who find text book learning rather difficult or boring.
Multimedia Asset Development: Multimedia assets are considered to be the building blocks of a multimedia software package. Simulation software provides students and faculty with the ability to simulate and solve a wide variety of problems and to emphasize practical applications of the concepts. The development of multimedia assets can be divided into three general areas: (1) Computer graphics production, (2) Video production and (3) Sound production. Other multimedia module components such as file format conversion, Authoring system integration, Computer Animation Technology, Principles of Animation, Design of Animation sequences, Conventional Animation and Computer Assisted Animation have been dealt in Chapter II.

ROLE OF MULTIMEDIA BASED COMPUTER ANIMATION COURSEWARE IN SCHOOLS

Most of the Multimedia animation softwares have been designed to remove the difficulties, which the teachers and pupils have in teaching learning processes. Especially the scientific concepts can be understood easily with the help of computer animation coursewares. For examples when the working of Van de Graaf Generator with animation is visualised by a physics student, he enjoys and understands very easily the parts and all working details. Similarly, the Biology students and Chemistry students at the higher secondary stage understand the difficult concepts soon when animated pictures are shown to them with the help of computers.

MULTIMEDIA - ITS APPLICATIONS

Multimedia finds its application in various areas such as advertisements, art, education, entertainment, engineering, medicine, mathematics, business and scientific research.
In Education, Multimedia is used to produce computer-based training courses (popularly called CBT) 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. Multimedia can be applied in teaching different subjects - foreign language, science subjects like Physics, Chemistry & Biology, humanities like History, Geography, musics and arts.

THEORIES OF INTELLIGENCE

Intelligence is a great property to be acquired by everyone. Nobody is born intelligently but everyone can grow intelligently. According to David Wechsler, intelligence is a global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment.

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. Howard Gardener's Theory of Multiple Intelligences is based on studies not only on normal children and adults but also by studies of gifted individuals of persons who have suffered brain damage, of experts and virtuosos, and individuals from diverse cultures. This led Gardner to break intelligence down into at least eight different components: logical, linguistic, spatial, musical, kinesthetic, naturalist, intrapersonal and interpersonal intelligences. 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 everyday life such as giving an extempoaneous talk (linguistic) or being able to find one's way is a new town (spatial). Gardner believe that traditional types of intelligence, such as IQ, fail to fully explain cognitive ability. Multiple intelligence is a psychological and educational theory which suggests that each individual manifests varying levels of eight different components of intelligence given by him.

**COMPUTERS IN EDUCATION**

Computers in Education are revolutionary both in Teaching and Learning processes. Computers allow the development of interactive and individualised relations with the learner and no other technology has this potentiality except a human teacher. Uniqueness of computers lies in their informational capacity to present the learner a whole world in a capsule enabling the learner to interact directly with a domain of knowledge. Computers have brought a revolution in information technology - composing, communicating, processing, retrieving, preserving and destroying information. It is difficult to decide how to use computers because the technology keeps on changing and new studies induce the teachers to shift their properties for use of computers for the development of skills needed for national development, computers are used in education.

The interactive computer based instruction changes the traditional teacher based instruction. The systematicity and the potential multidimensionality of the computers as instructive, individualised tutors facilitate the learners to learn effectively.
COMPUTER ASSISTED INSTRUCTION

In education, an early attempt made in computer managed learning was the Individually prescribed Instruction (IPI) project, in which a computer was programmed to provide daily tests and assignment lessons for studies. Teachers freed from record keeping, and from deciding what and how students should learn, were function as tutors, helping the children to maximise the leaving from their computer-prescribed lessons.

Computer Assisted Instruction (CAI) in the natural outgrowth of applications of the principles of programmed learning. The different types of CAI applications are games, simulations, problem solving, drill and practice and tutorial programs. The psychological principles involved in the CAI are principle of small steps, principle of active responding, principle of immediate reinforcement, principle of self-pacing and principle of student-evaluation.

CAI can be modified to suit many needs of individual learners. The level of task difficulty, the extent of remediation, the pacing of instruction, the frequency of reinforcement and the use of motivational elements can all be adjusted to suit the learners requirements. The use of CAI reveals increase in both effectiveness and efficiency. It is possible to use the computers to teach new skills or concepts, give remedial teaching, provide for enrichment of learning, promote creative thinking and problem solving, etc.

Kemmis, Akkins and Wright proposed a frame work for Computer Assisted Learning (CAL). They proposed four paradigms for applying the computer to education. The paradigms are given as follows:
MULTIMEDIA BASED COMPUTER SOFTWARE IN PHYSICS

The development of the Multimedia Based Computer Software in Physics depends upon three components namely instructional strategy, screen design and human factors. Curriculum based courseware around these three components, designed by educators can proceed to new technological development into teaching-learning process. A good educational software tries not only to teach but it should provide a stimulus for the learning experience. Hence, the teachers and courseware designers should coordinate together to produce curriculum based learning packages.

The investigator should have a thorough knowledge of the +2 Physics textbook and to identify the chapters which are most suitable for the development of Computer Based Teaching and Learning Packages with Multimedia Techniques. He also would have made discussion with the Physics teachers, computer experts and educational technologists while planning for the preparation of Teaching Learning packages in the subject Physics. Consequently, the investigator selected one chapter called “Electrostatics” which is syllabus based content area in +2 Physics.

An educational self learning package should satisfy the needs of individual learners and also it should instruct a conceptual information according to their own pace of learning. So, it was decided to develop a syllabus based instructional self-learning packages in Tutorial method.
INSTRUCTIONAL STRATEGIES AVAILED IN THE STUDY

In this study two different instructional strategies were adopted to the control group and Experimental group.

(i) Lecture Method (LM)

The Lecture method treatment was given to control group. The lecture method is one of the successful instructional strategies in physics teaching ever after the availabilities of the sophisticated media. This teacher centered method is still useful to explain the equations in physics and the cause and effect phenomena. It is flexible method, since the teacher can adopt himself to the subject matter, time limit, available apparatus and equipments. Attention and interest of the students can be captured by the teacher by his way of presentation of subject matter. The Physical environment of the classroom enhances the sense of security in the minds of the students providing them with group feeling, emotional attainment and social reinforcement which lead to expected levels of interaction and feedback in the Physics class. Hence this lecture method which is considered as one of the best and cheapest methods of teaching was adopted by the investigator in the control group.

(ii) Multimedia Based CAI as Individualised Instructional Strategy:

Now a days computers are considered to be one of the most powerful sources of information. Multimedia Based Computer Assisted Instructional (MBCAI) packages are useful for the learners to study the lessons at their own pace. We know that there are individual differences existing among the students. So, MBCAI packages provide the instruction
according to the ability of the individual learner and motivates the learners to learn much faster. The MBCAI as individualised instructional strategy was used as the experimental intervention to the experimental group.

**NEED FOR THE STUDY**

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.

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 multimedia 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 effectiveness of multimedia with computer as a tool for delivering instructions and its effect to all the categories of students achievement.

**STATEMENT OF THE PROBLEM**

In Schools and Colleges, in a normal class, students with different intelligence (i.e.), Low Achiever (LA), Medium Achiever (MA) and High
Achiever (HA) are there. Teachers experience difficulties to provide instructions to all the categories of students simultaneously. A most suitable technique is to be found and adopted for teaching and learning of physics. Current trend is multi-media technique with CAI 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 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 (i.e), 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 centered 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 LA, MA and HA. One chapter from +2 physics has been choosen and it was divided into six units. Each and every units have been taught with multimedia techniques as six 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 multimedia based Computer Assisted Instructional Packages of a selected chapter in +2 Physics.

2. To find out the efficacy of these modules of instruction in teaching and learning of 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 (cattle & cattle) to the random samples chosen from Aided schools to obtain three groups of samples namely Low Achiever (LA), Medium Achiever (MA) and High Achiever (HA) from two major groups Viz 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 previous knowledge of the students (samples) to make them learn the modules by EG and CG.

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 Criterian Referenced Test (CRT) - (Post Test)
   (iv) Marks obtained in +2 Public Examination.

4. To assess whether there is any significant difference 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 Criterian Referenced Test (CRT) 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 find out whether there is a significant difference in connection with difficulty levels of modules experienced by both CG & EG of all the three categories (LA, MA & HA) and the opinion given by Teachers handling +2 physics.

HYPOTHESES

The hypotheses of the study are stated as follows:

1. There exists significant difference among three categories 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 categories of students in Control Group and Experimental Group with respect to Pre-Test Scores.
3. There is significant difference among three categories of students in CG and EG with respect to modular studies (modules from 1 to 6).

4. There exists significant difference 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 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 Criterion Referenced Test (CRT) and +2 Public Examination marks of LA, MA & HA of both CG and EG.

15. There is significant correlation in respect of overall performance among I.Q scores, scores of Knowledge level (K), scores of Understanding level (U), scores of application level, total scores of (K, U & A) and +2 Public Examination marks in CG & 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 categories (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. The 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 Cattle and Cattle**

The Culture Fair Intelligence test scale-3 Form A developed by R.B Cattle and A.K.S Cattle measures individual intelligence. It was designed to reduce, as much as possible, the fluence of verbal fluency, culture climate and educational level. This test contains four tests which may be conducted individually or in a group. Those tests are non-verbal and require only that examinees be able understand relationships in shapes and figures. These tests can be administrated in a single session to all the samples for grouping the samples into required number of categories. Raw scores obtained in I.Q test by the samples (students) upto 16 was considered as LA, from 17 to 20 as MA and from 21 to 24 as HA in both the CG and EG.

**The Criterion Referenced Test (CRT)**

**Prepared by Investigator for Post-Test**

Six objective based criterion-referenced tests from six modules, each one from each module, 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 of 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

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 30LA, 30MA & 30HA in control group and 30LA, 30MA & 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 categories of students of control group and experimental group 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 I.Q 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 modes 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.
MAJOR FINDINGS AND CONCLUSIONS OF THE STUDY

1. From the analysis of null hypothesis : 1, it is found that the ‘F’ values are significant at 1% level with respect to I.Q.scores. Hence, the null hypothesis is rejected and the hypothesis is accepted. It is concluded that there is significant difference among three categories of students (LA, MA & HA) in control and experimental groups with respect to I.Q.scores.

2. From the analysis of the null hypothesis : 2, it found that the ‘F’ value for control group is significant at 5% level but the ‘F’ value for experimental group is not significant. Hence, the null hypothesis is rejected with respect to CG but accepted regarding EG. It is concluded that there is significant difference among three categories of students in control group but in experimental group, there is no significant difference with respect to pre-test scores. The three categories of all the students in experimental group would have possessed thorough basic knowledge required to study the chapter Electrostatics. This may be the reason for difference in significance levels between CG and EG.

3. From the analysis of the null hypothesis : 3, it is found that there are no significant differences in ‘F’ value among three categories in CG with respect to scores of modular studies from the modules 1 to 6 except modules 4 & 5 at knowledge level and understanding level and module 6 at application level. Hence, the null hypothesis meant for CG is accepted to the maximum extent and hypothesis is rejected.
It is concluded that all the modules taught by the investigator might be easy to understand by all the categories of students except the module 5 knowledge level and understanding level, similarly application level in module 6.

Regarding EG, it is found that there are no significant differences in 'F' values among three categories with respect to the scores of modular studies from the 1 to 6 except module 4, knowledge level and module 6 application level. Hence, the null hypothesis meant for E.G. is accepted to the maximum extent and hypothesis is rejected. It is concluded that all the modules of multimedia Based Computer Assisted packages (MBCAP) developed by the investigator might be easy to understand by all the categories of students. (i.e.) Even low achiever and medium achiever can also study the packages easily. In module 4th and 5th knowledge level 5% significance and in module 6th application level 1% significance are resulted. So the reasons for this occurrence may be: Packages - modules 4, 5 & 6 may be difficult or the students would have not learnt thoroughly.

4. From the analysis of the null hypothesis : 4, it is found that the 'F' values are significant at 1% level both in EG and CG. This means that the different categories of students differently performed in +2 Public Examination (Physics), according to their intelligence level both in EG and CG. Hence, the null hypothesis is rejected and hypothesis is accepted.
5. From the analysis of null hypothesis : 5, it is found that the 'F' values are not significant between the mean scores of LA in EG and mean scores of LA in CG with respect to both I.Q.test and pre-test. Hence the null hypothesis is accepted and the hypothesis is rejected. It is concluded that the low achievers (LA) in EG and CG scored more or less same scores in both the tests.

6. From the analysis of null hypothesis : 6, it is found that there is significant difference in 't' value between the mean of total scores obtained by LA of EG and LA of CG with respect to (i) Knowledge level 1% (ii) Understanding level 1% and (iii) Application level 5% in the cognitive levels of learning. Hence, null hypothesis is rejected and hypothesis is accepted. But in +2 public examination marks obtained by LA of EG and LA of CG, there is no significant difference in 't' value between them. So this part of null hypothesis is accepted and hypothesis is rejected. It infers that both the groups of students would have prepared and performed well in the +2 public examination.

7. From the analysis of null hypothesis : 7, it is found that there is no significant difference in 't' value between the mean scores obtained by MA of EG and MA of CG with respect to I.Q.test but there is significant difference (1% level) in 't' value between the mean scores of MA of EG and MA of CG with respect to pre-test. Hence, the null hypothesis is partially true and partially faulse and hypothesis is also partially true and partially faulse.
8. From the analysis of null hypothesis: 8, it is found that there is significant difference in 't' value between the mean of total scores obtained by MA of EG and MA of CG with respect to (i) Knowledge level 1% (ii) Understanding level 1% (iii) Application level 1%, but there is no significant difference in 't' value between MA of EG and MA of CG with respect to +2 public examination marks. Hence, the null hypothesis is rejected with respect to modular studies but accepted regarding +2 public examination marks and hypothesis is accepted with respect to modular studies but rejected regarding +2 public examination marks.

9. From the analysis of null hypothesis: 9, it is found that there is no significant difference in 't' value between the mean scores of HA of EG and HA of CG regarding the I.Q. test but there is significant difference between the mean of HA of EG and HA of CG at 1% level. Hence, the null hypothesis is accepted regarding I.Q. test but rejected with respect to pre-test and the hypothesis is rejected regarding I.Q. test but accepted with respect to pre-test. The reason for such occurrence of result (NS) is quite natural, because the intelligence of HA of EG and CG will be same and the performance of HA of EG and CG in the pre-test is different (significance at 1%). Ex-post factor would have resulted.

10. From the analysis of null hypothesis: 10, it is found that there is significant difference in 't' value between the mean of total scores obtained by HA of EG and HA of CG with respect to
modular study 1 to 6 (i) Knowledge level 1% (ii) Understanding level 1% (iii) Application level 1% but there is no significant difference in ‘t’ value between HA of EG and HA of CG with respect to +2 public examination marks. Hence, the null hypothesis is rejected with respect to modular study but accepted regarding +2 public examination marks and the hypothesis is accepted with respect to modular study but rejected regarding +2 public examination marks.

11. From the analysis of null hypothesis : 11, it is found that there is significant difference in ‘t’ value between LA of EG and MA of CG pertaining to I.Q. scores 1%, Pre-test score 1%, modular studies knowledge level 1%, Understanding level 1% and +2 examination marks 1% but in scores of application level of modular study only there is no significant difference in ‘t’ value. The results are not in accordance with the stated null hypothesis except in application level of modular study. Hence, the null hypothesis is rejected to the maximum extent and hypothesis is accepted.

12. From the analysis of null hypothesis : 12, it is found that there is significant difference in ‘t’ value between LA of EG and HA of CG regarding to I.Q. scores 1% Pre-test scores 1%, +2 Public examination scores 1% and in modular studies knowledge level 1%, Understanding level 5% but in application level there is no significant difference in ‘t’ value. The results do not coincide with the stated null hypothesis except in application
level of modular study. Hence, the null hypothesis is rejected to the maximum extent and hypothesis is accepted.

13. From the analysis of null hypothesis: 13, it is found that there is significant difference in 't' value between MA of EG and HA of CG with respect to I.Q. scores 1%, Pre-test scores 5%, +2 public examination scores 1% and in modular studies knowledge level 5%, Understanding level 1% and application level 1%. Since the above mentioned results are in accordance with the stated null hypothesis, the null hypothesis is rejected and the hypothesis is accepted.

14. From the analysis of null hypothesis: 14, it is found that the Regression coefficients are not significant for LA and MA of both CG and EG, where as it is highly significant at 1% in the ease of HA of both CG and EG, indicates that as total marks in CRT increases +2 public examination mark also increases. The simple correlation coefficients were also worked out between total marks of CRT and +2 public examination marks for each category. The correlation coefficients are not significant in the case of LA and MA of EG and CG where as in the case of HA, the correlation coefficients are significant at 1%, indicating that there is a significant relationship between total marks of CRT and +2 public examination marks. It is concluded that only in HA of both CG & EG, there is significant correlation between scores obtained in CRT and +2 public examination marks. Hence the stated null hypothesis is accepted in the case
of LA & MA of EG and CG but the stated null hypothesis is rejected in the case of HA of both EG and CG. In total, the stated null hypothesis is accepted partially and hypothesis is rejected partially.

15. From the analysis of null hypothesis: 15, (A) the following are the inferences regarding CG.

1. There is significant correlation between total knowledge scores and total I.Q. scores at 1% level. This means that when I.Q. is more, the score to be obtained will also be more.

2. There is no significant correlation between the scores of Total (U) and I.Q. This result is unexpected. Various reasons may be there for such a unexpected result.

3. There is significant correlation between the scores of Total (U) and total (K) at 1% level.

4. There is no significant correlation between the scores of Total (A) and I.Q. This result is also unexpected.

5. There is significant correlation between the scores of Total (A) and Total (K) at 1% level.

6. There is significant correlation between the scores of Total (A) and Total (U) at 1% level.

7. There is no significant correlation between the scores of Total of total and I.Q.
8. The correlation is significant at 1% level each for the combinations of Total of Total and Total (K), Total of Total and Total (U) and Total of Total and Total (A).

9. The correlations are significant at 1% level each between (+2 public examination mark and I.Q. scores), and (+2 public examination mark and Total K).

10. There are no significant correlations between the pairs (+2 mark and Total U), (+2 mark and Total A) and (+2 mark and Total of total). This unexpected results may be due to various reasons.

With these inferences, one part of the stated null hypothesis regarding CG is rejected to the maximum extent and hypothesis is accepted.

(B) The following are the inferences regarding EG.

1. There is no significant correlation between Total (K) and I.Q. scores. This result is not meaningful and various reasons may be there for such occurrence of result.

2. There is no significant correlation between Total (U) and I.Q. score but there is significant correlation between Total (U) and Total (K) at 1% level.

3. There is no significant correlation between Total (A) and I.Q score but there are significant correlations between [Total (A) and Total (K)] and [Total (A) and Total (U)] 1% each.
4. There is no significant correlation between Total of Total and I.Q. scores but there are significant correlations between [Total of Total and Total (K)], [Total of Total and Total (U)] and [Total of Total and Total (A)] 1% each.

5. There are significant correlations between [+2 mark and I.Q] and [+2 mark and Total (K)] 1% each.

6. There are no significant correlations between [+2 mark and Total (U)], [+2 mark and Total (A)] and [+2 mark and Total of Total]

With these inferences, the other part regarding EG of the stated null hypothesis is rejected to the maximum extent and the hypothesis is accepted.

16. To analysis of null hypothesis 16, the two statistical techniques, Friedman Two-way analysis of variance and spearman's Rank correlation have been attempted. From Friedman Two-way Analysis of variance, the order of difficulty levels of six modules ranker by 20 physics teachers is found as

\[ 2 < 1 < 3 < 4 < 5 < 6 \]

calculated value of mean of ranks of different modules ranked by 20 physics teachers : 73.171 (as per Friedman test statistics) [Table value = 15.086 - 1% significance: 11.07 - 5% significance]. Since the calculated values of Rank means of different modules (73.171) ranked by 20 physics teachers is greater than table value 15.086 (1%), there is significant difference between the mean ranks of different modules ranked by teachers.
The correlation between the mean ranks as given by 20 physics teachers for all the six modules and the mean marks obtained by the students in 6 modules in all the categories and groups were used to find out whether there is significant correlation between the teachers and students.

When the correlation coefficients were tested for significance no correlation coefficients were significant. From this it is concluded that the ranking of the difficulty level as given by the physics teachers and the performance of the students of all the 6 modules are independent. So this stated null hypothesis is accepted and hypothesis is rejected.

**DISCUSSION**

In the field of education, there are tremendous changes taken place. Government focus its attention towards the expansion of educational opportunities to all the learners at all the stages. The specific aim of the educational department is to provide effective education to all (SSA).

In the age of information explosion, the challenge of keeping up with emerging technology and knowledge has led to a situation that demands an effective system of continuing technical education throughout one's career. All kinds of education have their supreme aim “the development of individual personality that consequently leads to the development of a society”. It was suggested that the educational technologies should be used as a mean for developing science and humanity courses rather than a mean for commercial purposes. Learning theories pointed out that it is
important for the learners to provide them the subject matters on their own interest so as to remember the material. But, it is inevitable that out present educational system is mainly based on competition which is reflected in almost every aspect of life.

In classroom learning, Traditional methods are felt by today’s students to be out of step. The students of presentday are not ready to accommodate with many of the past routine learning methods. This situation demands the requirement of new technological based methods of instructions.

Tools and software, based on technology offer new opportunities to the present day students to learn effectively. Computer with multimedia techniques are the most effective tool to the students for effective and efficient learning. Especially to teach and learn +2 physics, the software package (MBCAI) developed by the investigator is found to be more effective.

Computers and related information technologies have an instrucmental role in the educational, social and occupational futures of the present generation. Computers have major impact on how students learn and teachers teach. Unlike earlier educational techniques most of which are wasting out, computers are taking hold in the education because they are already transforming society itself (Bhat, 1998). As the computer is considered as an instrument which may be used to analyse the learning achievement and it has the capacity to obtain speedy feedback to the learner.

This is the reason that the computer can be utilised in the instrucmental process as well as in individualised learning.
The result of the study reveals that between two instructional strategies viz., Lecture method (LM) applied to control group and MBCAI method to experimental group, MBCAI substitutes the best classroom (LM) teaching. The performance produced by both methods in this study is the same. The advantages of MBCAI are stated that

(i) the work load of teacher is reduced.

(ii) slow learners (i.e) LA & MA can learn the subject content at their own pace by staying even at their houses if computers exist there.

(iii) even difficult concepts could be understood easily.

It is suggested that all the schools can have sufficient computers with computer-based multimedia packages at the class rooms or at laboratory to provide concrete education to all type of learners.

RECOMMENDATIONS

1. From the findings of the study, it is observed that MBCAI (Multimedia Based Computer Assisted Instruction) is the effective instructional strategy in teaching physics at Higher Secondary stage. Hence it is recommended that the MBCAI strategy in teaching physics at Higher Secondary strategy be used as a supplementary method for the regular classroom instruction in physics.

2. The results of the study have proved that modules prepared by the investigator are the substitute of best teaching and learning process in schools. So Multimedia Based Computer Assisted Instructional packages may be developed by the expertise of resource persons.
and it can be utilised for students of all the standards, especially to
the students of Higher Secondary course as of they have to
score more marks to get admissions in professional courses.

3. Multimedia Based software packages like self learning packages
should be developed which may help the students to learn at their
own pace. The psychological factors such as need, motivation, age,
interest, intelligence, etc. must be taken in to account while designing
the computer packages. Hence, the software developers should
produce MBCAI packages in consultation with the practicing teachers.
The software developed, in such a way, should attract even low
achiever and medium achiever to learn the subject contents
very easily.

4. Classifying students into various categories such as LA, MA & HA
will enable the teachers to devise required remedial instructions to
facilitate their learning. The Teacher trained in this regard will be able
to identify and classify the students into various categories and they
will be able to accommodate their instruction to individual differences.
Such training can be provided to the teachers at District level by
DIET or SSA, at state level by SCERT and at National level by
NCERT.

5. Teachers of middle schools and High schools can also be given
orientation as to how to prepare modules and how to develop
multimedia packages.

6. The NCERT and SCERT may take up the task of developing
modules for each subject and those modules can be supplied to all
the schools so that the teachers can effectively make use of these modules, for the benefit of the entire class.

7. Conferences can be arranged to discuss the importance of computers in Education as well as multimedia techniques to be implemented in learning.

8. The packages of MBCAI can be utilised even in mass classroom teaching by projecting on the screen with the help of LCD projector to have an effective teaching and learning of physics at the Higher Secondary stage. It was implemented by the investigator to his physics class.

N.B:

The above cited recommendations were made because of the following reasons: Multimedia learning enhances various strategies that includes,

★ Drill and practice to master basic skills.
★ The development of writing skills.
★ Problem solving.
★ Understanding abstract mathematics and science concepts.
★ Simulation in science and mathematics.
★ Manipulation of data.
★ Acquisition of computer skills for general purposes, and for business and vocational training.
★ Access for teachers and students in remote locations.
★ Individualized and co-operative learning.
★ Management and administration of classroom activities.
★ Work of own pace and control their learning path.
★ Learn from an infinitely patient tutor.
★ Actively pursue learning and recieve feedback.
SUGGESTIONS FOR THE FURTHER RESEARCH

The present study has been focussed on the effectiveness of multimedia in relation to intelligence in the context of teaching and learning of physics at higher secondary stage. The present investigation has directed to desirable areas for further research.

1. In the present study, CAI in tutorial mode was adopted. But, CAI is available in different modes such as Tutorial, Drill & practice and Simulation. Hence the studies may be conducted in other modes also to provide effective teaching and learning process.

2. In the present study, multimedia based computer assisted modular study has been found to be effective equivalent to best class room teaching learning process to teach at +2 level. To ensure more dependable conclusions, the experiment may be conducted on a wide range of levels and schools.

3. In the present study, the effectiveness of these modular instruction with reference to LA, MA & HA at higher secondary level has been studied. So this procedural study can be extended to high school and middle school students also.

4. In the present study, only one chapter has been covered for investigation. In turn, the full syllabus of particular subject can be taken up into consideration.

5. In the present study, samples (students) have been selected only from urban schools. A comparetive study can be made by selecting students both from rural and urban schools.

6. A separate study, similar to the present study, can be conducted to assess the relative effectiveness of these modular study with reference to various categories of schools (i.e) Government, aided, Matriculation, Corporation and Anglo Indian Schools.