CHAPTER-VI
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6.1. Summary

A research report cannot be considered complete without a crisp summary. So the conceptual frame work, need for the study, objectives of the study, the hypotheses formulated for testing, the methodology followed and the findings scientifically arrived at are summed up in this chapter.

6.1.1. Introduction

Education is defined as bringing upon, leading out or making manifest the inherent potentialities in a pupil. Broadly speaking, education refers to any act or experience that has a formative effect on the personality of an individual. Swami Vivekananda proclaims that education is the manifestation of the perfection already in man. Education is the process of helping the child to adjust to this changing world. Such an adjustment is not a "somehow" one but a superior adjustment.

In the words of Swami Vivekananda the only true teacher is he who can immediately come down to the level of the students, and transfer his soul to the student's soul and see through the student's eye and hear through his ears and understand through his mind. Such a teacher can really teach.
Education is a unique investment for the present and the future. All educational efforts aim at bringing fullness and richness to man's life. Education is considered to be the vehicle for acquiring knowledge and skills. Education should culminate in the growth of wisdom which lies in tolerance, understanding and catholicity of outlooks. It is meant "not to fill an empty vessel, but to turn the eye of the soul towards the light".

The structure of science education is complex and its development depends on the imagination of science educators and their deep desire to understand the ways in which the subject matter of science can be utilised to provide educative experiences for students (Gardner, 1975).

"In general, education is now undergoing a revolutionary transformation based on the application of scientific technology to instruction" (Kulik & Bangert, 1984) But the field of science teaching is not experiencing a revolution but rather a paradigm shift. "A more extensive and varied world could be opened to the child which he/she could approach with increased flexibility" are the hopes of Hilgard & Bower (1977).

Teaching is seen as a transaction between the students and teacher. But the question is "whether teaching is a matter of transmitting facts efficiently or stimulating a desire to learn" (Becker, 1979). The traditional teaching gradually has to be withered in science teaching since there is an increased recognition of shift from teacher / teaching centered to learner / learning centered education. "A system with open plan and flexible structure constitute a pre-requisite for the effectiveness of the modern conception of scientific education. (Henri, 1977). These objectives are met with by educational technology which refers to the application of technological assistance in instructional purposes with pedagogical and psychological theories. Yet, technological devices are used to decrease the uniformity of learning because of the heterogeneity in the mental capability, the motivation to involve in learning and the attitude towards the mode of learning and content.
Becker (1979) argues that no single method is a panacea of teaching learning problems and modularity is strictly a "cafeteria" offering and the learner chooses the most appropriate one according to his ability, attitude and desire.

The idea of inclusive education is gaining ground all over the world. It was given further impetus by the UNESCO World Conference on Special Needs Education, held in Salamanca, Spain in 1994. The conference considered the future direction of the special needs field in the light of international efforts to ensure the rights of all children to receive basic education. The conference specially examined how far special need is part of this "Education for All" movement. The two confronting questions are: should we aim for a unified system of schooling that is capable of responding to all children as individuals, or should we continue with the tradition of parallel systems whereby some children have separate forms of education?

Inclusive education can be defined as the process of increasing the participation of students in the cultures, curricula, and communities of local mainstream schools whereas exclusive education is the process of reducing the participation. The concept of participation, culture, curriculum, community and locality require careful analysis. The study of inclusion and exclusion involves the engagement with, and analysis of all students and staff within a school. Inclusive education is concerned with reducing all exclusionary pressures, on the basis of disability, ability, race, gender, class, family, structure, lifestyle or sexuality.

The process of inclusion and exclusion are inextricably linked. An analysis of pressures towards exclusion is very important to understand inclusion. It is because within a single school the same students may be both encouraged and discouraged from participation. All schools, respond to the diversity of their students with a mixture of including and excluding measures in terms of who they admit to the school, how students are categorised, grouped and disciplined, how teaching and learning is organised, how resources are used, how students who experience difficulties are supported
and how curricula and teaching is developed so that such difficulties are reduced (Booth, Ainscow, Dyson, 1997).

When the students seen as having special needs are integrated into mainstream schools, the teachers tend to adopt practices derived from experiences in special education. Many of these approaches are simply not feasible in primary and secondary schools. These approaches do not fit with the ways in which mainstream teachers' plan and go about their work. The teachers have to plan for the whole class. Apart from many other consideration, the large number of students in the class as well as the intensity of the teacher's day makes this inevitable.

Therefore, the task becomes one of developing the work of the school in response to pupil diversity. Ainscow (1997) notes that this has to include a consideration of overall organisation, curriculum, and classroom practice, support for learning and staff development. There is an increasing amount of evidence from various countries suggesting that measures school take to cater to pupil diversity can lead to more effective form of education for the pupils.

Inclusive education lays stress on accommodating instructions to individual differences. Apart from physical and sociological individual differences, students are bound to manifest differences in learning aspects. There may be special needs children, there may be average, above average and even gifted students. These students may differ from one another in a variety of ways in learning the given concept. To make his teaching more effective a teacher should take all possible efforts to accommodate his instruction to individual differences. This warrants different modes of instruction in the instructional process, which will be highly likely to cater to individual differences. This is what this study aims at. To make his instruction cater to individual differences, a teacher should have a thorough knowledge about individual differences in students and how far different modes of instruction reach out to all the learners.
Television and record player are the powerful media which have become highly influential in the present day lifestyle. They play a pivotal role in the teaching learning process also. Multimedia packages help to overcome barriers. They go beyond the four walls of the classrooms. It fulfills the gap in learning. Difficult process can be shown with ease. Inaccessible places can be viewed sitting in cozy classroom. These multimedia packages can penetrate more deeply into human character with an immediate excitement than any other single medium. The dual effect of audio and video strengthens and enriches the understanding and expedites the mastery of the concept.

Realising the importance of multimedia, the National Policy of Education (1986) emphasises that the modern educational technology, in general, should reach out to the most distant areas and the most depressed sections of beneficiaries.

Modules are self-contained and auto-instructional material dealing with a single conceptual unit. It caters to individual difference. Each student can take his own time to complete the module. Here, what matters much is the mastery of the subject, not the time. So these modules are very suitable to the students. Moreover, when we provide multimedia base to the modules, they are more effective, especially to under achievers, low achievers etc.

In the era of expanding knowledge, students can no longer remain passive dependents on teacher for knowledge. Student’s need is to learn to think independently and to adopt a fluid approach to learning. Growth in confidence, self direction, knowledge, skills, initiative, tenacity and motivation have been the characteristics of a typical learner” and De Rose (1968) recommends that they should learn how to go about learning because “teaching is not talking and learning is not listening” (Davis, 1976). There is something more, what is it? To find an answer, varied attempts have been made and one such is the present investigation in science education.
6.1.2. Title of the Problem

"EFFECTIVENESS OF THREE MODES OF INSTRUCTION IN INCLUSIVE EDUCATION IN ENHANCING THE ACADEMIC ACHIEVEMENT OF VARIOUS CATEGORIES OF STUDENTS IN BOTANY AT PLUS ONE LEVEL"

6.1.3. Objectives of the Study

**General Objectives**

1. To develop modules, video packages and computer software for selected units of plus one Botany subject.

2. To find out the efficacy of these three modes of instruction in teaching Botany at plus one level.

3. To assess the advantage of these three modes of instruction in an inclusive setting over the traditional lecture method.

**Specific Objectives**

1. To know whether there is any significant difference in the pre-test performance of the students among the control group, experimental video group, experimental modular group and experimental CAI group.

2. To assess whether there is any significant difference in the pre-test performance among any same category of students i.e., normal students, under achievers and the low achievers in all the four groups.

3. To know whether there is any significant difference in the post-test performance among the control group, the experimental video group, experimental modular group and experimental CAI group.

4. To assess whether there is any significant difference in the post-test performance of the normal students among the control
group, experimental video group, experimental modular group and experimental CAI group.

5. To find out whether there is any significant difference in the post-test performance of the under achievers among the control group, experimental video group, experimental modular group and experimental CAI group.

6. To test whether there is any significant difference in the post-test performance of the low achievers among the control group, experimental video group, experimental modular group and experimental CAI group.

7. To find out whether there is any significant difference between the pre-test and post-test performances in respect of the control group taught through traditional lecture method, experimental video group, experimental modular group and experimental CAI group.

8. To test whether there is any significant difference between the pre-test and post-test performances in respect of each category of students i.e. normal students, under achievers and low achievers in all the four groups.

9. To know whether there exists any significant difference in the retention-test performance of the students among the control group, experimental video group, experimental modular group and experimental CAI group.

10. To assess whether there is any significant difference in the retention-test performance of the normal students among the control group, experimental video group, experimental modular group and experimental CAI group.

11. To find out whether there exists any significant difference in the retention-test performance of the under achievers among the
control group, experimental video group, experimental modular group and experimental CAI group.

12. To test whether there exists any significant difference in the retention-test performance of the low achievers among the control group, experimental video group, experimental modular group and experimental CAI group.

13. To know whether there is any significant difference in the performance of the students of all the groups between the post-test and the retention-test.

14. To examine 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.

6.1.3.1. Assumptions of the Study

1. It is possible to develop video package, learning modules and computer assisted instruction software for Botany subject prescribed for plus one level.

2. It is feasible to promote the achievement of students in Botany at plus one level by using video instruction.

3. Modular instruction may be more effective than the traditional lecture method in enhancing the achievement of students in Botany at plus one level.

4. Computer assisted instruction as a mode of instructional strategy will enhance the achievement of students in Botany at plus one level to a considerable extent.

5. Though the three modes of instruction are likely to enhance the achievement of students in Botany at plus one level, the degree of effectiveness may vary from one mode of instruction to another.
6.1.4. Hypotheses of the Study

1. There exists no significant difference in the pre-test performance of the students among the control group, experimental video group, experimental modular group and experimental CAI group.

2. There is no significant difference in the pre-test performance among any same category of students i.e., normal students, under achievers and low achievers in all the groups.

3. There is significant difference in the post-test performance of the students among the control group, experimental video group, experimental modular group and experimental CAI group.

4. There exists significant difference in the post-test performance of normal students, among the control group, experimental video group, experimental modular group and experimental CAI group.

5. There exists significant difference in the post-test performance of under achievers among the control group, experimental video group, experimental modular group and experimental CAI group.

6. There exists significant difference in the post-test performance of low achievers among control group, experimental video group, experimental modular group and experimental CAI group.

7. There exists significant difference between the pre-test and post-test performances in respect of control group, experimental video group, experimental modular group and experimental CAI group.

8. There exists significant difference between the pre-test and the post-test performances in respect of each category of students i.e. normal students, under achievers and low achievers in all the four groups

9. There exists significant difference in the retention-test performance of the students among the control group,
experimental video group, experimental modular group and experimental CAI group.

10. There exists significant difference in the retention-test performance of the normal students among the control group, experimental video group, experimental modular group and experimental CAI group.

11. There exists significant difference in the retention-test performance of the under achievers among control group, experimental video group, experimental modular group and experimental CAI group.

12. There is significant difference in the retention-test performance of the low achievers among control group, experimental video group, experimental modular group and experimental CAI group.

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

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

6.1.5. Scope of the Study

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 video instruction, modular instruction and 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 affected, 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.

Keeping this efficacy in mind, required, video cassettes were procured from District Science Centre, Tirunelveli and International Educational Research Centre, New Delhi. These Video cassettes in addition to the video cassettes developed by the investigator were used for instructional presentation to experimental video group. Modules were developed and validated for the units selected for the study. Modules of all the units were given to the experimental modular group students in the form of a handbook, so as to facilitate auto learning by the students. Teacher support system was limited to the extent of clarifying doubts and guiding the project works. As for computer assisted instruction, commercial softwares 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.

Hundred students from South Street Hindu Nadar Higher Secondary School Muhavur in Virudhunagar District, Tamilnadu, were selected for the study. They were classified into four matching groups. The first group was experimental group-I, which was taught through video instruction. The experimental group-II was taught through modular instruction. The experimental group-III was taught through computer assisted instruction and the last group was control group and it was taught through traditional lecture method.
6.1.6. Need and Importance of the Study

Higher secondary level is a critical point for every student since it prepares the students for collegiate education as well as professional courses. It also serves as a turning point in a student's life as it is directly connected with his future career and future life. But the sorry state of affairs that prevails now-a-days is not at all conducive for the mastery learning of the students who have aspirations burning like a flame in them to evince maximum achievement in the plus two public examination which paves the way for professional courses. But what the students actually get in the classroom is a mere chalk and talk treatment. This amounts to doing deliberate injustice to the students. Such maximum achievements can be ensured by introducing new innovative modes of instruction in teaching Botany to the plus one students.

In this technological era, where knowledge explosion is taking place in every sphere, any instructional strategy without incorporating audio and video instruction cannot be effective to a great extent. For optimum realisation of instructional objectives, the judicious blend of audio and video instruction is a must.

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. Now a days a teacher can not depend on any single method of teaching. The teacher has to try out several innovative methods to present the content to the students. When they are taught by innovative methods, the students are able to understand the concept, principles and content in an effective manner.

The immense knowledge explosion taking place in the world warrants newer methods of teaching. Students need unique experience in the presentation of the content. Video, modular and computer assisted instruction approaches provide such unique experience to students. But, utmost care
should be evinced in the development of video packages, Modules and computer assisted instructional soft-wares which is a complex technical task.

Destiny of a nation is being shaped in her classrooms. A classroom with inclusive setting comprising a heterogeneous population of students, warrants such a study, as this proposed one, to be undertaken for the enrichment of our teaching learning process.

Above all, 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 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. This media based approach is such a strategy.

Although much has been achieved in this field of education, there are many opportunities for experimentation 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 learning method can be precisely planned to suit their needs (Tansely and Gulliford, 1962)

Now the current trend is propagating auto learning by the learner himself at his own pace. This paved 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 present investigation based on three modes of instruction exactly fits in
Video, Modular and CAI strategies provide a natural way for learning to take place. Learning can be accelerated by involving maximum number of sense. Sensory experience forms the foundation of intellectual activity within any formal school situation and learners differ in the effectiveness of their sense reception. Learning experiences with three different modes of instruction have the advantage of appealing to the individual, the learners’ pace, interest and readiness.

Besides, cognition and conceptualisation depend on a chain of events which begin with the learners perception of stimulus, be the auditory, visual, tactile and olfactory. It is important that these initial learning experiences be accurate, dependable and understandable. Unless the learner’s 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 video, modular and computer assisted instructional strategies.

Video, modular and computer assisted learning experiences help to stimulate interest in learning. It economises time and effort, reduces verbalism in teaching and imparts broad education to pupils. Not only children but also adults remember facts better when the multimedia aids are used to explain the concepts. Further, modular approach supports Paivio’s (1991) dual code theory of memory which suggests that information coded both visually and verbally is remembered better than the information coded in only one of those two ways.

(1995) have conducted studies on slow learners but not related to the effectiveness of different modes on various categories of students in an inclusive setting.

Systematic researches are, therefore, necessary to develop video lessons, modular packages and computer assisted instructional software so as to assess their effectiveness with reference to various categories of students in an inclusive environment. The present study is an attempt to measure the relative effectiveness of video instruction, modular instruction, computer assisted instruction with reference to normal students, under achievers and low achievers at plus one level in an inclusive setting and also to assess their advantage over the traditional chalk and talk method.

6.1.7. Methodology

The methodology followed in this study is discussed under different headings namely development of modules for learning Botany at plus one level, establishing the validity and reliability of the modules developed, development of video cassettes for instructional presentation, application of computer assisted instruction in the experimental treatment, construction of achievement test, selecting samples and sample design, application of the three modes of instruction in the experimentation, scoring procedures, data collection and finally the statistical techniques used in the study for arriving at dependable conclusions.

6.1.7.1. Development of Modules

The major objective of the study was to develop modules for the selected units in Botany at plus one level. In the plus one syllabus Biodiversity and Cell Biology were selected for the study. In the development of modules, the guidelines given by the NCERT have been followed, by the investigator. Each of the selected unit was divided into three to four conceptual sub-units. Each sub-unit constituted the subject content for development of one module.
Each module was developed in self-contained and self-instructional manner. Each has at its first page the overview of the module which specified the unit, the conceptual sub-unit and the pattern of the module. In the succeeding page instruction is given to the students as to how to use the modules for self learning. The third page contains the entry test consisting of objective type test items to assess the preliminary knowledge or the entering behaviour of the students required for learning the module. Then comes the pre-test which helps to self evaluate the student’s status when he proceeds with the module. After the pre-test, general and specific objectives I and II are presented. Provision is made for formative evaluation in the form of embedded tests. Summative evaluation is made in the post-test. In each module provision has been made for practicum and projects to be undertaken as follow up works. For students’ guidance a list of reference books and key to all the tests are furnished at the end.

The above provisions enable the students to make self study with the help of the modules. The modules thus developed were then subjected to individual and group try-outs and necessary corrections, modifications, refinements etc. were made in the modules. Both the try-outs ensured better refinement and perfection of modules. The agreement of views of experts who reviewed the modules, was taken as the index of validity of the content of the modules. After this validation, the modules were made ready for the use of experimental modular group students.

6.1.7.2. Development of Video Cassettes

After developing the modules, the investigator had to shoulder the Herculean task of providing multimedia base to the prepared modules. Eight video cassettes had been procured from the International Educational Research Centre, New Delhi for this purpose before hand. Those cassettes were played to the experimental video group students during the period of experimentation. Since readymade video cassettes are not available to the specified units of study, there was need to develop video cassettes by the researcher himself. For the units not covered by the readymade video
cassettes, the investigator had to resort to video shooting and editing. Outstanding teachers of meritorious service were selected for this purpose to present the lessons selected for this study as per the instructional direction of the investigator. A professional videographer was employed for shooting. The shooting was done in the classroom of the school where the experiment was carried out. It took some ten days to accomplish the task. The shots were made according to the description of the scenes such as such as long shot (LS) medium shot (MS) close up shot (CS) zoom in (ZI) and zoom out (ZO). After proper editing and validation, the video cassettes were made ready for instructional presentation to the experimental video group students.

6.1.7.3. Development of CAI Software

The CDs commercially available in the open market for plus one Botany were procured and they were sequentially played to all the categories of students in the experimental CAI group, in addition to the CAI software developed by the investigator. The experimental CAI group students were provided with adequate computers to learn through CAI during the period of experimentation.

6.1.7.4. Construction of Tool

To measure the performance of the students before and after the experiment, an achievement test was constructed by the investigator on the basis of item analysis. Out of 120 objective type items, 100 items were finally selected on the basis of item analysis for the final form of the achievement test. With regard to item difficulty, the percentage clustered around the 50 percent level in most cases. On the basis of this analysis, too easy and too difficult test items were deleted in the final form of achievement test. As for test item discriminating power, 50 percent of the test items had D-value exceeding +0.40, less than 40 percent had D values between +0.40 and +0.20, Also about 10 percent had D values between +0.20 and 0.0 and such test items were excluded from the final form of achievement test. The detailed
procedure adopted to develop the achievement test was explained in Chapter-IV. Each item was scored 'one' mark for the correct response and 'zero' for the wrong response. The duration of the test was 2 hours. The same achievement test was used as pre-test, post-test and retention-test for all the groups mentioned in the study.

6.1.7.5. Sample of the Study

For the purpose of this investigation 100 students from plus one studying at S.S.Hindu Nadar Higher Secondary school, Muhavur were selected. Out of the selected 100 students, 25 each constituted each of the three experimental groups, and the remaining 25 formed the control group. The low achievers and the normal students were classified on the basis of their performance in Raven's Progressive Matrices Test. The under achievers were identified and selected on the basis of their performance in the RPM test and in the half-yearly examination. How the 100 students were selected out of 103 students, how 60 normal students, 20 low achievers and 20 under achievers were selected have been explained thoroughly in chapter-IV.

6.1.7.6. Implementing the Strategy

The experiment was carried out for a period of 45 days after the school hours at the rate of 1.30 hrs per day. CAI software and computers were provided to all the categories of students in CAI group during the period of experimental treatment. Similarly video cassettes were provided to the students of all the categories in the experimental video group. The developed modules in the form of hand book were made available to the students of all the categories in the experimental modular group, during the entire period of experimentation. The students of the experimental groups were not allowed to take home the video cassettes, modules handbook and the CAI software, since there was every possibility for the control group students to make use of them at home, which could very much distort the findings. After the experimental period, a post-test was conducted to assess the progress made
by the students in achievement. Then after a lapse of 45 days, a retention-test was administered to the students of all the four groups to assess the effectiveness of the applied strategies in terms of retention. The same achievement test was used as pre-test, post-test and retention-test.

6.1.7.7. Data Collection

At the end of the experimental period, a post-test was conducted to the students of all the experimental groups and the control group. Exactly 45 days after the post-test, a retention test was administered to all the four groups to measure the degree of retention with regard to each mode of instruction. The responses given by the students in the pre-test, post-test and the retention test formed the vital date required for the analysis. The scores of the four groups in the pre-test, post-test and the retention test are given in Appendix -VII.

6.1.7.8. Scoring Procedure

The achievement test consisted of 100 objective type questions. The total score of test is 100. For each correct answer, the score is one and for each wrong answer the score is zero. The answer key to the achievement test is given in Appendix -V. English version of the key to the achievement test is given in Appendix-VI.

6.1.7.9. Statistical Techniques Used in the Study

The data thus obtained were analysed using appropriate statistical techniques such as mean, standard deviation and t/f - test. In the first stage, mean and standard deviation (S D) of pre-test scores were calculated for all the four groups of students.

In the next stage, to know the effectiveness of the three modes of instruction in teaching Botany at plus one level, mean and S.D were calculated for the post-test scores in respect of all the four groups. Based on the mean and S D, t/F - test was calculated to know the significant difference,
if any, between any two groups or among the groups. The same calculation was applied to retention test also.

6.1.7.10. Findings and Conclusions

i) There is no significant difference among the various groups. It indicates that all the groups i.e control group, experimental video group, experimental modular group and experimental CAI group were very much alike in the pre-test performance. All the four groups have shown a matching performance in the pre-test. Therefore, there is no variation in the pre-test achievement between any two groups. Further, the obtained F-value shows that all the four groups were matched ones before the experimentation.

ii) There is no significant difference in the pre-test performance among the same category of students in all the groups. Normal students in all the groups, the under-achievers in all the groups and the low achievers in all the groups were very much alike in their pre-test performance and so there is no variations in their achievement before the experiment. All the F-values testify to the fact that all the groups formed for the study were matched ones before experimentation. It may be noticed that the finding of this table is in total agreement with the finding of table-1.

iii) There is significant difference in the post-test performance among the four groups of this study. The obtained F-value (3.42) simply points out that there is significant difference among the four groups selected for this study. But it doesn't clearly specify between which two groups there lies the significant difference. Hence to know between which two groups significant difference exists, t-test was applied. The obtained t-values [Control Group vs Video Group (2.47); Control Group vs Modular Group (2.35); Control Group vs CAI Group (2.81)] indicate that there is significant difference in the post-test
performance between control group and each of the experimental groups. And there is no significant difference in the post-test performance between any two experimental groups. [Video Group vs Modular Group (0.13); Video Group vs CAI Group (0.46); Modular Group vs CAI Group (0.58)]. The progress made by all the experimental groups can be ascribed to the effectiveness of the three modes of instruction applied during the period of experimentation. Further, this table testifies to the advantage of the applied modes of instruction over the traditional lecture method.

iv) There is marked difference in the post-test performance of the normal students among the four groups. The achievement of the normal students in each of the experimental groups is better than that of the control group normal students. The achievement of the normal students in all the groups is almost alike. There is not much variation in their performance even-though the normal students of CAI group are slightly ahead of the normal students of the other two groups. This analysis substantiates that the three modes of instructions are effective to the normal students with the computer assisted instruction on the lead.

v) There is marked difference in the post-test performance of the under achievers among the four groups. The achievement of the under achievers in each of the experimental groups is higher than that of the control group under achievers. As for the experimental groups under achievers, the CAI group under achievers stand first scoring highest mean scores followed by the under achievers of experimental modular group. Trailing behind are the under achievers of the experimental video group. This analysis brings to light the relative effectiveness of the applied modes of instruction with reference to under achievers. Computer assisted instruction is most effective to the under achievers. Modular instruction stands second with the video

vi) There is significant difference in the post-test performance of the low achievers among the four-groups. The low achievers in each of the experimental groups have shown a better performance than their counterparts in the control group. In terms of relative effectiveness, video instruction is most effective to low achievers followed by modular instruction and CAI. This supports the findings of Borras Isabe (1993), Joanna Veeran (1992), Kannan (2000), Leitner, Rona Karan (1992), Mallic and Sahoo (1994), Maria Araselvi (1996), Naggy, Linda Farincili (1992), Ponnambalam (2004), Ramar (1994), Smith, Bonie Jean (1993), Steele Jeery Reed (1994), Tay, Young-Wu (1994) and Uma Joshi (1993) who have established the effectiveness of video instruction and modular instruction with reference to low achievers.

vii) There exists no significant difference between the pre-test and the post-test in respect of control group students whereas there exists significant difference between the pre-test and the post-test in respect of experimental video group students, experimental modular group students and experimental CAI group students. The control group students could not show any progress in achievement in the post-test performance. So there is no difference in their performance between the pre-test and the post-test.
On the other hand, the students of all the experimental groups have shown remarkable progress in their post-test achievement. The experimental video group students have made a mean gain of 15.12, the experimental modular group students have made a mean gain of 13.16, and the experimental CAI group students have made a mean gain of 17.12. In terms of rate of progress, the experimental video group, the experimental modular group and the experimental CAI group have shown 29.65%, 25.15% and 33.33% respectively. In terms of relative effectiveness computer assisted instruction has been more effective than the other three modes of instruction including the traditional lecture method which was applied to the control group. The video instruction comes next followed by modular instruction. In terms of relative effectiveness the traditional lecture method stands last.

The significant difference between the pre-test and the post-test in respect of all the experimental groups is the resultant product of the experimental treatment. The vertical progress in the post-test performance can be attributed to the effectiveness of the applied instructional strategies i.e. video instruction, modular instructions and computer assisted instruction. Further, this table substantiates the advantage of the applied three modes of instruction over the traditional lecture method.

viii) There is significant difference in the performance of students between the pre-test and the post-test in respect of each category in all the experimental groups, whereas there is no significant difference in the performance of the students between the pre-test and the post-test in respect of each category in the control group. Since the control group students did not undergo the experimental treatment, they could not make any remarkable progress in the post-test performance. Though the low achievers in the control group have made some
progress in the post-test, they could not make any significant difference.

As for the normal students, the normal students in each experimental group have done better in the post-test than in the pre-test. The progress shown by the normal students in the CAI group is remarkable and it is better than that of the video group and modular group students. In terms of relative effectiveness, as far as the normal students are concerned, computer assisted instruction is most effective followed by video instruction and modular instruction.

In the case of under achievers, the under achievers in each experimental group have shown a better performance in the post-test than in the pre-test. In terms of rate of progress, the under achievers in each group have shown a better rate of progress than the normal students in each group. It substantiates that all the three modes of instructions were effective to under achievers than they were to normal students. In terms of relative effectiveness, computer assisted instruction is most effective to under achievers followed by modular instruction and video instruction.

With regard to the low achievers, the low achievers in each experimental group have made a remarkable progress in the post-test performance. The progress shown by them in the post-test performance is better than their performance in the pre-test. The progress shown by them is more than that of the normal students and the under achievers. In terms of rate of progress, it is the low achievers who rank first followed by the under achievers and the normal students. In terms of relative effectiveness, modular instruction is most effective to low achievers followed by computer assisted instruction and video instruction.
To sum up it can be stated that modular instruction is more effective to low achievers than it is to the under achievers and the normal students. All the three applied modes of instruction are most effective to the low achievers in each experimental group, more effective to the under achievers in each experimental group and they are just effective to the normal students. In terms of inter-group rate of progress, the low achievers stand first followed by the under achievers and the normal students. The progress shown by each category in each experimental group can be attributed to the effectiveness of the three applied modes on instruction. A comparative glance at the table will bring to light the advantage of the applied modes of instruction over the traditional lecture method.

ix) There is significant difference in the retention test performance among the four groups. The students of each experimental group have shown a better performance in the retention-test than their counterparts in the control group. All the three modes of instruction have been effective in ensuring retention of learned concepts. It is much interesting to note that the computer assisted instruction has been more effective in ensuring retention than the other two modes of instruction. This can be attributed to the interactive effect of CAI which the other two modes lack. Next to computer assisted instruction video instruction comes with the modular instruction at the tail.

x) There is significant difference in the retention-test performance between the normal students of control group and the normal students of each of the experimental groups. The achievement of normal students in each experimental group is higher than that of the normal students of the control group. It is to be noted that there is no significant difference in the retention-test performance between any two experimental groups. As for relative effectiveness, CAI group normal students have a higher
mean score than the normal students of the other two groups. In terms of relative effectiveness with reference to normal students, CAI comes first followed by video instruction and modular instruction. It vouches for the effectiveness of the applied modes of instruction in ensuring retention.

xi) There is significant difference in the retention-test performance of the under achievers among the four groups. The under achievers of the experimental groups have shown a better performance in the retention-test than their counterparts in the control group. There is no significant difference in the retention-test performance of under-achievers between any two experimental groups. All the experimental groups under achievers have shown a matching performance in the retention-test. It shows that all the modes of applied instructions have been equally effective for under achievers in ensuring retention.

xii) There is significant difference in the retention-test performance of the low achievers among the four groups selected for this study. The achievement of low achievers in each experimental group is better than the achievement of the low achievers in the control group. As for relative effectiveness, video instruction is found to be more effective to low achievers in ensuring retention, which is followed by modular instruction and computer assisted instruction. This table substantiates the effectiveness of the three applied modes of instruction in ensuring retention. A comparison with the control group will bring to light the extent of effectiveness of the applied modes of instruction with reference to the low achievers.

xiii) There is no significant difference in the performance of students of all the groups between the post-test and the retention-test. It indicates that all the modes of instruction were effective in ensuring retention. All the t-values indicate that all the modes of
instruction could facilitate retention of the concepts learned during the period of experimentation even-though the retention-test was conducted 45 days after the post-test. This table vouches for the effectiveness of the applied strategies not only in instruction but also in retention.

xiv) There is no significant difference in the performance of all the categories of students between the post-test and the retention-test. All the categories of students in all the groups showed a matching performance in the post-test and retention test. It is much interesting to note that all the modes of instruction applied have been effective to all the categories of students in all the groups in ensuring retention. This vouches for the effectiveness of the applied strategy in an inclusive setting. This finding supports the findings of Antonisamy (1989), Deepa Jain (2000), Janakumar (1995), Maria Araselvi (1996), Natarajan (1995), Ponnambalam (2004), Ramar (1994), (1996), Shevde (1997), Stella (1993), Swanup (1998), Thalamalai (1996), Viannae Timmons (2004), Zaveri (2001) who have established one of the above strategies or the other with reference to one of the above categories or the other. As for relative effectiveness in terms of retention all the applied strategies have been found to be equally effective in ensuring retention as in imparting instruction.

6.2 Implications of the Study

1) The results of the study have established that the applied three modes of instruction i.e., video instruction, modular instruction and computer assisted instruction have been more effective than the traditional lecture method in teaching Botany to various categories of students at plus one level. Only the degree of efficacy differs from category to category. So similar studies can be attempted in a wide range of schools to arrive at more dependable conclusions.
2) Classifying students into various categories such as normal students, under achievers and low achievers will enable the teachers to devise required remedial instructions to facilitate their learning. The teachers trained in this regard will be able to identify and classify the students into various categories and they will be able to accommodate their instruction to individual differences. Such training can be provided to the teachers at district level by DIET or SSA and at State level by SCERT.

3) Expertise of resource persons can be utilised for development of modules for various subjects and various standards and thus their expertise can be made available to a wider range of student population. State PTA body can play a decisive role in this regard. They can make modules in the form of Handbook available to all the students as they provide practical manuals for Physics, Chemistry, Biology subjects to all the students at low cost.

4) Teachers of Middle Schools and High Schools can be given orientation as to how to prepare modules and how to develop multimedia packages especially LTIM materials making use of the resources locally available. This will give them a better preparedness to ensure optimum human resource development.

5) Keeping the result of the study in mind, the NCERT and SCERT may take up the onerous task of developing modules for each subject as they produce teachers handbook and these can be supplied to all the schools so that the teachers can effectively make use of these modules, for the benefit of the entire class, since the modules, being self contained and auto instructional, cater to individual differences.

6) The instructional video programmes based on subject unit may be developed by the NCERT and SCERT making use of the
expertise of talented teachers at national level and state level respectively. These video cassettes may be supplied to all the schools. Or, these may be supplied in VCD or DVD form which are not much expensive these days. Since almost all the schools have T.V. and computer of their own, it will be very much possible for them to play the cassettes / CDs and the students can view the instructional programmes based on their subject units. In this way the expertise of the talented teachers can be made available even to the schools in the remote far flung areas.

7) Video cassettes and audio cassettes based on subject unit can be developed by DIET or even by commercial agencies and the schools can procure them either from science or from audio visual fund available in the special fees account. State Government should provide adequate fund to District Science Centres for this projects so that the District Science Centres can write the developed instructional video programmes in VCD / DVD etc. and make them available to the schools that approach them for multimedia aids.

8) The students can take these cassettes home and they can learn according to their convenience at their own pace without any sort of inhibition or fear of authority, the factors that hinder learning process.

9) CAI and CAL software also can be developed by the NCERT and SCERT and even by commercial agencies since they are deemed to be more effective to low achievers, under achievers etc. So the teachers should be adequately prepared by means of orientation programmes or in-service training to play a supportive role in order to lead the various categories of learners towards optimum level of attainment in inclusive setting.
10) Since the computer finds a place in the syllabus of high schools right from class IX onwards, the use of CAI and CAL can be widely popularised without much effort. The educational use of computers can be widely applied since CAI and CAL have been verified to be effective in reaching out to all learners which is much stressed in inclusive education.

11) Since the applied three modes of instruction have a far reaching consequence for the backward students, it can be effectively made use of in distance education in which about 50% of the total enrolled students are average and below average. Appropriate and optimum use of media sources will yield better result in distance education. Setting up a separate channel for education will be a landmark in human resource development and ultimately national development. The huge amount spent in this regard should be taken in the right spirit as investment made on education or human capital.

12) Since the use of the applied modes of instruction enhances the achievement of under achievers and low achievers, it will diminish wastage and stagnation in our schools. So the teachers should be adequately prepared by means of orientation programme and such orientation may be given at DIET level also, so that awareness about video instruction, modular instruction and computer assisted instruction can be developed among the primary school teachers also.

13) Sarva Siksha Abiyan (SSA) and Block Resource Centres can also play a key role in providing orientation or training programmes to the primary as well as upper primary teachers as to how to accommodate various categories of students in inclusive education and how to devise instruction so as to cater to student differences.
6.3. Delimitations of the Study

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 Virudhunagar district of Tamil Nadu state.

ii) The sample consists of 100 students at the rate of 25 for each group selected on the basis of systematic purposive random sampling technique.

iii) Only two units in plus one Botany syllabus i.e. Bio-Diversity and Cell biology have been included for this study.

iv) The experiment was conducted for a period of 45 days at the rate of one hour per day.

v) The video cassettes were procured from District Science Centre, Tirunelveli and International Educational Research Centre, New Delhi. For the units not covered by the commercial video cassettes, the investigator developed his own video cassettes using the expertise and technology locally available.

vi) 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 Botany Laboratory where the experiment was actually carried out. The experimental CAI group students were not permitted to take them home to avoid the students in other groups using the said software which would distort the result.

vii) As for the modules, they were developed and validated by the investigator himself covering the selected units.
viii) The achievement test used in the study is a teacher made one with its own validity and reliability.

6.4. Suggestions for Further Research

1. In this study video instruction, modular instruction and computer assisted instruction have been found to be very effective to teach Botany at plus one level. To ensure more dependable conclusions, the experiment may be conducted on a wide range of schools.

2. A parallel study can be made to find out the effectiveness of three modes of instruction with special reference to backward students like low achievers, under achievers, slow learners, learning disabled etc., at primary and high school levels.

3. A parallel study can be made covering the full syllabus of a particular subject and internal analysis can be done.

4. A comparative study can be made by selecting students both from rural and urban schools.

5. A study can be undertaken to assess the attitudes of the students and teachers of high schools and the middle schools towards the three modes of instruction applied in this study.

6. A separate study can be conducted to assess the relative effectiveness of these modes of instruction with reference to various categories of schools. i.e., Govt. aided, unaided, matric and Anglo Indian schools.