CHAPTER – I
INTRODUCTION

1.1. Inclusive Education: Concept, Meaning and Importance

1.2. Individual Differences in Students

1.2.1. Bases of Individual Differences

1.3. Accommodating Instruction to Individual Differences

1.4. Instructional Strategy: Concept, Meaning and Definition

1.5. Modular Instruction: Concept, Meaning and Definition

1.6. Video Instruction: Concept, Meaning and Importance

1.7. CAI: Concept, Meaning and Importance

1.8. Relevance of the Modular, Video and Computer Assisted Instruction Modes in Learning Botany

1.9. Need for the Above Three Instructional Strategies in Learning Botany at Higher Secondary Level
1.1. Inclusive Education: Concept, Meaning and Importance

Swami Vivekanandha proclaims that "education is the manifestation of perfection already in man". Much has been talked about general education and special education. Education is a man making process, and add salt to life. It plays a key role in human resource development. To optimise human resource development the concept of education for all came into vogue. Normal students were placed under the general education umbrella while handicapped and special needs students were placed under special education umbrella. This situation deprived the special needs children of the required exposure and interaction with normal and gifted students. As a result there emerged a raging debate on general education and special education with focus on inclusion and exclusion. There were arguments for and against placing special needs children under general education.

This debate on nature of education evolved terms and techniques like mainstreaming, integration and inclusion. Though these terms refer to general education, there are minute distinctions. It is the demarcation line that marks the distinction. Mainstreaming refers
to the type of instruction provided in the general education setting. In mainstreaming, the students were normal and endowed. Integration refers to integrating some special needs children in the general education classroom where they receive instruction as others. But the term “inclusion” is the latest one derived from inclusive education. According to the concept of inclusive education, the handicapped, disabled, socially and culturally disadvantaged and some other special needs children who do not require special equipment and special instruction for their learning should be included in the general education classroom. In the inclusive setting instruction is devised so as to reach out to all the learners i.e., normal, endowed, ignored etc. The current trend is inclusive education. To develop a deep insight into inclusive education in a better way, one should understand the relationship between general education and special education.

During the 1980s the relationship between general education and special education became a matter of great concern to policymakers, researchers and advocates for special children. Educators proposed to change the relationship between general and special education. They made radical calls to restructure or merge the two. This came to be known as Regular Education Initiative (REI). Moderate proponents of REI suggested that general education teachers take more responsibility to teach students with mild or moderate disabilities. Special educators should serve more as consultants or resource persons to regular classroom teachers and less special teachers of children. More radical proponents of REI suggested that special education be eliminated as a separate identifiable part of education. They called for a single, unified education system in which all children must be viewed as unique, special, and entitled to the same quality of education.

Regardless of how one views REI, the controversy about the relationship between special and general education has made the
classroom teachers more aware of the problems of deciding just which students should be taught with specific curricula, which students should receive special attention or services, and where and by whom these should be provided. There are no part answers to the questions about how special and general education should work together to ensure that every child receives an appropriate education. However, it is clear that the relationship between general education and special education should be one of co-operation and collaboration. They should not become independent or mutually exclusive educational trades.

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 needs” 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 exclusion 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 processes 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.

Inclusive education means welcoming all children, without discrimination, into regular or ordinary schools. Indeed, it is a focus on creating environments responsive to the differing developmental capacities, needs, and potentials of all children. Inclusion means a shift in services from simply trying to fit the child into 'normal settings'; it is a supplemental support for their disabilities on special needs and promoting the child's overall development in an optimal setting. It calls for a respect of difference.

Therefore, the task becomes one of developing the school in response to pupil's diversity. This has to include a consideration of overall organisation, curriculum and classroom practice, support for
leaning and staff development (Ainscow, 1997). It does not mean that we should cease to identify and refer to the disabilities of the learners, or to provide particular kinds of support when and where needed. It does mean that we should cease perceiving learners as all being similar because they are referred to by the same name.

Inclusive education implies that education is about learning to live and learn together with each other. Central to the present thinking is the approach towards learning, which is termed as "inclusive learning", a move away from labeling the student and towards creating special educational environment; concentrating or understanding better how people learn so that they can be better helped to learn; and see people with disabilities and/or learning difficulties first and foremost as learners. The Salamanca Statement and Frame for Action on Special Needs Education (UNESCO, 1994) provides the clearest and most unequivocal call in articles 2 and 7 towards the inclusive approach.

Indeed, there are some children with severe disabilities for whom it would be extremely difficult to create a truly inclusive educational environment; it would neither benefit the child nor others in the setting. However, this does not mean that the child should be segregated and isolated from all life in the community. There should be a range of inclusive settings whereby the child can feel included and be best served. Such settings could be arranged within the school premises, family circles, at community gatherings, at sports events, religious services and other recreation centers which are likely to ensure the opportunities for social interaction. 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.
Challenges of Inclusive Education

The real challenge of inclusive education is to meet the special needs of all children with and without disabilities (Kajubi, 1999). Inclusion is not a soft process. It requires a lot of struggle and commitment to overcome all types of barriers mainly attitudinal and social. Inclusive education can only flourish in a system, which generates inclusive ideology. People have to change their established beliefs, practices and modes of working. Indeed, practical problems could be encountered while including children with diverse educational needs. But oftentimes the practical difficulties have more to do with bringing attitudinal change and the reorganisation of learning environments and school activities, with the reallocation of money and resources than with the needs of children.

Many determinant factors affect and regulate the development of inclusion. Limited understandings of the concept of disability, negative attitude towards persons with disabilities and a hardened resistance to change are the major barriers impeding inclusive education. Of particular concern is the fact that teachers' attitudes are seen as the decisive factors for successful inclusion. Inclusion has been based on the assumption that teachers are willing to admit students with disability into regular classes and be responsible for meeting their needs. However, regular classroom teachers do not perceive themselves as having the appropriate training and skills to meet the instructional needs of students with disabilities. Unfortunately, evaluation studies indicate that teachers do not always have the support they need to make inclusion successful.

In some schools, regular teachers are asked to teach special needs students without receiving any form of training as well as administrative assistance. Without support, teachers who do not have sufficient background knowledge in special education are at a loss. An inclusive education demands the class teacher to be innovative,
flexible, creative, ready to learn from the learners and capable of imitating active learning. The development of an inclusive educational policy, curriculum and teacher training programs are frontiers of challenges encountered in course of implementing inclusive education. Generally, the challenge towards inclusive education could emanate from different directions such as attitudinal factors, rigid school system, and resistance to change, lack of clear educational guideline, and fear of losing one’s job on the part of special school teachers.

To tackle the challenges of inclusive education, an educator must be aware of the salient features of inclusive education so that he can ensure a better preparedness on his part to make his instructional presentation so as to reach out to all the learners in the inclusive setting. An insight into the salient features of inclusive education is a must for a teacher in inclusive setting to attain the required teaching competency.

Salient Features of Inclusive Education

Inclusive education is still a new field. So there are no tested methods and techniques. Researchers have frequently visited inclusive schools and they have frequently observed the students, staff and their interactions in the actual classrooms. Moreover, they have made exhaustive interviews. On the basis of their observations and interviews of pupils, teachers and parents, some programmes have been found to be effective.

a) Accepting, accommodating and catering to diversities.

b) Devising instructions so as to reach out to all the learners.

c) Encouraging students’ participation.

d) Formal planning.
e) Overcoming barriers to learning.
f) Responding by category.
g) Responding to age.
h) Learner centred mode of instruction.
i) Promoting positive behaviour.
j) Providing help and support.
k) Principle of acceptance.

a) *Accepting, accommodating and catering to diversities*

A class-room in an inclusive setting is an integral whole of diversity. Such existing diversities should be basically accepted, radically accommodated and the educational programmes should be meticulously devised so as to cater to the existing diversities, when the school or educator fails to do so, such act will culminate in exclusion which is alien to inclusion.

b) *Devising instructions so as to reach out to all the learners*

Devising instructions so as to reach out to all the learners is of much importance. The main criterion for distinguishing inclusive education is devising the instructional strategy so as to reach out to all the learners. Each category of the diversities in the classroom should derive optimum benefit from the instruction provided. This is the key note in inclusive education.

c) *Encouraging students' participation*

Teachers must be purposeful, enthusiastic and clear in their directions and instructions to promote greater participation of students. Since the excluded are included in the classroom, the teachers must make efforts to link lesson experience to the student’s experience to
enhance their understanding and participation. Deliberate use of group-work and collaborative learning strategies between students as they carry out their task will ensure better participation. This is guaranteed well in the modular instructional strategy selected for the study.

d) **Formal planning**

Formal planning is very important in inclusive education. The formal planning has two elements. First of all, there is the planning of the overall learning environment. This involves taking the programmes of the study outlined in the national curriculum. The second element is concerned with planning for individuals. This requires the creating of individual curriculum plans for each child based upon the best available knowledge amongst the staff team working with the child.

e) **Overcoming barriers to learning**

Adult support to overcome problems of participation must be provided in lessons for students categorised as having 'special needs'. It must involve adapting or giving access to the curriculum for individual students. Teachers should have specialisation in 'literacy difficulties', severe learning difficulty, or visual disability. Teachers should make use of specially prepared materials and adapted materials related to the lesson content in teaching the special needs students. This has been effectively used with encouraging positive results at Richard Lovell Community High School in U.K.

f) **Responding to category**

A traditional category system divided the students into 'mainstream' and 'special'. They were labeled according to their perceived severity of 'need'. The categorisation of some students as having special instructional needs has a number of consequences,
both educational and social. So means of engaging with and developing ordinary classroom to become responsive to diversity of all learners should be constructively contrived and carried out.

**g) Responding to age**

Most schools cut down student diversity by grouping students by age. Age carries expectations of increasing attainment and maturity. In the English system, students are very rarely allowed to advance a year or to be retained for an extra year. But it is not so in many of the developing countries. So response to age becomes a factor to be reckoned with. Students can be grouped on the basis of age as junior, seniors and super seniors. Curriculum must be framed somewhat differently for each of these phases. Each of these three phases must have its own head, together with a team of teachers who can take some specific responsibility for the students in that phase. Appointment of Assistant Headmasters for each level in Indian Higher Secondary schools can be made functional in tune with this systems.

**h) Learner Centred mode of instruction**

A good lesson is when it is all set out on the board and the students get it done in their own time rather than the teacher telling them they have got ten minutes to get this done. Teachers should know the students first before they start teaching the lessons. Knowing the learner well is more important than knowing the lesson to be taught, well. Ample opportunities must be provided to the students to pursue individual projects in some detail over an extended period of time.

**i) Promoting positive behaviour**

In U.K. in inclusive education schools they have adopted a system known as ‘positive behaviour’. This system consists of a set of classroom rules placed prominently in every classroom. There are
cumulative rewards and punishments called consequences for adhering to the rules and breaking them. Rewards consist of credits, certificates and prizes. These procedures have been found more effective in promoting positive behaviour which is very much required for optimum learning.

To accomplish this the following should be ensured

- Teachers should not vary their treatment from pupil to pupil.
- They should ensure that the bright students do not look down upon or ridicule the students with special needs.
- Teachers should be sympathetic with all the students in general and with students with special needs in particular. At the same time they should be harsh when the situation demands.

j) Providing help and support

Students willingly admit to their own areas of difficulty and need someone they can turn to for help. To serve this purpose there must be a school council for providing the students with counselling and guidance. The students can take their grievances to this school council. The presence of additional adult helpers in some lessons will yield better results. It is likely that the presence of large team of support personnel to support students said to have special needs may also have a wider impact on feelings of being supported.

k) Principle of acceptance

A good interpersonal relationship is very essential. Similarly, there should be a cordial relationship between the students and the teachers. A good relationship prevailing in the school can encourage the climate of support discussed above. Good relationships are
always positively influential. There must be a sense of acceptance of differences among the students. This sense of acceptance manifests itself in a variety of forms. There should not be any discrimination on the grounds of caste, creed, and colour. In the inclusive education system there are more possibilities for acceptance of students with disabilities as being just part of the normal school community. This acceptance helps the children with disabilities cope a bit more. It is the duty of the teacher to ensure that a sense of acceptance prevails in his classroom besides his accepting all students alike.

So the key note in inclusive education is accepting differences among the students and accommodating instruction to individual differences.

1.2. Individual Differences in Students

The problem that plagues every teacher in every subject at every grade level is how to teach a lesson to a class that contains students with different skills and learning rates. Accommodating instruction to student differences is one of the most fundamental problems of education and often leads to politically and emotionally charged policies.

The problem of accommodating student differences is so important that many educationists have suggested that instruction be completely individualised so that students can work independently at their own rates. In the past twenty years, this point of view has led to the creation of individualised instructional programmes and computer assisted instruction. Simply speaking, individual difference refers to how the students differ from one another in a variety of ways, some important to instruction, some not.

Each of the many ways of accommodating student differences has its own benefits, but each introduces its own problems, which
sometimes outweigh the benefits. Researches on various means of accommodating classroom instruction to student differences have been undertaken. However, before delving into the details, it will be apt on our part to consider what student differences are and which of them the teachers must take into account.

1.2.1. Bases of Individual Differences

From their first day in a school, students differ. They differ on several obvious dimensions that are of little importance to instruction, but they also differ in cognitive abilities and learning rates, which are of great concern to educators.

Many students enter L.K.G. or first standard knowing the alphabet and numbers upto ten, and some can already read a little. Others lack these skills. As time goes on, initial differences between students tend to increase, so that by High School or Higher Secondary School students may enter class with markedly different skills.

Differences in prior learning create the most serious problem in instruction (Tobias 1981, Como and Snow 1986). For example, if a teacher presents a series of lessons on the discovery of America, it is of considerable importance to know how much students already know about the subject, how much they understand about the Renaissance in Europe, how well they can interpret maps and globes, and at the most basic level, how well they can read. If students are quite diverse in these skills, then the teacher must somehow take this diversity into account when presenting the lesson.

Another student difference, that teachers have to take into account is learning rate. Even if all the students begin class at same level, some are likely to learn more easily and rapidly than others. For example, a class learning a foreign language for the first time might begin with equal ignorance, but some students have an ‘Ear' for
foreign languages that others lack, and some have greater motivation to learn a foreign language than others. For these and other reasons, some students will learn more rapidly than their classmates.

A third difference that the teachers should be aware of is learning style (Dunn and Dunn 1978; Mossick 1984 and Carbo et.al., 1986). For example, some students learn best auditorily, some visually. Some work best alone, others with peers. Some need total silence to concentrate, others work well in a noisy room. Low achievement in academic performance may be due to the aforesaid factors. The instructor should, therefore, take care of such bases of differences and accordingly devise his instruction so as to cater to individual differences, especially to under achievers, low achievers etc.

1.3. Accommodating Instruction to Individual Differences

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.

Heterogeneity is the mark of inclusive setting. A classroom is miniature whole of diverse elements. Even in a group there may be individual differences as discussed above. Heterogeneity is the
underlying factor in any mainstream or inclusive setting. In any classroom under inclusive setting there will be a few special needs children. There will be some problem students and there will be low achieving students like under-achievers, low achievers and slow learners. Inclusive education emphasises including the excluded in general education classroom. All these diverse categories of students account for the heterogeneity in the classroom. The very objective of inclusive education is imparting instruction to these diverse categories under one umbrella. To do this task successfully a teacher should have a thorough knowledge about educational technology as well as instructional technology. Moreover, he should be able to decide upon the appropriate instructional strategy so as to make his instruction reach out to all the learners.

1.4. Instructional Strategy: Concept, Meaning and Definition

Instructional strategy refers to the application of appropriate psychological principles or definite methods and techniques in the instructional process. Instructional strategy is a means of achieving the instructional objectives in the best possible manner at the lowest possible cost.

Without proper instructional strategy, it is not possible to bring about all round human resource development. Instructional strategy should be designed in such a way that it should promote the learning of all categories of pupils i.e. above average, average and below average students. The educational philosophy, psychological theory and the appropriate educational technology and the predetermined educational objectives should be the criteria to decide upon the instructional strategies. There are various approaches, methods, techniques and models to impart / instruct the students.

Media play a vital role in any instructional strategy. Since the present age is rightly called technological age, we can't decide upon
any instructional strategy which does not involve media application. An instructional strategy, which encompasses maximum utilisation of media, can alone ensure effective teaching learning process. Though there are various components of media, in a developing country like India, video and audio instructions are found more feasible and profitable. Modular instruction, Video instruction and CAI are certain instructional strategies which make use of instructional technology to the best advantage of the students.

1.5. Modular Instruction: Concept, Meaning and Definition

Module is a self contained, suitably tested, auto instructional material. Modular approach provides a strategy for the teacher and the learner to mutually share the responsibility for learning. The teacher becomes the facilitator of learning, rather than the traditional way. A module is a self-contained and self instructional material. It is self-contained in the sense that everything is self-explanatory. It is a self instructional package because each module has a set objectives and fulfils in developing the expected skills in the learner. Since it is an individualised instructional material, the learner can take his own time to complete the material. It is not time but achievement which is the criterion in a module.

A module will help the learners in the following ways:

i) It develops learning autonomy in a learner because it is an auto learning material.

ii) It ensures achievement of an expected standard.

iii) It provides remedial instruction. The embedded tests and objective by objective movements help the learner to classify things.

Learning packages, unipacs, learning activity packages, etc. are some of the titles used for a strategy useful for self learning. But no
title has gained universal acceptance as the phrase learning module; it is considered the general name for the strategy. Although learning modules will differ, each can be expected to have similar elements and sequence in the module.

Elements of Modules: A learning module should have the following elements.

i) A title or topic designation.

ii) A list of major concepts to be learnt.

iii) The rationale for studying the module.

iv) A pre assessment activity.

v) Objectives stated in behavioral terms.

vi) Guidelines for leaner, teacher preparation.

vii) A detailed learning sequence.

viii) Summary

ix) Suggested depth or quest activities

x) A post assessment activity

In order to maximise learning, suitable instructional materials in the form of modules may be developed. These modules should be validated before use. Self instructional modules are extensively used in different situations for efficient learning.

Components of an Instructional Module

i) Entry test

ii) Pre-test

iii) Objectives
iv) Introduction

v) Development of learning materials for objectives I. Diagrams, sketches, pictures, examples, work sheets embedded test, etc.

vi) Development of learning materials for objectives II. Diagrams sketches, pictures, examples, work sheets, embedded test, etc.

vii) Summary / conclusion

viii) Case study

ix) Post-test

x) Key to questions

xi) References

xii) Projects/ Guidelines for further action.

**Special Features** : The following are the special features of a module

i) Validated / tested material

ii) Mass produced for use in institutions for learning different subjects.

iii) Participation of learner explicit

iv) Specially suited for individual’s self-learning

**Development of a Module:**

The first page depicts the main unit and the single conceptual sub unit covered in the module. Also, it reflects the components of the learning module, i.e. development or construction pattern of the module. The next page gives necessary instruction as to how to use the module. Instruction is followed by an entry test which consists of
objective type items on the preliminary knowledge required for learning the module. If a student fails to attain minimum level achievement, he may not understand the module and so he should not go through the learning module unless his entering behavior is strengthened. The pre-test follows the entry test. The pre-test is also an objective type test, which helps to self evaluate the student’s status when he proceeds with the module. It is followed by introduction of the topic. General objectives and specific objectives are listed out. Then the relevant learning materials will be presented for the objectives stated. Necessary diagrams, sketches, pictures, worksheets, examples, dimensional drawings, summary and conclusion, case study, etc. will be included in the material suitably. Immediately after the presentation of the subject for each objective, it will be suitably recapitulated. Provision is made for formative evaluation in the course of the module in the form of embedded tests. After all the learning materials are presented, a post-test is given. This post-test is also of objective type, but the items are different from the pre-test. Necessary bibliographical references, assignments and guidelines for further follow-up action should find a place in the module.

Once the learning material under the identified topic is drafted, incorporating the components of a module is the next step. After that, it requires editing, reviewing and validating. Editing has to be done with reference to accuracy and relevance of the material, style, vocabulary, density of presenting the facts and content interest. Only editing can unearth many inadequacies prior to testing. Once the editing is over, the material is ready for try-outs. Try-out helps in refining the module and makes it relevant to the target population. For a module, the try-out may be conducted in two ways.

i) Individual try-out

ii) Group try-out
**Individual Try-out**

Under the individual try-out, the module developer sits face to face with the randomly selected individuals of the target students one at a time. This gives an opportunity to the developer to study the reaction of the learner in respect to the materials presented. The number of individuals to be tried out depends upon the quality of the draft of the material and the degree of refinement required. The developer notes down the time taken for reading and understanding. Clarifications asked, remarks made and the scores obtained in the pre-test and post-test etc. should be noted down. On the basis of these ratings and analysis of the try-out, the developer makes corrections, modification, refinement etc., then and there. Then after completion of a number of individual try-outs, the material becomes better refined.

**Group Try-out**

Under group try-out, the cyclostyled copies of developed modules are administered to a group of students of the same target population. Separate answer sheets may be provided for writing the answers to the pre-test and post-test items. The creation of congenial atmosphere and establishment of proper rapport are the vital requirements for group try-out. The students must be instructed about the nature of his auto instructional material and what is expected of them along with the purpose of the try-out. The reaction of the students during the try-out should be noted down, so that they may be considered for further refinement. Evaluation of answer sheet will bring to light the percentage of incorrect responses and their level of mastery achievement. Based on the scores, norms may be evolved. The post-test score minus the pre-test score will be the gain score which can be attributed to the effectiveness of the modules.
Appraisal of the module

In general, learning modules need to be subjected to critical appraisal of structure and content. Critical appraisal need to be done in the following seven areas:

i) Objectives

ii) Subject matter

iii) Design characteristics

iv) Learning activities

v) Adaptability

vi) Validity and

vii) Evaluation

On completion of all these processes, the learning module can be presented to individual students.

1.6. Video Instruction : Concept, Meaning and Importance

Instructional media are the electromechanical devices which act as middle conditions between the student and what he is to learn. An instructional medium is simply a means of transmitting instruction. It is not the substance of that instruction. In an age enamoured of technology, it is important to keep in mind that the instructional medium serves as the channel of instruction. What passes through that channel is the substance of instruction.

There is distinction between the old or traditional, media and the more recently developed media [Erickson, 1965]. Several traditional media still make important contributions to the instructional process. First, models or mockups are simplified representations of real things. A globe, for example, is a model of the earth.
There are take-apart models of the human forms and the major human organs. Geometric models are increasingly used in the teaching of mathematics. Second, graphic materials are non pictorial in nature. Examples are maps, graphs, carbons, diagrams, and charts. Third, the motion picture combines motion, sound, and realism. Increasingly popular is the 8mm single concept film ready for insertion into its own projector. Fourth, projected still pictures, such as slides and filmstrips are useful media. Transparencies are used with the overhead projector and are usually made by the teacher. Microscope slides are particularly useful in the teaching of the life sciences. Fifth, the opaque projection materials use a special projector which reflects light from the surface of the picture or object onto a projection screen. Sixth, tape recordings have become the chief aural instructional medium.

Carlton Erickson also describes the new media. First among these is television. As a medium television has three aspects. It is a composite of auditory and visual presentation; it can reach an audience of unlimited size; and it can transmit programme content without delay from the point of origin to the point of reception. Television uses several of the older media. For example, a telecast may consists of a motion picture or video tape recording of a laboratory demonstration which uses slides, models and transparencies.

The invention of video and T.V. is a milestone in the application of technology in education. It has the advantage of transmitting both still and moving pictures and sound over a distance. Using relay transmitters the programmes can be telecast over a wide area. The placement of communication satellite in geostationary orbit has made it possible to send the television signals over a wide area. Using a chain of satellites it is now possible to telecast programmes from one part of the earth to any other part. Television was first used for
instructional purposes in the USA in 1958. In India, it was introduced in 1975. In addition to this, now there are video ready-made cassettes available for instructional purposes. They are used for individual learning, revision and practice.

Since it appeals to both the senses of sight and hearing, it can be used for teaching any subject. When the sense of sight is essentially required, where materials not easily accessible are to be shown, where events occurring/occurred in distant places are to be shown, where highly magnified or diminished pictures are to shown to note some essential feelings, where performance of some highly skilled persons or experts are to be shown, where instructions from seniors and expert teachers not available in the area is needed, television and video could be usefully employed.

Video instruction has the following advantages over the other media.

i) In instruction requiring both hearing and seeing with sight being more essential.

ii) In teaching of skills.

iii) In showing objects, experiments, etc. not easily available in schools.

iv) In showing currently occurring events in distant places.

v) For providing common instruction in all schools over a wide area simultaneously.

vi) For providing instruction through expert teachers not easily available in schools.

vii) Another main advantage of video instruction is its distributive powers. Instruction can be provided in many places at the same time. When instruction is carefully
designed and employs a wide range of human talent and instructional media, distinct advantage may result from extending the benefits of this instruction to as many students as may profit by it.

viii) Finally, distinct economic advantages can result from using video instruction rather than direct instruction.

1.7. CAI: Concept Meaning and Importance

Any discussion on instructional technology without highlighting the current use of computers will be incomplete. One means of individualised instruction that has been receiving a great deal of attention in recent years is Computer Assisted Instruction or CAI.

The computer was used in the beginning just like a teaching machine for presenting programmed instructional materials. This way of using the computer is called Computer Assisted Instruction (CAI). In the 1960's the computer was used in this way in some of the universities in USA. Once the instructional materials are computerised, the students can learn individually at the computer terminals. One computer can have several terminals and a large number of students can learn simultaneously from one computer. One project entitled PLATO (Programmed Logic for Automatic Teaching Operation) developed by Professor Donald Bitzer at the University of Illinois in collaboration with Central Data Corporation, used a very large computer controlling up to 4000 terminals (Woodhouse and McDougall, 1986).

Professor Patric Suppes of Stanford University developed a number of courses for use in CAI approach including courses in foreign languages (such as Chinese and Russian). In such an approach, the computer is not just used like a teaching machine, as it is capable of doing much more than can be done by a teaching machine. For a great variety of branching techniques can be adopted
in CAI programmes which cannot be done in a teaching machine. The course is broken up into small elements of information which the computer presents one by one followed by small questions. If the student gives correct answer, the computer gives further information. If he gives a wrong answer, depending on the answer, the computer gives alternate supplementary information. If the student can now give the right answer, the computer advances on the main programme and gives further information and puts questions. Here the computer is used as a tutor.

The decreasing cost and increasing availability of microcomputers in schools have led researchers as well as teachers to become, more interested in computer assisted instruction (Becker, 1986). The idea behind computer assisted instruction is to use the computer as a tutor to present information, give student practice, assess their level of understanding and provide additional instruction, as it can analyse student responses immediately to determine whether to spend more time on particular topic of skill. The computer can be quite effective in presenting ideas, using pictures or diagrams to reinforce concepts. Finally, for most students the computer seems to have a motivating quality of its own so that they work longer and harder when using it than they would on comparable paper and pencil tasks.

Computer assisted instruction has its roots in programmed instruction and in the behavioural theories of learning (Slavin, 1986). According to these theories, learning is accelerated by the use of controlled presentation of stimuli followed by reinforcement based upon the learners responses. Computer assisted instruction programmes stress drill practice exercises, teach students facts and concepts. Whatever their differences, computer assisted instruction programmes generally share the following characteristics.

i) Use of structured curriculum.
ii) Letting students work at their pace.

iii) Giving students controlled, frequent feedback and reinforcement and

iv) Measuring performance quickly and giving students information on their performance.

There are different modes of computer assisted instruction. The most important of them are

a) Tutorial computer assisted instruction.

b) Drill and practice computer assisted instruction.

c) Generative computer assisted instruction.

d) Dialogue/enquiry computer assisted instruction.

e) Simulation programme computer assisted instruction.

a) Tutorial Computer Assisted Instruction

In this mode, the course is broken up into small elements of information which the computer presents one by one followed by small questions. If the student gives correct answer, the computer gives further information. If he gives wrong answer, depending on the answer, the computer gives alternate supplementary information. If the student can now give the right answer, the computer advances on the main programme and gives further information and puts questions.

b) Drill and Practice Computer Assisted Instruction

In this approach, a list of simple problem is stored in the computer and the student communicates with the computer through a terminal. The computer presents a problem and if the student gives the correct answer, it gives the next problem list. If the student gives a wrong answer, the question is presented again. If the student again
gives a wrong answer, depending on the programme, he is given the right answer or some supplementary information and then presented the next problem. The computer can be used in this way for drill and practice of mathematical problems, spelling and grammar in language.

c) Generative Computer Assisted Instruction

Another way of using the computer for instruction is called generative CAI. In this form the computer is programmed to generate questions within a basic framework about a topic. Questions can be generated randomly in which case different students get different sets of questions or the questions can be generated depending on the previous answer of the student. Generative CAI approach can also be used in tutorial CAI or Drill and practice CAI.

d) Dialogue / Enquiry Computer Assisted Instruction

Dialogue / enquiry CAI programme permits the student to conduct a limited dialogue with the computer. The student can put questions within the basic framework of the topic which the computer will answer. The computer may also put questions which the student answers.

e) Simulation Programme Computer Assisted Instruction

Simulation involves creation of real life-like situations for the purpose of experimentation and observation. Science experiments can be simulated and student can obtain the results of the experiment without actually performing it. This is useful where the substances to be used in the experiment are too expensive, too dangerous to handle, or the experiment is too time-consuming. One can think of numerous instances in natural and social sciences where simulation can be usefully employed. In Chemistry, there are experiments which are too dangerous to perform, but which can be studied under simulation. In biology, experiments may take a long time
to obtain results; but the computer simulation can yield the result immediately.

In social sciences, experiments can be based on fictitious but consistent data obtained from survey and using statistical techniques, the result of any kind of intervention can be obtained. In Biology courses, the laws of genetics can be studied through computer simulation and genetic result of several generations can be obtained quickly. In medicine also, the medical student can study through simulation the patients having rare diseases and their behaviour under different medical treatment.

Although simulation is a very useful method of learning, it should not be used where the skill of performing the experiment is important. Further, the simulation should not over simplify the real life situation but closely correspond to it in important aspects.

1.8. **Relevance of the Modular, Video and Computer Assisted Instruction Modes in Learning Botany.**

Effectiveness of any mode of instruction largely depends on its relevance to the teaching of the subject to the set of students. It should be relevant from the following points of view.

- It should be conducive for better learning in the sense that it should make the instruction easier, make the learning deeper and complement the teaching learning process.

- It should be ideal for instructional presentation of subject matter, which should facilitate better learning.

- It should take into account the difficulty level of the students. Any educational technology which is not user friendly to the students can not be effective at all. The difficulty in handling the device will add to the difficulty of the subject.
- Effectiveness of a mode of instruction is marked by its distributive powers. Any mode of instruction incorporating educational technology should have this distributive power. That means, it should cater to many at a time.

- It should promote learner based teaching learning process.

- It should be cost and time effective.

The three modes of instructions selected for this study fulfil the above conditions to a considerable extent.

Video plays a prominent role in the present day teaching learning process. It not only supplements the teacher, but also enriches the content. It facilitates better understanding. It also provides unique experience to the learner in the presentation of the content. As a learning strategy video instruction is better than traditional method, since the dual effect of audio and video strengthens the understanding of the concept by the learners.

In video instruction there is much scope for making the expertise of expert teachers available to all the students even in far flung areas. It has got a unique distributive power. It can reach an audience of unlimited size. It ensures in the present era the cost and time effectiveness. A video CD can be bought or got for a meager amount of Rs.20/-

Modular instruction is the latest trend now advocated in learning. Modules are prepared on the same topic under different media software to suit the different tastes and interests of students according to the facilities available. The components of a module include modular lecture unit, group discussion unit, workshop unit, individual study unit, film unit, audio tape unit, etc. Here the same components of a module as discussed will be incorporated but the nature of the medium will be dominating in the presentation of the particular module.
When different varieties of modules are kept in the library, the interested students can use one or more variety for learning the topic. While one may like to listen to an audio lecture on the topic, another may like to see a video on it. The modules in this way suit to the interest of different individuals. Since the modules motivate the students to a very great extent, they promote their achievement ultimately. These modules can be used by the teachers of different classes also. They will remain as an asset to the institutions. The students can take them home and learn them at their own pace.

Since it is an auto instructional material, the students can take their own time to complete the module. They can learn at their own rate and pace. They can learn without inhibition at their own convenient time. The diagrams and sketches provide for better understanding, while the embedded tests in the module make for formative evaluation, the post-test makes for summative evaluation. As a learning strategy, it is very effective for all students in general and backward students in particular.

Computers have come in to wield a greater influence in the field of education. It is an era of computers. Computer and internet play a vital role in the present day learning process not only in higher education but also in school education. The computer and internet can cater to our need in any subject at any level in any place at any time. They have brought the whole world including books and persons into the drawing room or the study room which they are adoring. The educational values of computer assisted instruction can not be underestimated. The tutorial CAI, Drill and practice CAI, Dialogue CAI, and simulation CAI have been verified and found to have been effective in teaching various subjects at school level (Ramar 1996, Reddy & Ramar, 1998 and 2000).

With the provision of multi terminals they have much distributing powers and they can reach out to many learners simultaneously. It is
better than video instruction in the sense that one can interact with the computer. It is cost and time effective since the CDs are available at cheaper cost, also, from a single CD any amount of CDs can be got written at home or in the school or in the nearby computer centre. In the present era where the personal computer is adorning the study or drawing room of most of the families, its relevance to instruction and learning is unique, immense and unparalleled.

These are time as well as cost effective since teaching without incorporating any of the above modes of instruction cannot ensure optimum achievement on the part of student. They exercise greater influence on the achievement of the students in science at all levels of education.

1.9. Need for the Above Three Instructional Strategies in Learning Botany at Higher Secondary Level

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 +2 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.

Biology is a life science, for which ready made video cassettes and computer assisted instruction software are commercially available. But they are seldom used in the schools. The students can use them when they have readiness to learn, even at home and learn the concepts at their own rate. They can also learn without any inhibition and without the feeling of being preyed upon by the teacher.

The above three modes of instruction provide for considerable visualisation of objects. It is very essential for formulation of accurate concept. The diagrams and sketches in the modules serve this purpose. Diagrams, pictures, and sketches can be incorporated in computer assisted instruction also by scanning method.

There is tremendous knowledge explosion taking place in the present world. Under these circumstances, it is unreasonable to expect that the written or the spoken words alone can convey the voluminous information that a teacher has to present daily. This is where the above said three modes of instruction come in handy for furthering the teaching learning process.

It is natural that students get confused often. But they don't have the courage to ask the teacher to explain again. So they are unable to get their doubts cleared. In the case of these three modes of instruction specified in the study, the students can overcome this problem very easily. If they do not understand the concept at the first instance, they can make use of playback provision and understand the concept. They can view the video programme as many times as they need till the concepts are thoroughly understood by them. It applies to computer assisted instruction software also. In the case of modules there is ample opportunity for revision and review.
Video instruction provides unique experience to the students with regard to instructional presentation of the content. It ensures effective transmission of instruction from the point of origin to the point of reception with an immediate excitement and forceful effect. Also the dual effect of audio and video signals strengthens and enriches and expedites the mastery of the concept.

The specified three modes or instructions have the following advantages, from the learners point of view.

1) They supplement the instruction of the teacher.

2) The services of subject resource persons are made available to a wide range of student population in the form of video cassettes, modules and computer assisted instruction software.

3) They can be used for auto learning at home. Thus it can cater to individual differences.

4) Backward students need more revision, repetition and practice, which are not possible with a living teacher. But this can be easily provided in these modes of instruction.

5) These modes of instructions are not only content effective but also cost effective.

The salient feature of inclusive education is devising instruction so as to reach out to all learners. Ainscow (1998) states that the devised instruction should cater to pupil diversities. The existing mode of imparting education by traditional lecture does not serve the purpose of catering to pupil diversities in an effective manner. So innovative modes of instruction which can cater to pupil diversities should be employed in the classroom in inclusive setting.
The effectiveness of modular instruction with reference to low achievers, under achievers, slow learners have been established by some researchers (Ramar, 1994, 1996; Ponnambalam, 2004; Arunachalam, 2004). Similarly the efficacy of video mode has been verified with reference to problem students, low achievers, under achievers (Reddy and Ramar, 1996, 1997; Ponnambalam, 1999). Likewise some research evidences highlight the effect of CAI on achievement with reference to under achievers, slow learners, low achievers etc., (Ramar 1994, 1996; Reddy and Ramar, 1995; Stella, 1993).

All these factors emphasise that there is a growing need for the above modes of instruction for mastery level learning. The need is still greater in an inclusive setting at plus one level where the foundation is laid for higher education. Also, this is the stage where the subject of science is very much emphasised. It leads to specialised papers i.e. Physics, Chemistry, Botany and Zoology as separate subjects at higher secondary level. Unless the foundation is strong in the plus one science subjects, the students cannot understand the various science subjects at higher secondary level properly. The foundation of science subjects cannot be laid strong by a single strategy alone. A variety of instructions can lay stronger foundation. Realising the implications, the investigator has earnestly attempted to devise video instruction, modular instruction and computer assisted instruction so as to cater to pupil diversities for some selected units in plus one Botany syllabus. Further, he has endeavoured to measure the effectiveness of such developed modes of instructions on the achievements of students in Botany at plus one level and also to assess their advantage over the traditional lecture method.

The review of related researches is presented in the forthcoming chapter.