CHAPTER VI
AN OVERVIEW OF THE STUDY

INTRODUCTION

The work of the investigator is to assimilate what was done in the previous chapters and to give a summary of findings. It can be also possible here, to register his opinion for further research with recommendations. Thus, the investigator is giving a whole view of his work in this chapter.

EDUCATIONAL TECHNOLOGY

'Education 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. 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.

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.
COMPUTERS IN EDUCATION

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 society. Computer is one of the machines of automation in teaching and learning. The increasing importance of information in the modern world has resulted in the emergence of computers in education throughout the world. The recognition gained worldwide for the importance of computers compel the educationists to revise curricula to include informatics components.

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.

COMPUTER ASSISTED INSTRUCTION

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.

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.

**SELF-REGULATION IN 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).

**INSTRUCTIONAL STRATEGIES AVAILED IN THE STUDY**

In the present study three different instructional strategies were adopted to the control group and experimental groups.

**i) Lecture Method (LM)**

The Lecture Method is still one of the successful instructional strategies in Physics teaching even after the availability of the sophisticated media. This method is teacher centered. But, this method is still useful to explain the equations in Physics and the cause and effect phenomena. It is a flexible method, since the teacher can adopt
himself to the subject matter, time limit, available apparatus and equipments in a very short notice. Students' attention and interest are captured by the teacher by his way of presentation, gestures, etc. Apart from all these factors, the physical environment of the classroom itself 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, the lecture method which is still considered as one of the best and cheapest methods of teaching was adopted by the researcher in the control group.

ii) CAI as Individualised Instructional Strategy

Computers are considered to be one of the most powerful sources in the flow of information. Computer Assisted Instructional packages are helpful for the learners to study the lessons in their own pace. There are individual differences existing among the students and the CAI provides the instruction according to the ability of the individual learner. Instruction and instructional models of CAI geared the individuals to move quickly and this motivates the learners to learn much faster. The CAI as individualised instructional strategy was used as the experimental intervention to the experimental group-I.

iii) CAI with Peer Interaction

Some areas of Physics need imagination on the part of the learners for the better understanding of the concepts learnt. CAI with its acknowledged potentialities may not be sufficient for learners to understand some difficult contents in Physics which need some more explanation. Psychology suggests that an individual will learn more effectively when he receives information from his peer group interaction. Hence, it was decided to adopt the peer group interaction with CAI as another experimental intervention. The experimental group-II in the study involves CAI with peer group interaction.

NEED FOR THE STUDY

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 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 as a tool for delivering instructions and its effect on the students self-regulated learning.

STATEMENT OF THE PROBLEM

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

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.

NATURE OF THE STUDY

The present study is aimed at finding out the relationship existing between the computer as a medium of instruction in teaching Physics and the students’ use of higher order learning strategies (Self-regulated learning strategies). This study adopts the quasi-experimental method which emphasises the importance of computers in education as well as the need for teaching the students to regulate their own learning. This will be quite fruitful to harness the maximum potentiality of the students, which is imperative for the academic community.

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

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.

MAJOR FINDINGS AND CONCLUSIONS OF THE STUDY

1. From the analysis of the null hypothesis: 1, it is found that the 'F' values are significant at 0.01 level at knowledge, understanding, application as well as at the total achievement. Hence, the null hypothesis is rejected and the hypothesis is accepted. It is concluded that 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 at Higher Secondary stage.

   Further, from the ‘t’ test analysis, it is found that there is significant difference between the means of the control group and the experimental groups I and II at 0.01 level. It is also found that, there is significant difference between the experimental groups I and II at 0.01 level. The total mean score of the experimental group II is found
to be higher than that of the control group and experimental group I. Hence, it is concluded that among the three instructional strategies viz. LM, CAI and CAIPI, CAIPI is the most effective instructional strategy in terms of realising the instructional objectives in Physics at Higher Secondary stage.

2. From the analysis of the null hypothesis: 2, it is found that there is significant difference at 0.01 level among the total mean scores of LM, CAI and CAIPI. The total mean score of the CAI group is found to be higher than that of LM. The same mean score of the CAIPI group is higher than that of the CAI group. Hence, it is concluded that among the three instructional strategies, CAIPI is the most effective one in terms of its effectiveness in realising the instructional objectives in Physics in the context of the contents with low difficulty level.

Also, it is found that there is significant difference at 0.01 level among the total mean scores of LM, CAI and CAIPI groups. The total mean score of CAIPI is found to be higher than that of CAI. The same mean score of CAI is higher than that of LM. Hence, it is concluded that among the three instructional strategies CAIPI is the most effective one in terms of its effectiveness in realising the instructional objectives in Physics in the context of the contents with high difficulty level. The following conclusions were drawn from the analysis of the null hypothesis: 2.

a. CAIPI is more effective when compared to CAI as individualised instructional strategy and lecture method in modifying the cognition of the students at knowledge, understanding, application and total levels irrespective of the difficulty level of the content.

b. CAI is more effective than lecture method in modifying the cognition of the students at knowledge, understanding and total levels irrespective of the difficulty level of the content.

c. Lecture method is more effective than CAI as individualised instructional strategy in modifying the cognition at the application level among the students in the context of the contents with high difficulty level.
From the analysis of the null hypothesis: 3, it is found that the 'F' value is significant at 0.01 level. Hence, the null hypothesis is rejected and the hypothesis is accepted. It is concluded that there is significant difference among different instructional strategies viz. LM, CAI and CAIPI in enhancing the students' use of SRL strategies.

From the 't' test analysis, it is found that there is significant difference at 0.01 level between the means of the control group and the experimental group I, control group and experimental group II and the experimental groups I and II. The mean value of the experimental group II is found to be greater than that of the other two groups. The mean value of the experimental group I is found to be higher than that of the control group.

It is concluded that CAI as individualised instructional strategy and CAI with peer interaction strategy are effective in enhancing the students’ use of SRL strategies. Among the different instructional strategies viz. LM, CAI and CAIPI, CAIPI strategy is the most effective one in enhancing the students’ use of SRL strategies.

4. From the analysis of the null hypothesis: 4, it is found that the 't' values are significant at 0.01 level for some SRL strategies in the case of experimental groups I and II. However, there is no significant difference between the means of any of the SRL strategy in the case of the control group. Hence, the null hypothesis is partly accepted. It is concluded that the CAI and CAIPI have some influence on the students' use of SRL strategies and the lecture method does not have any influence on the students' use of SRL strategies. The following conclusions were drawn from the analysis of the null hypothesis: 4.

a. Lecture method does not enhance the students' use of SRL strategies.

b. CAI as individualised instructional strategy enhances the students' use of SRL strategies viz. self-evaluation, goal setting & planning, self-consequences and seeking social assistance.

c. CAIPI strategy enhances the students' use of SRL strategies viz. self-evaluation, goal setting and planning, seeking information, self-consequences, seeking social assistance and reviewing records.
5. From the analysis of the null hypothesis: 5, it is found that the $F'$ values are significant at 0.01 level at the knowledge, understanding, application and total levels. Hence, the null hypothesis is rejected and the hypothesis is accepted. It is concluded that there is significant difference among the instructional strategies viz. LM, CAI and CAIPI in terms of their effectiveness in enhancing the retention of what already learnt in Physics.

From the analysis of the 't' tests, it is found that there is significant difference at 0.01 level between the means of the control and experimental groups and between the experimental groups I and II at all levels of cognition viz. knowledge, understanding, application and total. The mean scores of the CAIPI are found to be more than that of the other two groups. The mean scores of the CAI group are found to be more than that of the lecture method at all levels of cognition. Hence, it is concluded that CAIPI is more effective when compared to the lecture method and CAI in enhancing the retention at knowledge, understanding, application levels and total score in Physics.

6. From the analysis of the null hypothesis: 6, it is found that the 't' values are significant at 0.01 level for the total achievement, knowledge, understanding and application levels. Hence, the null hypothesis is rejected and the hypothesis is accepted. It is concluded that there is a differential effect on the cognitive development of the students in Physics due to their use of self-regulated learning strategies.

DISCUSSION

There is a tremendous change that is taking place in the field of education. Today's focus of education is on the expansion of educational opportunities. There is an all-round demand for an all-round self-improvement calling for more individual recognition, rights, more opportunities and a better quality of life. The new emphasis for the new millenium would be to update one's own skills and adopt to the changing world.

In the present 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. But, 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. It should provide opportunities for those who have various limitations in learning.

Learning theories indicate that it is most important for the learner actively to confront the subject matter on his own so as to facilitate the establishment of a scheme of the subject matter as well as to remember the material. But, it is inevitable that our present educational system is mainly based on competition which is reflected in almost every aspect of life.

Traditional methods of classroom learning are felt by today's students to be out of step with their real world. The present day students does not ready to accept many of the past routine learning methods. These situation arises the requirement of new technological based methods of instructions.

Technological tools and software offer new opportunities for creating artifacts. Technology enhances the value of student-constructed artifacts by allowing each incorporation and linking of multiple representations, interactive testing and document revision. Those affordances may better facilitate the development of understanding among the learners. The microcomputers are not of the effective technological tool and it may be used for science teaching and learning. As science and society become more dependent upon the computer, it seems inevitable that the Physics teachers and their students has to rely on the use of computers in their teaching learning process.

Computers and related information technologies have an instrumental role in the educational, social and occupational futures of the present generation. Computers have a major impact on how students learn and teachers teach. Unlike earlier educational techniques most of which are washing out, computers are taking hold in the education because they are already transforming society itself (Bhatt, 1998). The fact that the computer is considered as an instrument which may be used to analyse the learning achievement and has the capacity to produce speedy feedback to the learner and is the reason that the computer can and must be utilized in the instructional process as well as in individualised learning.
Current studies in computer supported learning indicate that it engenders several positive outcomes which enhance learning (Jegede, 1998). Any system, such as the school computer which provides a stimulating alternative to the teacher may be perceived as a worthwhile and satisfactory substitute.

The computer is not in itself a technology of instruction. It is a physical tool that can be used to present programmed instruction, programmed tutoring, etc. Usually, the Computer Assisted Instruction (CAI) have been provided as an alternative method of teaching.

CAI uses the computer directly as a medium of instruction and an information delivery system. The computer's ability to engage in instructional "dialogue" with the student while delivering information makes it adoptable to any number of instruction situations (Heinich, et. al., 1985). In CAI the students interacts directly with the computers which stores the instructional material and controls its sequence.

Eventhough, the computers were introduced in education, educators eventually realised that there was something missed in the motivational and mediating impact of CAI. Hence, the concept of peer-based interactions with computers have been introduced (Jehng, 1997). The potential benefits of grouping students for instruction are enormous. Students who work together are generally more successful than students who work alone. Small groups provide opportunities for students to share ideas and experience, argue hypotheses and develop shared understanding of different perspectives. Additionally group instruction is very useful in helping students to learn values, each other's talents, abilities, skills and diversity of views (Jones and Carter, 1998).

But, it has become increasingly difficult to arrive at an acceptable theory that can provide answers regarding the ways to integrate the computers with instruction as well as how students can optimally utilise the computer in the learning process. Further, research studies have indicated that the student develops through the processes, problem solving ability and learning proficiency as more years are spent within the school framework. The increments in these fields correlate positively with an increase in the student's self-study ability and negatively with a need for assistance from a teacher.
Self-regulated learning has become a pivotal construct in the higher order learning processes. Self-regulation refers to students’ self-generated thoughts, feelings and actions which are systematically oriented toward the attainment of their goals. Research evidence reveals that the instructional techniques can be used for the development of the self-regulatory learning strategies. Hence, the present study was conducted to explore the relationship between the effectiveness of different instructional strategies to the students’ use of SRL strategies.

The result of the study reveals that among the three instructional strategies viz. Lecture Method (LM) Computer Assisted Instruction as individualised strategy (CAI) and Computer Assisted Instruction with Peer Interaction (CAIPI), CAIPI is the most effective strategy in realising the instructional objectives in Physics at Higher Secondary level. CAI is more effective when compared to the Lecture Method. Similarly, CAIPI strategy is the most effective one in enhancing the achievement of the students with the contents of high difficulty level. The same trend is found also in enhancing the retention of the learners in Physics. These findings support the claim that in computer based collaborative learning environments, students are able to develop better complex problem solving skills (Johnson and Johnson, 1984). In a peer based interactions, students learn from one another. Also, students can provide one another with special alternative viewpoints, additional insights, audience feedback and evaluation. These kinds of human interactions increase the learning and retention capacity of the students.

It is found that the instructional strategies enhance the students use of self-regulated learning (SRL) strategies. CAIPI strategy is the most effective one in enhancing the students’ use of SRL strategies, where as CAI strategy is more effective when compared to lecture method. Students who focused on understanding the material used SRL strategies more frequently. In lecture method, the teaching strategy was so arranged as to suit the needs of the average learner. There is no provision for shared understanding. Whereas in CAI, there is a provision for immediate feedback which enhances the self-evaluation of the learners and in CAIPI the learners have the opportunity for the shared understanding. Hence, it is concluded that the CAIPI and CAI strategies are effective in enhancing the
students' use of SRL strategies. CAI strategy enhances the students' use of SRL strategies viz. self-evaluation, goal setting & planning, self-consequences and seeking social assistance. CAIPI strategy enhances the students' use of SRL strategies viz. self-evaluation, goal setting & planning, seeking information, self-consequences, seeking social assistance and reviewing records.

It is also found that there is a differential effect on the cognitive development of the students in Physics due to their use of self-regulated learning strategies. It is found that the SRL strategies influence the achievement of the students' in Physics at all levels of cognition viz. knowledge, understanding and application. It is evident from the literature scanning that teaching the students to use self-regulatory strategies can improve the effectiveness of their learning. Also, studies indicate that most effective learners are self-regulative. Zimmerman and Martinez-pons (1986) proved that self-regulated learning strategies are the best predictors of academic achievement. This is vividly seen from the findings of the present study that SRL strategies influence the achievement of the students in Physics.

The results of this study provide an eye-opening issue regarding the students' self-regulated learning in which cognition, metacognition and motivation are the primary constructs. Hence, the educational planners must address the questions that how the students are self-regulated themselves and how the classroom instructions provided are helpful for the students to develop the self-regulation. This requires a careful planning supported by the computer technologies. Further, it was observed that schools do not appear to have the ability to absorb the rapid ongoing developments in technology oriented teaching aids. Therefore, it is most important to plan the introduction of computers in education and implement it in school level.

**RECOMMENDATIONS**

1. From the findings of the study, it was observed that the CAIPI was the most-effective instructional strategy in teaching Physics at Higher Secondary level. Hence, it is recommended that the CAIPI strategy be used as a supplementary method for the regular classroom courses in Physics.
2. It was observed that, the CAI and CAIPI strategies are helpful in enhancing the students' use of self-regulated learning strategies. Hence, it is recommended that the computer packages be used for the teaching at higher levels which may in turn increase the students' abilities.

3. More software packages like self-learning packages should be developed which may help the students to learn at their own pace. Further, while designing the computer packages, the psychological factors such as need, motivation, age, interest, intelligence, etc. must be taken into account. Hence, the software developers should produce the CAI packages in consultation with the practicing teachers.

4. The software packages should be developed in such a way that there will be more opportunities for the learners to regulate their learning. Further, the instructions must be provided so as to increase the students' use of self-regulated learning strategies.

5. The instructional packages in Physics should be planned, developed, evaluated and implemented with the help of the team of experts constitute Curriculum Planners, Educational Technologies, Psychologists, Computer experts and Physics teachers. This will be helpful in the development of quality packages in the teaching-learning of Physics.

6. Conferences may be organised to discuss the importance of computers in Education as well as the role of self-regulation in learning. Further, workshops should be organised to train the teachers, student teachers, teacher educators and computer experts to develop the instructional packages in an intended way.

7. From the research evidences, it was found that learning by modelling help the students to develop a self-regulation. Hence, teachers should provide model for effective use of resources. They should communicate goals and expectations to their wards and allow the students to redefine the same and formulate their own criteria. Teachers should allow the students for their choice of tasks, strategies and time management for the study which in turn enhance the students' self-regulation.
8. The assignments should be planned so as to enhance the students' procedural task, cognitive and motivational self-regulation. These tasks should pertain to long-term learning goals. Teachers were trained to administer the different types of assignments and to give differential feedback and support for these tasks thereby develop a self-regulatory competence among their wards.

9. By establishing a cycle of strategy use, goal-setting and self-evaluative recordings, the teachers can shift the burden of learning and help the students to develop a regulating habits. This will help the students to work strategically and will increase the motivation which will sustain them during long hours of practice necessary to achieve peak performance in their study.

10. It is the right time to realise the need for systematic efforts to impart computer training and education to all the school students, so that such training and education can play a catalytic role in the national endeavour for socio-economic development. Hence, in every school the computers must be introduced to teach at least some subjects at higher level.

SUGGESTIONS FOR THE FURTHER RESEARCH

The present study has been focused on the effectiveness of computer-assisted instruction in relation to the students' use of self-regulated learning strategies. The present investigation has opened up many desirable avenues for further studies in the area of computers in human learning, a few of which are given as follows:

1. In the present study, CAI in tutorial mode was used. But, CAI is available in different modes such as Tutorial, Drill & Practice and Simulation. Hence, studies may be conducted with a view to establishing the relative effectiveness among different modes of CAI in relation to SRL strategies.

2. Studies may be taken up to find out the different benefits associated with alternative modalities of implementation of CAI at different levels of education.
3. The present study confines to a representative sample of Higher Secondary students of the western part of Tamilnadu. Therefore, the same study be repeated in different parts of Tamilnadu to the different groups of students with the same tool. Also, the study may be repeated with the different modes of CAI packages.

4. The results of this study may be correlated with similar studies. Further, cross-cultural and inter-cultural studies have to be conducted by using the same tool as well as adopting/preparing other tools.

5. Studies may also be taken up to find out to what extent can CAI in teaching Physics be expected to enhance the participants' SRL and how does this vary from one socio-cultural content to another.

6. It is essential to find out how well students' perceptions are translated into actual activities. For this intervention, researches should be conducted. Research designs comprising "Pre-test, training and self-regulative performance" is to be adopted. For the training purpose, the different techniques can be used.

7. From the present study, it was observed that instructions strategies are useful in enhancing the students' use of SRL strategies. Research may be conducted to integrate the instructions, self-regulation, feedback and knowledge construction. They should explain how the students are engaged in the activities of learning and how these activities lead to improvement in performance.

8. It was observed that self-regulation promotes learning and perception of greater competence, sustains motivation and self-regulation to attain new goals. Further, it was found that when SRL is deliberative process, goals guide the SRL. Hence, research should be conducted to explore the relationship between the goals and SRL. They should address the nature of goals and how do goals guide the SRL among students.