CHAPTER 1

INTRODUCTION
CHAPTER I
INTRODUCTION

TECHNOLOGY AND EDUCATION 1
EDUCATIONAL TECHNOLOGY 2
DEFINITIONS OF EDUCATIONAL TECHNOLOGY 3
IMPORTANCE OF SCIENCE EDUCATION 5
OBJECTIVES OF TEACHING PHYSICS 5
NEED FOR ALTERNATIVE STRATEGIES IN TEACHING PHYSICS 6
COMPUTERS IN EDUCATION 7
COMPUTER ASSISTED INSTRUCTION 9
METHODS OF CAI 10
PEER-BASED COLLABORATIVE INTERACTIONS WITH COMPUTERS 12
SELF-REGULATION IN LEARNING 13
NEED FOR THE STUDY 14
STATEMENT OF THE PROBLEM 15
SCOPE OF THE STUDY 16
OBJECTIVES OF THE STUDY 16
HYPOTHESES 17
TOOLS USED IN THE STUDY 18
METHODOLOGY IN BRIEF 19
DELIMITATIONS OF THE STUDY 19
A BRIEF RESUME OF THE SUCCEEDING CHAPTERS 20
CHAPTER I
INTRODUCTION

Education is a vital aspect for the economic and social development of the country. Education refers to the process by which the society through its different institution, deliberately transmits its cultural heritage from one-generation to another. Education is viewed as a product of experience, which helps for the manifestation of the personality of an individual. Education is indispensable for the well being and survival of mankind. It is a means of meeting the lifelong needs of the people.

It is emphasised that “the end of all education, all training should be man-making. The end and aim of all training is to make the men grow. The training by which the current knowledge and expression of will are brought under control and become fruitful is called education”.

The main function of our present educational system is towards promotion of quality and excellence, in order to meet the challenges of science and technology, providing wider opportunities for vocational education and the development of human resource potential to its fullest extent.

TECHNOLOGY AND EDUCATION

We are at the threshold of a new era which presents momentous changes in the modalities of 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 assisted human beings in achieving their objectives in their respective spheres. 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 walk away from the system with an education that will make them educationally competitive and capable of enjoying life to its fullest.

We know that 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 (ET) 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.

In general, ‘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 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 hardware related
software provided to support the instructional strategies. In general, it assumes that technology has the power to change the process of learning.

There are three underlying trends in the development of Educational Technology (Lydia, Fernandes, 1997) as 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, educationists face the constant challenge of understanding the nature of technologies, their potential uses and their strengths and weaknesses (Rangaraj, 1995).

DEFINITIONS OF EDUCATIONAL TECHNOLOGY

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

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”.

The Modern Encyclopedia of Educational Technology (1994) defines Educational Technology as “continuing changes in educational procedures growing out of applied theory and practice meet and resulting in increasing precision in the control of environmental factors through the coordinated action of personal and instructional media in a man-machine system in the interest of more effective learning”.

International Encyclopedia of Educational Technology (1996) explains Educational Technology as a “problem solving process, concerning most aspects of teaching and learning through media and technology in the context of education and training”. Problems may arise in sub-domains of education, such as curriculum, instruction and learning, methods and media or organisation and management. In developing solutions, use will be made of many technologies in the narrower meaning of the world, educational aspect and applications of information and communication technology. A variety of education and instructional settings are presented as they determine potential solutions.

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.

**IMPORTANCE OF SCIENCE EDUCATION**

Education Commission (1964-66) states that science education must become an 
integral part of school education and ultimately some study of science should become 
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. 
Science strengthens commitments of man to free enquiry and search for truth as its 
highest duty and obligation. By its emphasis on reason and free enquiry, it helps to 
lessen ideological tensions.

It is commonly felt that a child's education cannot be complete unless they have 
some knowledge of science irrespective of the field of study he wishes to pursue in later 
life. Today the great advances in science rendered it absolutely necessary that a 
fundamental knowledge of science should be the 'sine qua non' of any person who was 
educated and who wished to lead a life which combined in itself something of scientific 
aspects of existence (Marlow Ediger and Bhaskara Rao, 1996).

**OBJECTIVES OF TEACHING PHYSICS**

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 devices 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 (Marlow Ediger and Bhaskara Rao, 1996) 
are as follows:

1. The pupil acquires knowledge of terms, facts, concepts, definitions, 
fundamental laws, principles and processes in the field of Physics.
2. The pupil develops understanding of terms, facts, concepts, fundamental laws, principles and processes in the field of Physics.

3. The pupil applies his knowledge and understanding of Physics to unfamiliar situations.

4. The pupil develops observing, manipulating, drawing and reporting skills.

5. The pupil appreciates the contribution of Physics to human happiness.

6. The pupil develops interest in the world of physical science.

7. The pupil develops scientific attitude through the study of physical science.

NEED FOR ALTERNATIVE STRATEGIES IN TEACHING PHYSICS

The quality of education largely depends upon the quality of the teachers and the teaching learning resources available for the system. In the developing countries, the main problem in enriching the teaching-learning process 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 explosion of mass media in our informatic age provides more and more varied sources of information to the society. The communication resources available, help the learners to absorb more information and vicarious experiences in many phenomena. In the last thirty years, 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 different media in science instruction has continued to grow as educators have been able to identify and understand the processes of the usefulness of the media to develop better understanding of science phenomena among the students. Physics being most complex in nature among all science subjects needs high imaginative power with reasoning abilities on the part of the learners to follow. 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 imperative to provide an alternative instructional strategy to teach Physics for the better understanding among the learners.

The alternative instructional strategies should fulfill the heterogeneous requirement of the learners. As review from literature, it is suggested that microcomputers be used as a tool for science teaching, particularly 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.

**COMPUTERS IN EDUCATION**

During the last 20 years, the enlightened countries are looking toward increasing the strength of human thinking with the machine speed and power of the computer. These countries are expanding knowledge by bringing intelligent power to the masses. The basis for many of the transformations taking place in the modern world is associated with the much more rapid flow of information and the greater capacity for its storage. The predominance of computers in society indicates too many educators that students should have at least some exposure to computers in the schools to cope up with the technological changes and the information society of the future. Teachers are also showing great enthusiasm for computers and there has been a significant increase in appropriate applications of computers into the learning experience. The computers are enabling people to acquire, shape and produce information faster, more powerfully and accurately.

The use of computers in Education is revolutionising both the learning processes and the instructional technology. Computers allow the development of interactive and individualised relations with the learner and no other technology has this potentiality except a human teacher. Computers allow a large variety of contents and symbolic modes. Their
uniqueness 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. In fact, computers have brought in a revolution in information technology - composing, communicating, processing, retrieving, preserving and destroying information. Deciding how to use computers is difficult because the technology keeps changing and new studies continue to cause teachers to shift their properties for computer use.

The computer use in education is directly related to the development of the skills needed for national development. The interactive computer based instruction changes the human thought structure for children, learn differently with computers when compared to the traditional teacher based instruction. The systematicity and the potential multidimensionality of the computes as instructive, individualised tutors facilitate the learners to learn effectively.

Computers in education creates a new environment in schools in helping to acquire a new skill to make an individual efficient in the international world of science and education. Computer as an educational aid is used to improve learners' skills in academic subjects at all levels of education.

In advanced countries, children use the computes in schools for four main purposes (David Hawkridge, 1990). They are,

1. To become generally aware of the uses and limitations of computers.
2. To learn computer programming (Usually in BASIC).
3. To learn to use programmes for word-processing, spread sheet analysis, graphics, process control and information retrieval from databases.
4. To learn selected topics from school subjects right across curriculum, with the computer and educational software either complementing or temporally replacing the teacher.

Computers help children to become less dependent on the teacher as expert. Computers require children to do less memorizing of facts and more information-handling and problem solving. Computers encourage children to learn collaborating rather than competing with other children.
COMPUTER ASSISTED INSTRUCTION

The Psychology of learning emphasizes the individualisation of the instruction. The prime concern in this area was “Programmed Learning”. The main objective of the programmed learning is to provide individualised instruction to meet the special needs of the individual learners. To accomplish this objective, it needs an efficient and flexible device that can store a massive amount of organised information and use a select portion to meet the needs of individual learners. Computer serves this purpose effectively. Computer Assisted Instruction (CAI) is the natural outgrowth of applications of the principles of programmed learning.

In CAI, the computer itself will select and present the right type of programmed materials for a particular student with the help of teaching machine attached, if the data related to the individual’s abilities are fed, then the student will learn the content which is most appropriate to him. Under computer assisted learning, the student has even the option of putting the question to the computer.

There is no single instructional design methodology for developing CAI program. Most of the literature on CAI enumerates a number of different types of instructional programmes under the broad category of CAI. The list of different types of CAI application includes games, simulations, problem solving, drill and practice and tutorial programs.

Coburn, et al. (1982) defined Computer Assisted Instruction as “Computer applications applied to traditional teaching methods such as drill, tutorial, demonstration, simulation and instructional games”. The teaching-learning process includes the presentation of information, guiding learners' interaction with the learning materials, their practice of the learning materials and testing their performance in the subject taught so as to offer a meaningful feedback both to the teach and taught for the betterment of instructional process. The computer may serve any combination of the above said phases of instruction. Hence, it is evident that when computer is responsible for the total instruction, it is important that all the four phases be included in computer assisted instruction.

CAI is found to be one of the best method of giving instructions to the students. The psychological principles involved in the CAI are:
* principle of small steps
* principle of active responding
* principle of immediate reinforcement
* principle of self-pacing
* principle of student-evaluation.

With these psychological and practical advantages, CAI is viewed as potentially the ultimate expert system. CAI can be adjusted 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' needs. The use of CAI reveals increase in both effectiveness and efficiency.

Nowadays, computers are used in the classroom as a support system to improve the teaching-learning process. It is also 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.

METHODS OF CAI

It was found that most of the literature on CAI revealed a number of different types of CAI instructional programs. One dominant perspective within the variety of CAI stems from the fact that most books about CAI emphasize design techniques for developing drill & practice and tutorial materials rather than other (Christopher and Kathleen, 1988). Preparing CAI becomes primarily a matter of designing all the possible frames of information which might be required and anticipating all the branches between frames in which student needs might be dictated. The frequently used CAI programs in school setting are tutorial, drill & practice and simulation.

1. Tutorial method

This method aims at satisfying presentation of information and guiding the learners through initial use of the information. Students are introduced to new information/processes in a step-by-step fashion. Activities or exercises often accompany these programs to provide practice and reinforcement. A good tutorial
should include both presentation and guidance while extended practice and assessment are the domain of other methodologies. Tutorial design techniques are tend to be very similar to those used to develop programmed texts and primarily stress the mastery of specific objectives as quickly and efficiently as possible. Tutorials are appropriate for presenting factual information, for learning rules and principles or for learning problem solving strategies (Gagne, Wager and Rojas, 1981). A good tutorial informs the students, the purpose and nature of the lesson followed by presentation of information, evaluating learners' performance and giving feedback to improve future performance. At the end of each interaction, the programs makes a sequencing decision to determine what information should be treated during the next interaction.

2. Drill and practice

Drills preceded instructional methodologies that present the information and guide the student through initial learning. In computer assisted instruction, this may mean preceding the drill with appropriate tutorial or simulation. It may also mean preceding the computer-based drill with readings in text book, a classroom instruction or a group discussion. Students perform straight forward question and answer type exercises and immediate feedback is provided. The function of drill is to provide practice applicable to all types of learning assuming that initial presentation and guidance have already occurred. Drills may be applied to simple paired associate learning and complex problem solving.

3. Simulation method

Simulation is a powerful technique that teaches about some aspect of the world by imitating or replacing it. Learners are not only motivated by simulations but also learn by interacting with them in a manner similar to the way they would react in real situations. In the simulation method, students observe movements or processes as they occur in real life. Opportunities are often provided for students to become involved in the simulation or activities are provided to test or reinforce their understanding the material/ concept presented. Simulation also simplifies the reality by omitting or
changing details. Thus, simulation helps the learner build useful mental model of part of the world and to provide an opportunity to test it safely and efficiently. In the simulation, the students learn by actually performing the activities to be learned in a context that is similar to the real world. Simulation may serve for initial presentation, for guiding the learner, for practice, for assessing learning or for any combination of these phases. Simulation that assesses learning usually does not incorporate any of the other phases, but when the other phases are present they are usually in combination. Simulations may be of four categories viz. Physical, Procedural, Situational, and Process.

**PEER-BASED COLLABORATIVE INTERACTIONS WITH COMPUTERS**

Computer-based group instructions are emphasised due to the introduction of co-operative and collaborative learning environments. It was expected that the computer networked learning environment is likely to cause students to demonstrate different psycho-social behaviour during collaborative interactions (Jehng, 1997).

In a peer-based collaboration, learners work jointly on almost all parts and at most all stages of a task. This involves greater social interaction than any other method of interaction. In the collaborative learning environment, individuals having greater knowledge or expertise in the subject tend to dominate the learning environment. Researches revealed that collaborative learning approach is best suited for investigating the peer-based interactions with computers.

The peer-based collaborative learning is viewed as a process of knowledge co-construction in which the knowledge of respective subjects transforms to coverage (Roschelle, 1992). Collaborative learning requires team members to achieve shared understanding of action in a particular situation. Shared understanding is a form of negotiation in which team members successfully refine meaning until an understanding is mutually acceptable.

The intellectual process during collaborative interactions is enriched by different ideas and thoughts through a joint effort of the collaborative partners. This process has three different situations viz. communication, negotiation and consolidation. These three
situations are differentiated in terms of the level of cognitive processes carried out by the subject in a particular situation (Jehng, 1997).

The analysis of conversation interactions during different collaborative situations on variables that characterise the psycho-social processes underlying these collaborative interactions may provide a better understanding of how shared knowledge is developed in the context of peer-based collaborative learning activity. Research studies indicate that the psycho-social behaviours demonstrated by the subjects during the collaborative work in a computer-mediated learning environment can be determined by the degree to which collaborative partners perceive the social presence of others (Walther, 1992).

Peer-based collaborative learning is frequently used for pedagogical reasons with the goal of promoting effective learning of difficult and complex knowledge. Since, most of the subject matters in Physics needs mental effort to understand and it is usually not possible for all the individuals, it may require the assistance of others and hence, the concept of peer-based collaborative learning with computers has been taken into account.

SELF-REGULATION IN LEARNING

Rapid change is common in a technology based society. The students must update their skills and knowledge or even learn new skills and knowledge independently so that, they can withstand in the competitive society. It requires an ability to manage one's own learning process. Self-regulation has become an unifying concept bringing together diverse fields of research to provide a coherent picture of how a learner manages the complex activities inherent in the academic learning.

Self-regulation can be defined as self-generated thoughts, feelings and actions for attaining academic goals (Zimmerman, 1998). Self-Regulated Learning (SRL) is known as 'learning that occurs from students' self-generated behaviours systematically oriented toward the attainment of their learning goals. Hence, self-regulation of learning refers to cognitive, motivational and behavioural processes that learners use to promote their own achievement (Zimmerman, 1998).
Students' ability to regulate their own engagement in academic tasks or academic self-regulation, has been identified as an important contributor to their academic learning and school performance. Students can be described as self-regulated to the degree that they are metacognitively, motivationally and behaviourally active participants in their own learning process (Zimmerman, 1986).

Self-regulators are characterised as purposeful, strategic and persistent in their learning. They possess the ability to evaluate their own progress in relation to the goals they have set and to adjust subsequent behaviour in light of those self-evaluations. They generate and direct their own learning experiences rather than act in response to external controls. In sum they are self-initiators who exercise personal choice and control of the methods needed to attain the learning goals they have set for themselves (Nola et al. 1996).

Hence, it is interesting to see how the students are becoming active participants in their own learning process. A detailed theoretical framework about Self-Regulated Learning is presented in the Chapter-II.

NEED FOR THE STUDY

Modern society is characterised by rapid development especially in technology. Computers have an important role to play in the schools of our nation. The National Education Policy (1986) emphasised the introduction of technology in education. CAI is becoming an increasingly popular technique for education. In schools, students face a lot of problems in learning, particularly in Physics. It raises the importance of individualising the instructions and computers do serve this purpose. Moreover, computers 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 students’ learning which in turn increases their academic achievement. There is a considerable body of knowledge, which suggests that teaching the students to use self-regulatory strategies will improve their learning. Also, researchers suggested that the instructional techniques may be used for the development of self-regulatory strategies. CAI is proved to find out the effect of computer as a tool for delivering instructions and its effect on the students self-regulated learning.

STATEMENT OF THE PROBLEM

Researches have reported that Computer Assisted Instruction is effective in many learning situations. An assessment of the effects of computers on learning is a complicated process since, it involves human-computer interaction. There is a considerable debate on the effects of computers in education as well as the students' higher order of learning such as self-regulated learning.

Learning with computers is predicted on a high level of learner initiative and autonomy. This in turn is related to the self-regulated learning strategies such as self-evaluation, organizing and transforming, etc. There is a suggestion that educators should continue to use different CAI techniques to facilitate learning. It is to discern whether the different learning styles and strategies affect the outcome of education. Unfortunately, there is no conceptual framework available to evaluate the relevance of results obtained in a technologically saturated environment compared to those obtained in a technologically scarce one. It is imperative to ascertain whether the CAI is effective in school setting and whether there is any relationship existing between the students' use of SRL strategies and the effectiveness of CAI. A study with clearly specified objectives, detailed theoretical work and their practical implications could take such ideas into consideration. Keeping these points in view, the present study on “Effectiveness of Computer Assisted Instruction in Relation to Students’ use of Self-Regulated Learning Strategies” was taken up.
SCOPE OF THE STUDY

Children of today are the future citizens of the country. The problem that plagues every teacher at all levels of education is how to deal with students who differ in their skills and learning rates. The existence of individual differences among the learners is one of the most fundamental problems of education. The problem of accommodating student 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. Moreover, it is important for every individual to become aware of himself/herself and the complexity of the society.

The present study assesses the impact of different instructional techniques on the achievement of the students in Physics at Higher Secondary level. This study establishes the efficiency of the computers in education besides exploring the effect of instructional techniques on students' higher order learning (SRL). This study provides an idea and method to evaluate the educational software packages and also reveals the importance of criterion-referenced tests which are used to assess the mastery learning of the students. Moreover, assessing the students' use of self-regulated learning is a pioneering work (in the Indian context, particularly in South India) and hence this study assumes importance. The results of this study will be useful for the decision makers to know about the individual and group performance of the students, their use of learning strategies and hence they can design suitable teaching-learning methodologies. This may in turn help the students to face the challenges in the society.

OBJECTIVES OF THE STUDY

The objectives of the study are stated as follows:

1. To find out whether there is any difference among the three instructional strategies viz. Lecture Method (LM), CAI as Individualised Instructional Strategy (CAI) and Computer Assisted Instruction with Peer Interaction (CAIPI) in terms of their effectiveness in improving the performance in Physics among the Higher Secondary Students with different levels of cognition viz. knowledge, understanding and application.
2. To develop syllabus based computer software packages for the selected units in Physics at Higher Secondary level.

3. To evaluate the developed computer software packages from technical and pedagogical points of view.

4. To find out whether there is any difference among different instructional strategies viz. Lecture Method, CAI as Individualised Instructional Strategy and Computer Assisted Instruction with Peer Interaction in terms of their effectiveness in enhancing the retention as revealed by the learners' performance in the retention test.

5. To construct Criterion-Referenced Tests (CRT) based on the content areas taught through different instructional strategies in the present study.

6. To develop a tool to measure the students' use of Self-Regulated Learning (SRL) Strategies.

7. To find out whether there exists any relationship between the effectiveness of the different instructional strategies as measured by the post-test and the students' use of self-regulated learning strategies.

8. To find out whether there is any relationship existing between the students' performance in Physics as measured by the post-test and their use of self-regulated learning strategies.

HYPOTHESES

The hypotheses of the study are stated as follows:

1. There is significant difference among different instructional strategies viz. Lecture Method (LM), CAI as Individualised Instructional Strategy (CAI) and Computer Assisted Instruction with Peer Interaction (CAIPI) in terms of their effectiveness in realising the instructional objectives in Physics at Higher Secondary Stage.

2. There is significant difference among different instructional strategies viz. LM, CAI and CAIPI in terms of their effectiveness in realising the instructional objectives in Physics in the context of the contents with varying difficulty levels.

3. There is significant difference among different instructional strategies viz. LM, CAI and CAIPI in enhancing the students' use of self-regulated learning strategies.

5. There is significant difference among different instructional strategies viz. LM, CAI and CAIPI in terms of their effectiveness in enhancing the retention in Physics.

6. There is a differential effect on the cognitive development of the students in Physics due to their use of self-regulated learning strategies.

TOOLS USED IN THE STUDY

The tools used in the study are as follows:

1. Five syllabus based Computer Software Packages in the content area viz. Laws of Motion, Wave Motion, Elasticity, Semiconductors and Semiconductor Diode prescribed in the eleventh standard Physics syllabus were developed by the investigator. The packages were developed in Visual Basic. All the above said five packages have been evaluated by the computer experts, educationists and practicing teachers using the ‘Courseware Evaluation Proforma’ developed by the investigator.

2. A separate test was developed in Physics and used as a pre-test, to assess the entry behaviour of the students. The pre-test contains 25 items in the multiple choice type. The test assesses the knowledge of the students at the tenth standard level.

3. Five 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. In total, there are 78 items in all the five tests among which 35 items are pertaining to knowledge, 27 items to understanding and 16 items to application. The reliability and validity indices of the tests have been established using appropriate procedures.

4. Self-Regulated Learning Scale (SRLS) was developed by the investigator to measure the students' use of self-regulated learning strategies. The tool consists of 40 items which assess ten SRL strategies. The tool is in the five point scale ranging from ‘Very Often’ to ‘Never’. The reliability and validity indices of the tool were established using appropriate procedures.
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. Three identical groups each of 35 eleventh standard students were formed on the basis of their scores in self-regulated learning scale and scholastic achievement in Physics. One of the groups was identified as control group and the other two groups were treated as experimental groups. Conventional Lecture Method was adopted for the control group, while CAI as Individualised Instruction and Computer Assisted Instruction with Peer Interaction were introduced as experimental interventions to the other two groups.

Five syllabus-based computer software packages in tutorial mode in the selected content areas from the eleventh standard Physics (Laws of Motion, Wave Motion, Elasticity, Semiconductors and Semiconductor Diode) 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 three groups were taught the same content through the respective instructional strategy. Criterion-referenced tests were developed in the above mentioned five content areas and were used as post-tests. The students’ use of SRL strategies was also assessed before and after the experimentation using the Self-Regulated Learning Scale (SRLS). Retention tests in the same content areas were also administered to all the three groups a month after the completion of the experiment.

DELIMITATIONS OF THE STUDY

The delimitations of the study are as follows:

1. The homogeneity among the control and experimental groups was established based on the scores of the pre-test and that of the use of self-regulated learning strategies of the eleventh standard students (Sample). The intervening variables such as anxiety, fatigue, motivation, attitude, personality and intelligence were not taken into consideration while establishing the homogeneity among the control and experimental groups.
2. The investigator has developed only five syllabus based CAI packages in the eleventh standard Physics. Due to the vastness of the syllabus, it was not possible for the investigator to develop the packages for the whole syllabus since, it involves more time, money and energy.

3. Even though different modes of CAI is possible, viz. tutorial, drill & practice and simulation, the investigator decided to assess the effectiveness of the tutorial mode only.

4. The study is limited to a sample size of 105 Higher Secondary Students, since presenting computer-assisted instruction to a larger sample is not possible for the reason that it is a costly affair.

A BRIEF RESUME OF THE SUCCEEDING CHAPTERS

A detailed theoretical framework about Self-Regulated Learning and Self-Regulated Learning Strategies have been presented in the Chapter II.

In the Chapter III, an account of some of the previous studies related to CAI and SRL 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, the development of SRL scale and the development of CRT in Physics have been presented in this chapter. The establishment of reliability and validity indices of the tools have also been presented in this chapter. The procedure adopted for conducting the study and the methods 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 from the study. Some suggestions for further research in the area of SRL in relation to computer media have also been given in this chapter.