CHAPTER-III

3.1. Introduction

It is often stated that a well defined problem is a half solved problem. Statement of the problem attempts to focus on a stated goal and gives direction to the research process. The problem may be stated in the form of a question or declarative statement but it should be stated in clear, simple and concise terms. It is important that the problems should be stated – whatever the form be – that both the investigator and the reader should comprehend precisely what is to be investigated.

This chapter titled “Statement of the problem” defines the problem undertaken by the investigator in concrete terms. It enumerates the objectives and the assumptions. Not only that, but also it provides the research hypotheses which give the researcher the required direction for his investigation. The hypotheses are highly indispensable in any research process to achieve dependable knowledge. It very much helps the researcher to relate theory to observation and observation to theory. Also, the hypotheses in combination with the specific objectives go a long way in enabling the investigator to identify the variables involved in the study and suggest the systematic methodological procedures that are to be employed to arrive at decisive conclusions. This chapter also deals with the scope, need and importance and delimitations of the study.
3.2. Title of the Problem

“RELATIVE EFFECTIVENESS OF TUTORIAL AND DRILL CUM PRACTICE COMPUTER ASSISTED INSTRUCTIONAL PROGRAMMES ON THE ACHIEVEMENT OF VARIOUS CATEGORIES OF STUDENTS IN PHYSICS AT PLUS ONE LEVEL”

3.3. Operational Definition of the Terms Used in the Study

Effectiveness:

Oxford Dictionary (1975) defines effectiveness as “being able, to bring about the result intended”. The Chambers 21st Century Dictionary (1999) defines effectiveness as “having the power to produce or provide a desired result”. According to Cambridge International Dictionary of English (1996) effectiveness is a "method of achieving something or something that produces the result intended to”. Tang (1999) gives a new dimension of meaning to the term effectiveness. He defines effectiveness as “the difference between the treated and the control groups in proportion of the events of complete or almost complete overall recovery”. Chambers Twentieth Century Dictionary (1975) defines effectiveness as “being successful in producing a result or effect”.

In this study effectiveness refers to the impressive results in the learning of physics by the plus one students consequent to the treatment of computer assisted of instruction. Effectiveness refers to the degree of realisation of educational objectives. It also refers to the degree of realisation of higher level attainment.

Computer Assisted Instruction:

The Association for Education Communications and Technology (1977) has defined computer-assisted instruction (CAI) as a method of instruction in which the computer is used to instruct the student and where the computer contains the instruction which is designed to teach, guide, and test the student until a desired level of proficiency is attained.
David Slykhuis and John Park (2006) state that computer assisted instruction is a broad term that relates to any intervention by a computer with a student.

Stella (1993) defines computer assisted instruction as an instruction provided with the help of computer.

Slavin (1986) states that computer assisted instruction is an instruction provided by the computer in tutorial or drill and practice form.

Reddy & Ramar (1996) define computer assisted instruction as a well planned and systematically devised instructional programme scrupulously presented by the computer on proper command by the user.

Computer Assisted Instruction in this study refers to learning of students by interacting with computer using the software specially developed for the purpose covering the units included in the study.

**Enhancing:**

In this study enhancing means increasing the quantum of output. It also refers to the increased performance on the part of the students.

**Achievement:**

Oxford English Dictionary (1975) defines achievement ‘as bringing to a successful stage or accomplishing a task in a successful way’. Likewise, Webster’s College Dictionary (1995) defines achievement ‘as a thing accomplished especially by skill in a significant way’. Similarly, Slavin (1986) defines achievement ‘as a higher order of accomplishment at a significant level’.

According to Hallagan and Kauffman (1996) achievement means ‘successfully doing or accomplishing a task’. They define achievement as successfully bringing about a desired result.’

As far as this study is concerned, academic achievement is an attainment of expected level of mastery in physics. It means, a higher level of mastery learning made by the students and an impressive output performance evinced by them in the form of better score in physics in the achievement tests conducted at the time of experimentation.
Various Categories of Students:

According to Chintamani Kar (1982), emotionally disturbed, shy and withdrawn, impaired students, slow learners, gifted students, culturally and socially disadvantage students are the various categories of students in the general education classroom.

In this study various categories of students are the high achievers, average achievers, under achievers and low achievers in the classroom of the investigator.

Physics:

According to Janice Van Cleave (1985) physics is the study of energy and matter and the relationship between them. Studying physics, like studying all sciences, is a way of solving problems and discovering why things happen the way they do. In this study physics refers to the selected units in the higher secondary physics syllabus.

Plus One Level:

In a 10 + 2 + 3 system of education, plus two refers to the two years course after the high school or secondary level study and before the collegiate study. It is the doorway to collegiate education in Indian system of education. Further, it is the course, which decides the students eligibility for admission to professional courses like medical, engineering, veterinary, agriculture, law etc. The first year of this higher secondary course is called plus one level. Since the plus two students i.e. the second year students of the higher secondary course would be very much preoccupied with their focussed preparation for the highly competitive public examination, the investigator had to choose his samples from the plus one classes.

3.4. Objectives of the Study

To trim the study to a manageable size, the original problem may be broken into various sub statements. The general objectives and the specific objectives give definite direction to the investigation.
General Objectives:

1) To develop CAI programmes to teach physics at plus one level.

2) To identify the high achievers, average achievers, under achievers and low achievers in the general education classroom.

3) To verify the effectiveness of CAI programmes on the achievement of high achievers, average achievers, under achievers and low achievers in physics at plus one level.

4) To establish the relative effectiveness of computer assisted instructional programmes with reference to various categories of students such as high achievers, average achievers, under achievers and low achievers.

5) To verify the advantage of the computer assisted instructional strategy over the traditional lecture method.

Specific Objectives:

1) To assess whether there is any significant difference in the pre-test performance of the students among the control group taught through traditional lecture method, experimental group I taught through drill and practice CAI programme, and experimental group II taught through tutorial CAI programme in both rural and urban schools.

2) To know whether there exists any significant difference in the pre-test performance between the control group students and the students of experimental group I in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

3) To measure whether there is any significant difference in the pre-test performance between the control group students and the students of experimental group II in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.
4) To assess whether there is any significant difference in the pretest performance between the students of experimental group – I and experimental group II in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

5) To find out whether there is any significant difference in the pre-test performance between the rural students and the urban students in terms of group as a whole and in respect of each category i.e. high achievers, average achievers, under achievers and low achievers with regard to control group, experimental group I and experimental group II.

6) To verify whether there is any significant difference in the pre-test performance among the various categories of students in the control group taught through traditional lecture method in both rural and urban schools.

7) To establish whether there is any significant difference in the pre-test performance among the various categories of students in the experimental group I taught through drill and practice CAI in both rural and urban schools.

8) To ascertain whether there is any significant difference in the pre-test performance among the various categories of students in the experimental group II taught through tutorial CAI in both rural and urban schools.

9) To assess whether there is any significant difference in the pre-test performance between the boys and the girls in the control group, experimental group I and experimental group II in both rural and urban schools.

10) To know whether there is any significant difference in the post-test performance of the students among the control group taught through traditional lecture method, experimental group I taught through drill and practice CAI programme and experimental group II taught through tutorial CAI programme in both rural and urban schools.
11) To measure whether there exists any significant difference in the post-test performance between the control group students and the students of experimental group I in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

12) To find out whether there is any significant difference in the post-test performance between the control group students and the students of experimental group II in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

13) To assess whether there is any significant difference in the post-test performance between the students of experimental group I and experimental group II in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

14) To verify whether there is any significant difference in the post-test performance between the rural students and the urban students in terms of group as a whole and in respect of each category i.e. high achievers, average achievers, under achievers and low achievers with regard to control groups, experimental group I and experimental group II.

15) To establish whether there is any significant difference in the post-test performance among the various categories of students in the control group taught through traditional lecture method in both rural and urban schools.

16) To ascertain whether there is any significant difference in the post-test performance among the various categories of students in the experimental group I taught through drill and practice CAI in both rural and urban schools.

17) To assess whether there is any significant difference in the post-test performance among the various categories of students in the experimental group II taught through tutorial CAI in both rural and urban schools.
18) To know whether there is any significant difference in the post-test performance between the boys and the girls in the control group, experimental group I and experimental group II in both rural and urban schools.

19) To measure whether there is any significant difference between the pre-test and the post-test performances in respect of the control group taught through traditional lecture method, experimental group I with drill and practice CAI programme, and experimental group II with tutorial CAI programme in both rural and urban schools.

20) To find out whether there is any significant difference between the pre-test and the post-test performances in respect of each category of students i.e. high achievers, average achievers, under achievers and low achievers in all the groups in both rural and urban schools.

21) To verify whether there exists any significant difference in the retention test performance of the students among the control group, experimental group I with drill and practice CAI programme, and experimental group II with tutorial CAI programme in both rural and urban schools.

22) To establish whether there is any significant difference in the retention test performance between the rural students and the urban students in terms of group as a whole and in respect of each category i.e. high achievers, average achievers, under achievers, and low achievers with regard to control group, experimental group I and experimental group II.

23) To ascertain whether there is any significant difference in the retention test performance between the boys and the girls in the control group, experimental group I and experimental group II in both rural and urban schools.

24) To assess whether there is any significant difference in the performance of the students of all the groups between the post-test and the retention test.
25) To know whether there exists any significant difference in the performance of all the categories of students in all the groups between the post-test and the retention test.

3.5. **Assumptions of the Study**

1) It is possible to develop CAI programmes to teach physics at plus one level.

2) There are ways and means to identify the high achievers, average achievers, under achievers and low achievers in the general education classroom.

3) The developed CAI programmes will enhance the achievement of the high achievers, average achievers, under achievers and low achievers in physics at plus one level.

4) The CAI programmes will be effective to high achievers, average achievers, under achievers and low achievers but the degree of effectiveness may vary from category to category.

5) The CAI strategy will have distinct advantage over the traditional lecture method.

3.6. **Hypotheses of the Study**

1) There is no significant difference in the pre-test performance of the students among the control group taught through traditional lecture method, experimental group I taught through drill and practice CAI programme and experimental group II taught through tutorial CAI programme in both rural and urban schools.

2) There exists no significant difference in the pre-test performance between the control group students and the students of experimental group I in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.
3) There is no significant difference in the pre-test performance between the control group students and the students of experimental group II in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

4) There is no significant difference in the pre-test performance between the students of experimental group I and experimental group II in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

5) There is significant difference in the pre-test performance between the rural students and the urban students in terms of group as a whole and in respect of each category i.e. high achievers, average achievers, under achievers and low achievers with regard to control group, experimental group I and experimental group II.

6) There is significant difference in the pre-test performance among the various categories of students in the control group taught through traditional lecture method in both rural and urban schools.

7) There is significant difference in the pre-test performance among the various categories of students in the experimental group I taught through drill and practice CAI in both rural and urban schools.

8) There is significant difference in the pre-test performance among the various categories of students in the experimental group II taught through tutorial CAI in both rural and urban schools.

9) There is significant difference in the pre-test performance between the boys and the girls in the control group, experimental group I and experimental group II in both rural and urban schools.

10) There is significant difference in the post-test performance of the students among the control group taught through traditional lecture method, experimental group I taught through drill and practice CAI programme and experimental group II taught through tutorial CAI programme in both rural and urban schools.
11) There exists significant difference in the post-test performance between the control group students and the students of experimental group I in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

12) There is significant difference in the post-test performance between the control group students and the students of experimental group II in respect of each category i.e. high achievers, average achievers, under achievers and low achievers in both rural and urban schools.

13) There is no significant difference in the post-test performance between the students of experimental group I and experimental group II in respect of each category i.e. high achievers, average achievers under achievers, low achievers in both rural and urban schools.

14) There is no significant difference in the post-test performance between the rural students and the urban students in terms of group as a whole and in respect of each category i.e. high achievers, average achievers, under achievers and low achievers with regard to control group, experimental group I and experimental group II.

15) There is significant difference in the post-test performance among the various categories of students in the control group taught through traditional lecture method in both rural and urban schools.

16) There is significant difference in the post-test performance among the various categories of students in the experimental group I taught through drill and practice CAI in both rural and urban schools.

17) There is significant difference in the post-test performance among the various categories of students in the experimental group II taught through tutorial CAI in both rural and urban schools.

18) There is no significant difference in the post-test performance between the boys and the girls in the control group, experimental group I and experimental group II in both rural and urban schools.
19) There is significant difference between the pre-test and post-test performances in respect of the control group taught through traditional lecture method, experimental group I with drill and practice CAI programme and experimental group II with tutorial CAI programme in both rural and urban schools.

20) There is significant difference between the pre-test and post-test performances in respect of each category of students i.e. high achievers, average achievers, under achievers and low achievers in all the groups in both rural and urban schools.

21) There exists no significant difference in the retention test performance of the students among the control group, experimental group I with drill and practice CAI programme and experimental group II with tutorial CAI programme in both rural and urban schools.

22) There is significant difference in the retention test performance between the rural students and the urban students in terms of group as a whole and in respect of each category i.e. high achievers, average achievers, under achievers, and low achievers with regard to control group, experimental group I and experimental group II.

23) There is no significant difference in the retention test performance between the boys and the girls in the control group, experimental group I and experimental group II in both rural and urban schools.

24) There is no significant difference in the performance of the students of all the groups between the post-test and the retention test.

25) There exists no significant difference in the performance of all the categories of students in all the groups between the post-test and the retention test.

3.7. Scope of the Study

This experimental study encompasses the plus one students who toil and moil day and night for a better prospect in the academic career in the years to come. Instructional strategy is of vital importance for these
students for mastery learning. Within a short period of one year, they have to make mastery learning of four vital voluminous subjects, which will decisively, determine the prospect of their future. Success of any instructional strategy lies in reaching out to the learners. To accomplish this task with a considerable degree of success, traditional lecture method alone cannot be relied on.

Of course, the traditional lecture method has its own merits for perfection in learning and for precise mastery learning, but the good old traditional lecture method need to be supplemented as well as complemented with certain innovative approaches, which can promote better mastery learning. Perfection in learning and precise mastery learning are the prerequisites for a performance par excellence in physics examination. There are various instructional strategies that can be of much use in achieving this objective. CAI strategy is such a strategy.

An effective instructional strategy 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 centred mode of instruction. With these views in mind, the different modes of computer assisted instruction are earmarked for the study to verify the effectiveness of these modes with reference to different categories of pupils in an inclusive setting.

These modes cater to pupil diversities i.e. low achievers, under achievers and normal students. Low achievers in the rural area include mostly socially disadvantaged students, culturally disadvantaged, socio-economically backward, slow learners, students with mild learning disability and students with manageable handicaps. The proposed modes of instruction can accommodate the above pupil diversities. Moreover, these proposed modes of instruction are mostly learner centred and they cater to auto instruction to a great extent. They ensure student participation in a better way and provide for overcoming barriers to learning.
As for computer assisted instruction, commercial DVD/CDs were procured from Bangalore covering the units selected for the study. These software along with the ones developed by the investigator were made available for experimental CAI group students for learning selected subject units. Teacher support system was extended to the extent of clarifying doubts and guiding the project works.

Hundred students from South Street Hindu Nadar Higher Secondary School, Muhavur in Virudhunagar District, Tamilnadu, were selected for the study. They were classified into three matching groups. The first group was experimental group-I, which was taught through drill and practice CAI. The experimental group-II was taught through tutorial CAI. The last group was control group and it was taught through traditional lecture method.

3.8. Need and Importance of the Study

Need and Importance of the study can be analysed from the point of view of instructional strategy and from the learners’ point of view.

The Point of View of Instructional Strategy

Teaching effectively is the most important of all the competencies required of a successful teacher. Since effective teaching deals with the needs, interest and abilities of pupils as individuals, it requires knowledge of the environment in which the pupil lives, the development problem he or she faces and his/her mental abilities. It is more true so when the teacher is dealing with the under achievers and low achievers. It also calls for an understanding of the learning processes essential for creating an environment where learning can take place and for making instruction so stimulating that every pupil will be motivated to learn. Stimulating pupils to think critically, independently and creatively is essential for effective teaching and learning.

Effective teaching in any subject depends largely upon the introduction of newer methods of instruction. There is a growing need for trying out newer methods of instruction and establishing their effectiveness in teaching and learning. Now-a-days a teacher cannot depend on any
single method of teaching. The teacher has to try out several innovative methods. The students are able to understand the concept, principles and content in an effective manner when the innovative newer methods are incorporated in the teaching learning process.

The immense knowledge explosion taking place in the world warrants newer methods of teaching. Students need unique experience, which is provided in the two modes of computer assisted instruction selected for the study. Destiny of a nation is being shaped in her classrooms. The growing number of under achievers and low achievers at all levels of our educational system warrants such a study, as this proposed one, to be undertaken for the enrichment of our teaching learning process.

Science is an important subject in the school curriculum that has two major problem areas that cause ineffective learning.

*The Limitations of the Teacher:* Most Science teachers have in-depth knowledge only in their chosen elective such as physics, chemistry or biology that is required to teach fundamental concepts in the discipline, but they are hampered in teaching other branches which they must teach anyway. Many teachers are not adept at using quick sketches to explain certain content, or in drawing diagrams in biology. Some teachers do not possess a big enough knowledge-base to link scientific content with day-to-day examples. For effective teaching of science, teachers need to collect sample background information, for which they may not have the resources, time, or inclination.

*Lack of Audio-visual Aids:* Teachers often need to carry several charts, equipment, specimens, etc., even for teaching a single topic effectively. However, often these materials are either unavailable or inaccessible, moreover, teachers do not have enough time between classes to procure and test it for its usability. Hence, most science classes are limited to uninspiring, and sometimes, incomprehensible verbal lectures.
It is believed that computers cannot only help overcome these problems, but the vastly greater potential of this technology as an effective teaching aid will cause a quantum leap in the quality of science teaching and learning.

However, in the past, new technology in teaching learning has not always proved effective. Most science teaching material available for use by teachers was not able to accommodate the individual needs of the teacher. For example, educational films produced abroad did not match the local curriculum and were hard to understand due to different accents.

Today, general-purpose, easy-to-use software such as Microsoft PowerPoint has become available. For the first time teachers can easily modify and even produce their own CAI material based on the needs of their own classes. The investigator has, therefore, embarked on a new endeavour to study afresh the utility of the current generation of hardware and software in teaching learning, and conduct research on what techniques are effective.

**Learners’ Point of View**

Human resource development should be at the focus of any research effort for a developing country like India which has abundant human resources. In the Indian system of education, it is observed that the human resources – teachers and learners, are under developed and perform less than their capabilities. The learners are under developed in the sense that they are not achieving in tune with their capabilities. Even some of the most efficient teachers are not adequately equipped to identify and guide the under achievers and the low achievers to reach their optimum levels. As a result, the institutions, in turn, are not able to send their products into the society as fully developed learners. To ensure this we need a different strategy which can cater to individual differences. Computer assisted instruction is a new strategy which can be applied to various categories of students so as to enhance their understanding and achievement.
Although much has been achieved in this field of education, there are many opportunities for experiment and research. Throughout we have been constantly aware of the need for further investigation of the learning, thinking and adjustment of slow learning children so that teaching method can be precisely planned to suit their needs (Tansley and Gulliford, 1962).

Now the current trend is propagating auto learning by the learner himself at his own pace. This paved the way for CAI, CAL, etc., Here, the teacher is merely a facilitator of learning. He need not suffocate the learners with all the information at a time. In auto learning, the learner can take his own time and he can proceed at his own pace till he completes the lesson. It is not the time but mastery learning which is the governing criterion here. This is where the proposed CAI programmes exactly fit in.

Besides, cognition and conceptualisation depend on a chain of events which begin with the learner’s perception of stimulus, be the auditory, visual, tactile and olfactory. It is important that these initial learning experience be accurate, dependable and understandable. Unless the learners’ initial sensory impressions are accurate, it will be impossible for them to have reliable conceptualisation and understandings. With the existing numerous kinds of aids, carefully organised presentation of information through a variety of media should occupy the learner’s conscious attention to living stimuli. This is what is precisely ensured by the CAI programmes.

Students seem intrigued when they discover that the material they normally can only find in a book or class lectures is also available to them in a computer programme they can quickly master. The possibility of going through the programme in a non-linear fashion, jumping ahead or repeating sections at their will, gives the students a feeling of empowerment and control over their learning progress. Being able to type in their own answers (in the electronic notebook for short-answer questions) makes the programme interactive and lively. Further, CAI has a variety of inherently motivational features, such as visual effects, hidden pop-up windows, linkages to other material, etc.
Perhaps the strongest motivational feature is a content one: the questions in the CAI programme are similar to the ones the students will encounter in daily quizzes, the mid term, and the final exam. There is a “data bank” of exhaustive alternate exam questions built up over the various offerings of the course, and most of these questions have been included in the CAI programme. By going through the complete programme, a student can feel that s/he is ready to face the similar questions in the exams. If a problem is encountered, the computer will provide a pop-up help screen, often containing explanatory information and a page reference to the textbook.

Computer assisted instruction has come in to stay for ever to wield greater influence in the teaching learning process. There is a very urgent need to experiment the efficacy of computer assisted instruction and to assess its advantage over the traditional lecture method. No doubt, computer assisted instruction has a motivating quality of its own.


Though the efficacy of the CAI programmes has been established with reference to some category or other, the relative effectiveness of these programmes with reference to various categories of pupils in an inclusive setting is yet to be tried and tested. As catering to pupil diversity as well as reaching out to all learners is the vital principle of inclusive education, a beginning in this regard is to be made immediately on top priority basis.

Systematic researches are therefore, necessary to assess the efficacy of CAI programmes so that educational technology can be brought into actual inclusive classroom practice. The present study is an attempt to assess the efficacy of two modes of computer assisted instruction in teaching physics at plus one level, and also to measure their relative effectiveness in inclusive classroom and their advantage over the traditional lecture method.
3.9. Delimitations of the Study

The statement of the problem is incomplete without stating its scope and limitations. This is what is called delimitation of the problem. What area one’s investigation purports to cover in the chosen field, and if there are limitations what its limitations are should be stated in very clear terms.

The limitations of the study are as follows:

i) The study is confined to the plus one students studying in South Street Hindu Nadar Higher Secondary School, Muhavur and N.A.A.R. Memorial Higher Secondary School, Rajapalayam, Virudhunagar district of Tamil Nadu state.

ii) The sample consists of 90 students at the rate of 30 for each group from rural school as well as urban school selected on the basis of systematic purposive random sampling.

iii) Only three units in plus one physics syllabus have been included for this study.

iv) The experiment was conducted for a period of 90 days at the rate of one hour per day.

v) For the computer assisted instruction, commercially available computer assisted instruction software and the CAI software developed by the researcher were used for the experiment. They were used in the physics laboratory where the experiment was actually carried out. The experimental CAI group students were not permitted to take the CDs home to avoid the students in other groups using the said software which would distort the result.

vi) The various categories of students were identified and selected for the study on the basis of their scholastic achievement.

vii) The achievement test used in the study is a teacher made one with its own validity and reliability.

The methodology followed in the study is presented in the succeeding chapter – IV.