INTRODUCTION
CHAPTER – I

1.1 INTRODUCTION

Scientific and technological developments started a new period called “Information Age”. In this period information production has gained importance compared to goods and service by using information technologies profoundly. With changing conditions, present target of societies which are in competition and search in order to keep pace with new conditions is to be information society. In contemporary societies called as “Information Societies” the way of individuals to reach information, their styles of learning and styles of applying information have rather changed compared to traditional societies.

In the last quarter of the 20th century, important developments seen in data processing, rapid changes that can be called as computer revolution have caused education systems to undergo a complete transformation taking but traditional forms. Education has the leading role among social institutions which will be most affected by increasingly changing process of information society.

Computers which are an important part of our daily life and which are very essential for many people, institutions and establishments and also which are made use of in education considerably, are important tools for schools. In addition, computers are professions which people try to obtain for the future and their importance has increased more and more.

Computers have become the basis of data processing technologies used in realizing information production, manipulating, storing, sharing and distributing processes. Since they address to more senses compared to other technological tools and make abstract and complicated concepts concrete digitally because of their
extensive multimedia properties, they are one of the most important technological tools which are made use of in educational and instructional process. At the same time they play an influential part in accomplishing many pedagogical functions such as measuring and evaluating knowledge and giving feedback, observing activities and performances of students, being independent from time and environment, providing students with motivation and participation to the lesson, considering individual differences, regulating education level according to existing knowledge and progress of the students, and supporting instruction with such materials as graphics, pictures, animation and sound. In traditional teaching perspectives, they are tools which enable us to control many variables that are uncontrollable and effective in human learning. All these features of computers result from the fact that they are not only multifunctional display accessories which support the lesson such as overhead projectors, videos or lights, but also they can be used as the basis of a method which focuses on students.

With contemporary teaching perspectives, some differences have occurred in teachers’ roles. Teaching principles in which learning is emphasized as a basis considering individuals learning and teaching is emphasized as a basis considering the person teaching have also changed. In traditional teaching, computers are tools which transfer information to students as teachers. In contemporary teaching, on the other hand, it is adopted that all of the students strive to learn, have efficient roles in education, and reach predetermined level of behavioral objectives regarding teaching products. In accordance with changes in educational perspectives and new arrangements it has become compulsory for teachers to change themselves, gain new information and skills and apply these in the classrooms.
1.2. CONCEPT, MEANING AND DEFINITION OF EDUCATION

Education is defined as bringing upon, leading out or 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.

Therefore, the Indian Education Commission (1964-66) says that education ought to be related to life, needs, and aspirations of the people and thereby made powerful instrument of social economic and cultural transformations.

Mahatma Gandhi, the champion of basic education, considers education as a means to develop man. He says, “By education I mean an all-round drawing out of the best in child and man-body, mind and spirit”.

Tagore viewed education as the process of evolving unique creative patterns of self expression towards the realization of Universal Man”. He aimed at an education that sought to do justice to the economic, aesthetic, intellectual, social and spiritual aspects of man’s existence.

According to Aristotle (1976) “Education is the creation of a sound mind in a sound body. It develops man’s faculty, especially his mind”.

According to John Dewey (1976) “Education is the development of all those capacities in the individual, which will enable him to control his environment and fulfils his responsibilities.

According to Rousseau, “True education is simply the development of the original nature of the child”.
Comenius (1976) avers that “all who are born as human beings need education because they are destined to be real men, not wild beasts, dull animals and clumps of wood”.

Redden (1973) propounds that “Education is the deliberate and systematic influence exerted by the matured person upon the immature, through instruction, discipline, and harmonious development of physical, intellectual, aesthetic, social and spiritual powers of the human beings, according to individual and social needs and directed towards the union of the educaand with his creator as the final end”.

From the above, it is clear that education is the most powerful instrument which can bring about desirable changes in the socio economic, cultural and political spheres of life of the people. Indian education commission (1964 – 65) has very aptly pointed out that the destiny of the nation is being shaped in her classrooms. Education is the spark that ignites reformation. It serves as nucleus to social changes and progress. It is the foundation block to the development of the nation. Education is a Man-Making process. It is a pre-requisite for human resource development. It is the very salt of our life. It is more true so in case of mathematics education.

1.3. MATHEMATICS EDUCATION: CONCEPT AND SIGNIFICANCE

Mathematics has its roots deep in the soil of everyday life and is basic in our highest technological achievements. We use mathematics when we count the lumps of sugar for our breakfast cup of coffee, build our houses, erect lofty skyscrapers, construct imposing bridges, assemble radios or put together supersonic airplanes. Even though almost everything of a concrete character is mathematics, it is reputed to be and actually, is the most abstract and the most hypothetical of the sciences. Hence, it is but natural that students encounter varied problems in learning mathematics. The worst
sufferers in this respect are the slow learners who lack the capability and the skills for abstract thinking and problem solving skill required for learning mathematics. Moreover, the very fact that mathematics is the mother of all sciences emphasizes the need to probe into the causes of learning difficulties in mathematics and to evolve a special instructional strategy for all the learners so that the slow learners also can circumvent their weak or deficient areas and make an adequate learning of mathematics.

From the Egyptian papyrus scrolls, the oldest forms of recorded history we learn that as far as back as 4000 B.C. numbers and Mathematics were important. The first calendar required a system of numbering, as did recording the movements of celestial bodies. These early people laboriously counted with their fingers. Elementary – school children today quickly solve problems with inexpensive hand-held calculators. Are all the mathematics secrets known? No Mathematics is a living, growing science. The more we learn, the better the tools produced, and, with better tools, more questions arise. The science of math is a never ending quest with a constant reward of new math skills.

A little reflection will show what predominant role mathematics plays in our everyday life and how it has become an indispensable factor for the progress of our present day world. It is the pivot of all civilization. Everybody has to calculate his income and balance his family budget, although only a few of them undergo any course of the university. This is the subject which indisputably forms the very basis of entire world’s commercial system.

The gigantic works of construction of dams, bridges, other works of architect, building of ships, aero planes, bomb, etc, are possible only because of the quantitative
science. Even medical men have to measure the doses, the blood pressure, the beat of
the pulse, the bodily temperature, etc.

Even nature also embraces mathematics completely. The sun rises and sets at
the specified moment. The stars appear at fixed time. Mathematics runs in the veins of
natural sciences like physics and astronomy.

Arithmetic, the language of commercial activity, algebra which gives the idea
of functional dependence and generalization; geometry which teaches logical thinking
and natural design, all these combine to produce a very valuable literature of
interpretation, control and progress. We understand the world better. Mathematical
knowledge is thus indispensable and no one can hope to advance far as an investigator
in most of the exact sciences, if he has no mathematical knowledge.

To conclude, mathematics is the science of all sciences and art of all arts. So
mathematics education is of vital importance at school level. This will provide the
foundation block for future construction. Hence it becomes the primary duty of the
teacher to make his mathematics instruction as lovely as possible and also as effective
as possible. The fact that the students experience varied difficulties in learning
mathematics makes the teacher more responsible for teaching learning process to be
fruitful.

1.4. PROBLEM IN LEARNING MATHEMATICS

Mathematics is such an abstract subject that most students experience
difficulties in learning mathematics and the teachers who lack resource are also not up
to the mark in teaching mathematics. It is also possible that the students are unable to
understand the mathematical concepts thoroughly because they are taught in such a
way that it doesn’t facilitate proper learning. Sometimes the students may not have the
required entry behaviour to learn the prescribed mathematical concept. They may not have the readiness and maturation to learn the concept. Moreover, mathematics is a subject which needs problem solving skills on the part of the students.

The folly of requiring the student to perform in ways for which he is inadequately prepared is so often repeated. We forget that it is entirely avoidable. No matter what feats of will, self-denial, and enthusiasm the student may perform and no matter how much dedication, love and imagination the teacher may supply, the student cannot acquire new performances based on other performances which he has not acquired. Learning builds on learning in the way success builds on success. When the foundation blocks are missing, future construction, if possible at all, is a very precarious affair.

This is the problem that plagues Indian classrooms where the students do not have adequate foundation, in mathematics education. There are some contributory factors for this. Some of them are the students’ inability in abstract as well as analytical thinking and lack of problem solving skill. They are also poor in making transfer of learning and applications of knowledge and skills. Lack of learning readiness adds to this problem. It is therefore very important for the teacher to apply such appropriate methods that will enable the students to circumvent the weak areas of deficiency.

1.5. METHODS OF TEACHING MATHEMATICS

In the pedagogical study of Mathematics, the main concern is with two things; the manner in which the subject – matter is arranged and the way in which it is presented to the pupils. The former is called ‘Method’ and the later ‘Modes’. There are various methods and modes of teaching mathematics.
1.5.1. INDUCTIVE AND DEDUCTIVE METHODS OF TEACHING

Inductive method is based on induction. Induction is proving a universal truth of theorem by showing that if it true of any particular case, it is true of the next case in the same serial order. In this method we proceed from particular to general, from concrete cases to abstract rules, and from the special example to the general formula. The results can be generalized from facts.

Deductive method, the opposite of inductive method, proceeds from general to particular, abstract to concrete and formula to problems.

1.5.2. ANALYTIC AND SYNTHETIC METHODS

Analytic proceeds from unknown to known - Analysis means breaking up of the problem in hand so that it ultimately gets connected with something already known. It is the process of opening up or unfolding of the problem to know its hidden interior.

Synthetic method is the opposite of analytic method. Here we proceed from known to unknown. To synthesize means to place together things that is apart. In practice it is the complement of analysis.

1.5.3. PROJECT METHOD

Project method is considered to be the product of John Dewey’s philosophy of pragmatism. The main feature of this method is that some activity is taken as the core of centre and all the school subjects, as they arise, are studied in connection with it.

1.5.4. PROBLEM SOLVING METHOD

Mathematics is a subject of problems. Problem solving is the main activity in the learning of this subject. It can also be called Problem method.
1.5.5. HEURISTIC METHOD

Heuristic method involves finding out by the student instead of merely telling of everything by the teacher. It aims at removing the short – comings of lecture method. It demands complete self – activity, self education or active participation of the part of the learner. When this method is applied in its extreme from, the teacher stands aside as onlooker and the child selects his own path. The teacher’s job is not to solve problems for the pupil, but to enable the pupil to solve problems for himself.

1.5.6. LABORATORY METHOD

Mathematics is a subject which has to be learnt by doing rather than by reading. This method is based on the principle of learning by doing, learning by observation and proceeding from concrete to abstract. It is an extension of inductive method. Pupils do not only listen for information but do something practical also.

These are the only a few methods widely used by the teachers. But these are not the only methods to teach mathematics. With advent of the educational technology as a separate discipline, many instructional strategies have been introduced and their effectiveness has been established.

1.6. NEED FOR INNOVATIVE METHODS IN TEACHING MATHEMATICS

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

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-day a teacher cannot 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 slow learners are able to understand the concept, principles and content in an effective manner.

The immense knowledge explosion taking in the world warrants newer method of teaching. Students need unique experience in the presentation of the content. Moreover, the educational technology evolved the educational practice. It has led to emergence of new innovative methods like video instruction, computerized instruction, programmed instruction, modular instruction etc. These methods make use of instructional technology profusely in their approach and applications. Now a successful teacher has to employee appropriate instructional technology in teaching learning process to achieve best the pre-determined behavioural objectives.

1.7. CONCEPT, MEANING AND DEFINITION OF INSTRUCTIONAL TECHNOLOGY

The development of the modern educational technology has been either heralded as the necessary ingredient of an educational revolution which will lift the schools out of the Dark Ages and into twentieth Century enlightenment or castigated as a movement which can only reduce teachers and students robots in the manner described by our more pessimistic science fiction. The dispute often fails to distinguish
between two meanings of instructional technology (Lumsdaine 1966). One meaning refers to the detailed application of the psychology of learning to practical teaching problems. Francis Mechner (1965) uses this analogy. In the same way that an aeronautical engineer believes that he can design an airplane by applying a few basic physical principles and a little art and intuition, the educational technologist believes that he can build in the student a complex repertory of knowledge or behaviour by applying a few basic principles of learning psychology in addition to a little art and intuition. Arthur Melton (1959) observed that educational technology is based on the assumption that the psychology of learning encompasses all forms of relatively permanent behavioural changes which result from experience, including, of course, the experiences of child in school. In the first part of this chapter, in which we describe how to programme materials we are applying the psychology of learning to practical teaching problems. In other words, we are describing educational technology in this scientific sense. The programmes which such a technology produces are often called the software to distinguish them from the machines, or hardware, into which the programmes are fed. The second meaning of educational technology refers to the application of engineering principles in the development of electromechanical equipment used for instructional purpose. Examples of these devices are motion pictures, tape recorders, teaching machines and computers – the educational hardware.

The two meanings of instructional technology interact in the design and use of equipment to provide control over the learning situation, a rich array of stimulus material and interaction between the responses of the learner and the presentation of instructional material. When we organize instruction as in the case of team teaching, modular scheduling, and instructional systems, we must combine our application of the psychology of learning with electromechanical engineering to produce the desired
results. In fact Bern (1967) suggests that the educational psychologist of the future may be a psychologist engineer.

The current trend is emphasizing research on print media since this is the only affordable technology all over the world. Ultimate aim of any instructional technology is to ensure mastery learning of the subject. This is what is precisely achieved in computer assisted instruction.

1.8 COMPUTER ASSISTED INSTRUCTION: CONCEPT, MEANING AND DEFINITION

Any discussion on instructional technology without highlighting the current use of computers will be incomplete. One means of individualized instruction that has been receiving a great deal of attention in recent years in 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 computerized, 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).

The decreasing cost and increasing availability of micro computers 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 analyze student responses immediately to determine whether to spend more time on particular topic or 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.

1.8.1. 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.

1.8.2. 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.

1.8.3. 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 the 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.

1.8.4. DIALOGUE /ENQUIRY COMPUTER ASSISTED INSTRUCTION

Dialogue / enquiry CAI programme permits the students 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.

1.8.5. 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 substrates 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.

There are many advantages in using computers in educational instruction. They provide one-to-one interaction with a student, as well as an instantaneous response to the answers elicited, and allow students to proceed at their own pace. Computers are particularly useful in subjects that require drill, freeing teacher time from some classroom tasks so that a teacher can devote more time to individual students. A computer program can be used diagnostically, and, once a student’s problem has been identified, it can then focus on the problem area. Finally, because of the privacy and individual attention afforded by a computer, some students are relieved of the embarrassment of giving an incorrect answer publicly or of going more slowly through lessons than other classmates.

In order to transfer new technological developments to classroom environment, varied teaching methods are needed. There are two main teaching methods which are carried out by computers today: Computer-Assisted Teaching Method and Computer-Based Teaching Method.

1.9 COMPUTER ASSISTED TEACHING

It is transferring instructional content and activities to students via computers. Here, computers are tools which complete and strengthen the system; they are not alternatives which replace teachers in teaching process. In computer assisted teaching, computers are used to support education and instruction. Classroom teacher is the main teacher that teaches the subject, and determined objectives and attitudes. All of
educational and instructional activities are performed by the teacher. In this method, computers are used by teachers in educational and instructional environment as only supplementary tools. In computer assisted teaching method, a teacher can use computers in different periods, places and ways while teaching according to hardware and software facilities she/he owns, characteristics of the students and the subjects she/he will teach and teaching objectives determined. According to Aşkar and Erden (1996), Keser (1998), the ways of using computers can be given as follows:

1. The teacher teaches the subject with traditional method in classroom. Students who miss the lesson by any reason or who are unsuccessful or in need for learning can have an opportunity to learn the subject via computers. Here the computer is private teacher.

2. After the teacher teaches the subject with traditional method, evaluation studies are made in the classroom by means of computers.

3. After the teacher teaches the subject in the classroom, exercises, applications, and evaluations are carried out by means of computers.

4. The subject is taught by computers. The teacher can compensate for learning deficiencies by means of discussion method; and correct the student’s mistakes by examining them.

The role of computer assisted teaching in learning and teaching is beyond dispute that its contributions in educational and instructional process are so significant. According to Doğanay (2002), the advantages supplied by this method are as follows.

It increases efficiency in education and instruction; it makes effectiveness easier in classroom.
1. It makes education and instruction enjoyable and attractive.
2. It motivates the students to the lesson by the help of sound- pictures and music.
3. It makes it easier to repeat complicated problems, concepts and processes many times.
4. It contributes to the student’s intelligence to develop.
5. It gives the students concrete experiences similar to real life.
6. It causes the students and researchers to reach rich information sources.
7. Mistakes in texts written can be corrected easily, and some additions and omissions can be made easily, too.
8. It gives the students courage, ambition and excitement and in this way it make development and success of students easier.
9. It develops the students’ self-confidence.

Using computers is one of the most efficient ways to make the lessons audio-visual, to supply a fluent and effective education, to keep the students from memorization, to obtain speed and permanence in perception. Because computers address to more senses compared to other technological tools and make abstract and complicated concepts concrete digitally because of their extensive multimedia properties. According to Bagui (1998) if information is presented to the students in multi environment, it will be easier to transfer it to the brain.

1.10 COMPUTER BASED TEACHING

It means using computers to control some activities of computer systems such as planning teaching, measuring learning, recording data related to the students,
making statistical analysis on learning data. In computer based teaching, computers execute all of educational and instructional activities. In this way of teaching, computers are the main teacher that teaches the subject and determined objectives and attitudes. All of the educational and instructional activities are performed by computer programmes. The teacher manages organizational activities by being of secondary importance. The students can learn all information by applying different activities in computers. The teacher can be a helper or guide in these activities. Computer based teaching is a system which is personally focused, follows an order, adjusts its own speed, supports repetition and uses animation effects extensively. There is an interaction between the students and teaching materials inserted in CDs, and the students learn the materials following the subjects in a supplied guided order. These subjects are usually presented with sounds and animations. Simulations and exercises are completed with repetition. Individual tests provide the students with feedback about their performances and this is followed by a compensation stage to decrease learning deficiencies. The structure of computer based teaching which supports animation, includes repetition and adjusts its speed is seen as teaching which enables the students to comment on their own learning processes, directs them to repetition, and increases the transfer to cognitive awareness.

While performing computer based teaching, private exercises and repetition, association and some programmes for problem solving are made used of. The benefits of computer based teaching which is performed by using these programmes in the following titles: Flexibility, adjusting personal speed, easy recording, decreasing the need for human teachers, the same information for everybody, information which is consistent and of good quality, unlimited repetition, confidentiality and motivation.
Today, both methods are used for different subjects and programmes in pre-
schools, elementary and secondary schools, high schools and universities. However,
some questions such as whether these methods can be used for every lesson, in which
conditions these methods will be more effective are under debate. If these methods can
be used for right place, age group, topic and subject effectively, it may be possible that
more output can be obtained from the students, information can be permanent and
practical, and the attitudes of the students towards the lesson can be improved.

1.11 COMPUTER-BASED TEACHING MULTIMEDIA PACKAGES

Computers have brought a revolution to our lives is not a fact in contention.
Computers and the software packages included on them have brought about the rise of
an era wherein some of the most basic tasks have become mechanized. One type of
Computers package, application software, performs a task for the end user-word
processors, Web browsers and spreadsheets, for example. Systems software, the other
type of package, manages and supports the operation of Computer systems and
networks-operation systems and language translators, for example.

Packages provide an avenue to perform duties electronically that would take
much longer to complete manually. Computer users take advantage of packages for
accurate calculation, drawing, grammar and spell checking, emailing, storing data and
correcting mistakes easily. Computer packages can buy in retail stores or download
them from the Internet. Downloadable software is cheaper and benefits the
environment by means of eliminating packaging; moreover, can perform upgrades
online. Packages help to save money. Emailing is cheaper than using the post. Word
processors can help correct mistakes electronically, while typing mistakes can render a
whole page useless, thus wasting paper.
The role that computers play in the teaching of higher education has increased dramatically in recent years. The introduction of networked computers into the academic environment has meant that communication and searching for information through the internet have become important skills for both students and teachers to learn. The students of the 21st century are very comfortable with the use of computers since they will have been using them in an educational, as well as social context, since primary school. Teachers need to rise to the expectations of such students and make use of the opportunities that computer technology affords.

It is important for academic staff to be aware of the possible uses of computer technology and to be confident in introducing it to their teaching. The technology is now widely accessible to lecturers without the need for advanced computer skills. Such technology allows them, for example, to put notes on the networked system, introduce self-assessment exercises or observe external specialist web-sites (in order to recommend them to their students). Computer facilities are usually available to students within the university or college site outside of the normal working day and it is generally possible to access the networked site for most academic institutions externally, which allows students to ‘log-on’ via the internet, for example, from home or in an internet café. In addition, a Virtual Learning Environment (VLE), such as Blackboard (www.blackboard.com) or Web CT (www.webct.com) can be used to provide administrative as well as academic support for students.

There are a variety of ways that Computer Assisted Learning (CAL) has been used as support for students. The simplest package involves a lecturer providing their notes electronically, either at the beginning of a lecture series or after each timetabled session, in place of ‘handouts’. In electronic form, the notes can be complemented by illustrations and links to relevant web sites. Students apparently value this type of
resource, since it allows them to be confident that they have understood the salient points of a lecture series, helps them to become familiar with technical terms (e.g. species’ names) and assists them in navigation through the plethora of information available on the internet.

Multimedia CAL packages designed to replace lectures are also being introduced into science teaching. They can be attractive to teachers for both logistical and educational reasons. A Multimedia CAL package in place of a series of lectures to a large class solves the problem of finding a suitable lecture room in a congested university timetable. In one study, in which a package was evaluated by several cohorts of students, time was allocated for them to use the computer rooms in the first year but subsequently, students were expected to organize suitable times to use the computer package themselves. By appealing to a range of learning styles, a well-designed package should also empower students to become independent, ‘active’ learners, rather than passive recipients of information. However, there is no strong evidence that students, who are taught through Multimedia CAL, rather than conventional lectures, perform better in assessment and when asked, students are not enthusiastic about replacing their lecturers with computers.

Another area of biological science teaching that can be supported by computers is laboratory practical. Computer simulated practical can overcome the problems of the use of live animals or the scarcity of clinical specimens. Computer packages can also be valuable in teaching diagnostic and treatment skills to medical and veterinary students, since the ‘virtual’ patient cannot be harmed.

It is now feasible to devise electronic multiple choice tests, with the aid of programmes such as Question Mark. These can be used for summative assessment but the practical problems of identifying the candidate through their ‘log in’ details and
ensuring that there are sufficient terminals in an examination room often make this harder than setting and marking a paper examination. However, the use of computer-based multiple choice tests as formative or self-assessment has been widely reported in the teaching of sciences. These would be expected to help students test their factual knowledge and familiarize themselves with technical terms and key scientific theories. It is much easier to include clear illustrations in a computer-based rather than a paper-based test. It is possible to design a programme that selects a random set of questions each time the test is accessed so that, by repeated use of the test, the student can assess their learning thoroughly (instead of their ability to recall answers in the correct order!). Students are reported to find computer-based self-assessment tests useful, particularly for revision.

There are logistical advantages to using computer packages in some situations and theoretically they should enhance student learning by encouraging each individual to work in a way and at a pace that suits them. This ought to promote deep, reflective learning, allowing students to understand the material and apply it subsequently - not only to pass assessments but in their professional life.

Despite the wide availability of Multimedia CAL packages and high expectations from some students and teachers, there appears to be a lack of studies clearly evaluating their effect on student learning.

In this study, Multimedia CAL package “Technology for Education” was gradually introduced, over three weeks, into a module and the value of this package was assessed in three ways:

1. By assessing the students’ knowledge of package as a learning experience.
2. By monitoring students’ use of the learning materials.

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3. By measuring the effect of the package within the module on student performance.

1.12. SIGNIFICANCE OF MULTIMEDIA CAL PACKAGE AS AN INSTRUCTIONAL STRATEGY

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 the need of the students 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 adorning. The educational values of computer assisted instruction cannot be underestimated.

The latest trend now gaining momentum is the application of Multimedia instructional presentation. For a specified topic different media gadgets’ software’s can be prepared to cater to the different taste and interest of the students. The components of a multimedia instructional system are audio unit, group discussion unit, role play unit, film unit, VCD/DVD/CD unit. The same components of Multimedia strategy will be incorporated for each lesson. Different varieties of Multimedia packages may be kept in the library and the students can use one or more variety for learning the topic according to their interest. Some students may like to listen to an audio lecture on the topic while some others may like to see a video programme on the topic. In this way multimedia packages very much cater to the interest of different individuals. These multimedia instructional packages can be used by the teachers of different classes also. They will prove to be an asset for the institution. These students can take them home if they have required facilities at home and learn the lessons at their own speed.
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.

1.13 NEED FOR MULTIMEDIA CAI PACKAGE IN TEACHING

MATHEMATICS AT THE MIDDLE SCHOOL LEVEL

Middle school level is a critical point for every student. It also serves as a turning point in a student’s life. It is challengeable for all students to maximize their academic potential and prepare for a successful transition to high school by providing a rigorous, differentiated instructional program in a safe environment and promoting responsible citizenship in partnership with students, parents, community and staff. But, what the students actually get in the class room is a mere chalk and talk treatment. This amounts to doing deliberate injustice to the students.

In this technological era, if a teacher fails to incorporate different media sources, he cannot ensure mastery learning as well as high achievement among students. Moreover, a middle school teacher especially a mathematics master has to develop auto learning by students to a great extent so that a sense of creative thinking and critical analyzing can be developed in students. This warrants a special
instructional strategy for the students at the middle school level, to learn mathematics subject for that matter. Multimedia instructional packages strategy in such a strategy. Almost all the units prescribed mathematics syllabus easily lend themselves for development of Multimedia instructional packages. These packages provide for better comprehension and longer retention. These enable the students to make marked progress and enhance their level of competence. The practicum demonstrated in the visual displays and presentation promotes the learning of the students. A material learnt this way will linger long in the memory. It provide for concrete presentation. So the students are able to understand the relationship and associates in a better way.

Multimedia instructional packages ensure concrete presentation of instructional materials. So the student can overcome the problem of abstract thinking. Also, this approach ignites the spark of rational thinking in the minds of the student. Moreover, these Multimedia instructional packages carry the concepts from short term memory to long-term memory to a great extent. When the concepts find a place in long term memory they will lend themselves smoother for transfer, application and recall which the ultimate aims of our instructional process are.

Further, the Multimedia instructional packages take care of the following vital remedial programmes.

1. Grading of the teaching materials taking into consideration the capacity and requirement of the children.
2. Short frequent lessons instead of long lessons.
3. Giving importance to practice, drill, review, repetition and direction.

Finally, Multimedia instructional packages facilitate concrete presentation, clear demonstration and better perceptual grasp. From a critical scrutiny of
mathematics middle school syllabus, it can be understood that for most of the units, a resourceful teacher can develop Multimedia instructional packages, making use of the resources locally available. If the teacher takes a little pain, it will culminate in optimal gain for the students. Multimedia instructional packages in mathematics have the following advantages from the learners’ point of view.

i) The learners are involved in the learning process and their commitment to the task is increased.

ii) A large part of the Multimedia instructional packages will create interest among the students as it is a novel experiment.

iii) The students have the full control over the rate of study. So they can progress at their own pace.

iv) The consequences of failures are reduced. Each student can master each unit completely before proceeding to the next.

v) Each student can participate in the decision whether he has learned the subject matter adequately.

vi) It is possible that Multimedia instructional packages can be used for home resulting in saving of time.

vii) Each student can develop a sense of responsibility for his own learning.

1.14 CONCEPT OF SLOW LEARNERS

The experience of educators confirms that there are many children who are so backward in basic subjects that they need special help. These pupils have limited scope for achievement. They have intelligence quotients between 76 and 89 and they constitute about 8 percent of the total school population. These students do not stand out as very different from their classmates expect that they are always slow on the uptake and are
often teased by the other students because of their slowness. They are quite well built physically but rather clumsy and uncoordinated in movement. They are no trouble in school. Although much of the work is too difficult for them, they are patience and cooperative. Some of them are much more limited in their environmental, emotional interactions which impede their school progress and personal development. They need special help in the form of special class in ordinary school. Most of the slow learners struggle along in ordinary classes failing to have the special attention which they need.

Their ability to deal with abstract and symbolic materials, (i.e. language, number and concepts) is very limited and their reasoning in practical situation is inferior to that of average students. These pupils differ slightly from normal students in learning ability. They are also unable to deal with relatively complex games and school assignments. They need much external stimulation and encouragement to do simple type of work. These students who are known to be slow to „catch on“ are called slow learners. Burt (1937) has rightly pointed out that the term „backward“ or „slow learners“ is reserved for those children who are unable to cope with the work normally expected of their age group. In teaching backward children, the mental age is often taken as a guide to the levels of attainment to be expected of pupils. Thus, if a child’s mental age is 10 years, we assume that his attainment age should also be at the 10 year level. On the contrary, if his attainment age falls below his mental age he is considered a slow learner.

Jenson (1980) states that students with IQ 80 to 90 who are traditionally labeled “dull normal” are generally slower to “catch on” to whatever is being taught if it involves symbolic, abstract or conceptual subject matter. In the early grades in school, they most often have problems in reading and arithmetic and are labeled as slow learners. Nowadays they are labeled as “Late Bloomers”. But it is really not that they learn so slowly as that they lag behind in developmental readiness to grasp the concepts that are
within easy reach of the majority of their age mates. So they may be called rather “slow developers” than slow learners.

The handicaps of those children who are blind, deaf, or physically handicapped are readily apparent to the observer but the handicaps of the slow learners are not always so obvious. Their handicap is related to their power of thinking and ability to learn. They are therefore not so able as most children to meet the normal demands of education and life in modern society. Many of them will be absorbed into the life of the community as adults and will contribute usefully without drawing undue attention to them. The period at which their limitations are so obvious is that of the school years. In the school certain skills such as verbal intelligence, the capacity for abstract and conceptual thinking are valued. Education reflects the requirements of a calculation in its members and comparisons of attainments in these are most obvious at school. Slow learners lag behind in developing these skills at early grade itself and they find it very difficult to cope with their class mates. These students have learning difficulties which tend to increase if the teaching is not suitably graded to their slower rate of progress, and modified to achieve the most effective ways of learning.

Hence there is a greater need for special educational measures for the slow learners to ensure maximum progress they are capable of in the traditional three R’s and no less important, in other developments such as practical, personal and social which are very valuable in adult life. We have to give them special attention on humanitarian grounds so that they can overcome the unhappiness and personal inadequacy that are the concomitants of severe educational and social failures. Other utilitarian reasons also justify the need for special attention to slow learners in the school. First, the country needs the fullest development of its human resources, not only in those capable of development of higher skills but also in those capable of routine tasks which are equally
essential for the maintenance of the social organisation. Secondary, the cost of metal ill
health and delinquency which can result from educational failure may well be greater in
the long run than the cost of developing adequate means of special educational treatment
in childhood.

The experience of schools confirms that there are many children who are so
backward in basic subjects that they need special help. The backward children can be
classified into three broad categories. The first category consists of those students who are
very backward because of retarded mental developments which are often accompanied by
additional handicaps, such as physical deficiencies, ill-health, and limited verbal
experiences at home and emotional disturbances. Their educational problems are so acute
that they need special educational treatment outside the ordinary school. The second
category consists of under achievers whose ability is not quite so limited but who
nevertheless have more difficulty in learning than average children. Absence from school,
unfortunate personal circumstances, or inadequate environmental conditions further
limitations their progress. Failure to recognize and provide for their problem is one of the
main contributory causes of their backwardness. The third category consists of the slow
learners who have very limited cognitive ability. The causes of their failure range from
specific perceptual difficulties to emotional maladjustments. These students needs some
form of special or remedial teaching to make a marked progress.

According to Kirk (1962) the slow learners, average and gifted students can be
classified according to their rate of learning. He also strictly refused to equate slow
learners with mentally retarded because the former is capable of achieving a reasonable
degree of academic success even though at a slower rate than average student. A an adult,
a slow learner usually becomes self supporting, independent and socially adjusted, but in
the early stage, he adapts himself to regular classroom programmes which fit in with his
slower learning ability. These slow learners are markedly different from under achievers and learning disabled.

1.15 CHARACTERISTICS OF SLOW LEARNERS

Taking the aforesaid factors into consideration, characteristics of slow learners can be systematically listed out. They are as follows:

A) LIMITED COGNITIVE CAPACITY

Schonell (1942) defines general intelligence as an inborn, all-round mental power which is but slightly altered in degree by environmental influence although its realization and direction are determined by experience. Intelligence is viewed not merely as an unfolding or maturing of this innate potentiality but also as something that grows and develops in the course of the child’s active experience of his environment. This is what the slow learner’s lack. Due to limited cognitive capacity, slow learners fail to cope with learning situations and to reason abstractly. Rational thinking becomes practically impossible for them.

B) POOR MEMORY

Memory is a complex process and is not fully understood, although some researchers have established theories that seem to explain the various observable facets of memory. Flavell (1977) and Flavell and Wellmen (1977) define memory as a serious of cognitive processes, including recognition and recall, knowledge, cognitive strategies and met memory. Each of these processes has an influence on learning. Atkinson and Shiffrin (1968) consider memory from the view point of a flow through model. In the flow-through model, information is stored in sensory register for a brief time before it is
transferred to short-term memory and long-term memory. But the slow learners have a poor memory power.

C) DISTRACTION AND LACK OF CONCENTRATION

Research works of Curtis, K. and Shaver, J.P. (1980) reveal that the attention span of the slow learners is relatively short. Also, they lack concentration. They can not concentrate on the instruction of the teacher which is mostly verbal exposition for more than thirty minutes at a stretch. They need short and frequent lessons for better perceptions. Modular approach or personalised system of instruction can cater to the needs of slow learners. Media application in the instructional process can draw and sustain their attention for a little longer time and promote concentration also. To overcome distractibility and to promote concentration, multimedia instructional strategy will be very suitable for slow learners. Research studies (Soundraraja Rao and Rajaguru, 1995) reveal that when the learning materials are presented through concrete situations, the slow learner’s attention and concentration do not differ to concentrate on enjoyable and successful work for a considerable time. The degree to which the work is suited to the slow learner’s capacity, and engages interest and activity is important. The slow learner’s physical condition and his expectations of success or failure are also influential. In addition, the ability to concentrate seems to be, to some extent, a product of experience and training. Creative and practical activities seem to promote the development of good attention and of work habits.

D) INABILITY TO EXPRESS IDEAS

Tansley and Guilford (1962) state that schools give considerable though to the ways of achieving good standards in reading and writing, but important as reading and writing are, it must not be forgotten that they are only subsidiary skills in language.
Children’s ability to express themselves orally and to comprehend what is said to them is more important. This is where the slow learners are lacking. Slow learners have difficulty in finding and combining words, their immaturity and emotional reluctance being one of the chief reasons for their backwardness in expression. They often have resource to gestures or to action rather than words. To express ideas one, must be good at communication which involves listening as well as talking. But, slow learners are poor at remembering messages and listening to instructions. As a result, they are unable to express ideas with clarity.

1.16 EDUCATIONAL PROGRAMMES FOR SLOW LEARNERS

Psychologists and educationists have recommended various educational programmes to surmount the problem of slow learners in the mainstream. Most of the measures are within the purview of the teachers. Effectiveness of certain measures has already been established by the researchers. A clear perception of the educational programmes meant for slow learners will enable the teacher to combat slow learning in an effective manner. The following are the remedial measures which constitute the educational programmes for slow learners.

1.16.1 MOTIVATION

The word “motivation” is used to describe a drive, need or desire to do something. Motivation can be applied to behaviour in a wide variety of situations. One use of the concept of motivation is to describe a general tendency to strive towards certain types of goals. Success of a teacher largely depends on how effectively he motivates the students to learn. Experience has shown us that learning failure is very often largely due to poor motivation. Children taught by a teacher using motives in a sensible, individualized way will always learn more quickly and better, even if the method used is faulty. Slow
learners usually evince an attitude of avoidance resulting from previous experience of failure or dislike of a subject. They often glance at words rather than scrutinize them carefully, with the result that their errors in recall are the result of guessing from slight clues such as initial letters or superficial similarities. When the teacher succeeds in motivating the students, his instructions will be effective and the educational objectives can be achieved. The teacher should be worry not to discourage the slow learners who usually feel frustrated. The teacher should let them understand that they are not the ignored students and they are as dear to him as others are. When the teacher evinces this type of positive attitude, all his motivational techniques will work out successfully. Moreover, motivation not only instigates the behaviour of slow learner but also reinforces the ongoing behaviour. Motivation makes the slow learners desirous of learning to apply him to the task.

1.16.2 INDIVIDUAL ATTENTION

“Individual attention” refers to the attention given by the teacher to a particular student. Of all students it is the slow learners who need individual attention for the teachers. The individual differences of the children should be properly recognised and the individuality of the child must be respected. The teacher should take positive effort to ascertain the specific disability of the slow learners and accordingly he should devise his remedial instructional strategy which should cater to the needs of each slow learner. It is very necessary that the handling teachers should be very kind and sympathetic towards slow learners. Some incentives may be provided to those teachers who may be entrusted with the task of instructing the slow learners in the way the government gives incentives for those teachers who take special coaching classes or the SC/ST students. If this remedial measure is enforced, better individual attention can be given to the slow learners in the special classes which will ultimately, promote better human resource development.
1.16.3 RESTORATION AND DEVELOPMENT OF SELF-CONFIDENCE

Slow learners are the backward children who have, even before admission to the school, experienced years of failure and frustration as a result of which their self-esteem is seriously undermined. Constant lack of academic success, rejection by other children, faulty instruction and mismanagement by parents lead to emotional disturbance, feelings of inadequacy and personality and conduct disorders. These slow learners ultimately find themselves in a vicious circle. The interplay between the causes and symptoms becomes more and more complicated and difficult to disentangle. The breaking of this vicious becomes one of the most important objectives of remedial treatment. This cannot be broken unless the school establishes a special educational programme for the slow learners. The teacher should take all possible effort and make use of all possible opportunities to restore and develop self-confidence in slow learners which will ultimately goad them into manifesting better attainment.

1.16.4 ELASTIC CURRICULUM

Pratt (1980) identifies two basic assumptions that underlie all curricula: 1- that knowledge should be pursued for its own sake 2- that curricula should be designed to meet the immediate and long term needs of students. The knowledge centred curriculum focuses on the content of subject areas, whereas the needs centred curriculum assumes that human needs serve as the foundation for curriculum. The teachers should not lay much stress on abstract and theoretical study because the slow learners can not understand the abstract concepts very easily. Whenever there are abstract concepts the teacher should try to establish possible relationship or point out possible associations so that the slow learners can have a grasp of the abstract concepts. When there is concrete
presentation of instructional content, the slow learners are able to understand in a better way and it enhances their learning capacity and learning rate to a considerable extent.

1.16.5 REMEDIAL INSTRUCTION

Rastogi (1978) and Narayana rao (1987) have suggested that the remedial teaching classes or special classes should be conducted systematically based on laid down guidelines.

1. The instructional content must be very carefully graded keeping in mind the capacity, requirement, educational and experience levels of the students.

2. Short frequent lessons should be introduced instead of long lessons every week.

3. The slow learners are able to grasp concrete ideas rather than abstract ideas. Therefore there must be ample use of audio visual aids in the instructional process which can provide unique experience to the slow learners in the presentation of the content.

4. The teacher should be aware of that fact that a friendly approach in remedial teaching is highly conducive.

5. To generate interest social skills and confidence in slow learners, stress may be laid on effective use of art, music and drama.

6. The teachers dealing with the slow learners should give due importance to practice, drill and review which all facilitate the comprehension and retention of slow learners.
7. With a view to ensure optimum human resource development special remedial classes should be arranged for slow learners.

1.16.6 HEALTHY ENVIRONMENT

The school environment should be healthy and reasonably free for slow learners. Many a time poor environmental factors contribute a lot towards the slowness. Poor environmental factors should be adequately tackled or removed at the earliest so that congenial atmosphere can created for the effective learning of slow learners

1.16.7 PERIODICAL MEDICAL CHECK-UP

Physical anomalies sometimes serve as vital contributory factors for slow learning. Poor health and other malfunctions also have adverse effect on the learning of slow learners. If a particular anomaly is detected and correctly diagnosed, then a slow learner can become a normal learner after remedial treatment. In absence of periodical medical check-up, there will be no opportunity for the teacher to diagnose the cause of slow learning and to ensure the possible medical remedy.

1.16.8 LEARNING CONTRACTS AND PEER TUTORING

A) LEARNING CONTRACTS

A learning contact is an agreement between the teacher and the student to study and share information about a specific topic. It helps the classroom teacher organise the instructional programme for some exceptional students. Dunn and Dunn (1974) describe the contracting process they suggest that the contract include a list of media or resources and activities the students will use, as well as any methods the students will use to report what has been learned. Finally they suggest that the contract indicate how the student's
performance will be evaluated and, if appropriate, what the schedule will be for completing the project.

**B) PEER TUTORING**

Long ago educators realised that students could help one another learn. When one student teaches another, this is called peer tutoring. There are two types of peer tutoring: cross age tutoring where the tutor is several years older than student being taught, and same- age peer tutoring where one student tutors a classmate. When implementing peer tutoring, it is important that the rules for tutors be quite explicit; that is tutors show or tell their students what to do then watch as the students perform, they repeat the demonstration or instruction if the student makes an error, and then praise the student when the response is correct. Hence teacher monitoring of the tutors is an integral part of the system. It is not time consuming but it is extremely important. Thus, peer tutoring does seem to be an effective way to provide appropriate levels of instruction to students (Slavin, R.E. 1986). This makes it more relevant to slow learners who are in dire need of additional instructional time.

Slow learners or educationally backward children needs special attention and care for being duly helped in getting rid of their sub normality in terms of rate of learning and educational achievement. Neglecting or overlooking them may pose a serious problem for their progress and welfare besides proving a nuisance to the society. For taking measures, for their treatment and education, beginning should be made through regular medical check-up and necessary treatment and redressing their maladjustment problems at home and school. As far as possible, they should be taught along with their other non-disabled peers. However, in the most severe cases of retardation or backwardness, we can opt special schools as the placement option. The remedial steps and treatment measures for
the backward children should therefore be mostly arranged in the schools by adopting the measures like.

1) Provision of special curriculum, methods of teaching and special teachers.

2) Special coaching and proper individual attention

3) Checking truancy and non-attendance.

4) Provision of co-curricular activities, rich experiences and diversified causes.

5) Maintenance of progress record.

6) Rendering guidance services.

7) Controlling negative environmental factors and

8) Taking the help of experienced educational psychologist.

1.17 SPECIAL METHODS OF TEACHING

The research evidences reveal that the following special methods will be very effective for slow learners:-

a. Audio and visual instructions

b. Mastery learning strategy with extra corrective instruction

c. Modular instruction

d. Computer assisted instruction
A) AUDIO AND VIDEO INSTRUCTION

Slow learners need extra time for remedial and enrichment activities. In the audio instruction the expert’s service not ordinarily available in the school is made available. They can listen to the audio instruction based on their subject units in the evening hours. They can take them home and make use of according to their convenience. Also they can listen to relevant educational radio programme which also has positive effect on the slow learners learning. The video instruction provides unique experience to the slow learners in the presentation of instructional content. It penetrates more deeply into human character with an immediate excitement than any other single medium.

B) MASTERY LEARNING STRATEGY

Mastery learning is a system of instruction that emphasizes the achievement of instructional objectives by all students by allowing learning time to vary. The basic idea behind mastery learning is to make sure that all or almost all the students have learned a particular skill to a pre-established level of mastery before moving on to the next skill. Once the slow learners have the experience of mastery learning and attain a pre-determined mastery level, the learning will build on learning leading them to a remarkable success or achievement.

C) MODULAR INSTRUCTION

Module is a self contained auto instructional package dealing with a single conceptual unit or subject matter. Instruction through modules has been found very effective for all levels of students and it is found more effective with regard to low achievers and slow learners. It may be used individually or in small learning groups. It accommodates instruction to individual differences. The learning materials presented in
the module for each objective, the project work and the practicum incorporated in the
learning module enable the slow learners to surmount the problem of abstract thinking
and to understand the possible association which will, ultimately tell upon their retention.
Modular instruction takes care of concrete presentation of subject matter by incorporating
necessary diagrams, sketches, pictures, worksheets, examples etc. with the learning
material at appropriate places. Thus, in many ways, the modular instruction proves to be
suitable for slow learners.

D) COMPUTER ASSISTED INSTRUCTION

Computer assisted instruction is a kind of individualised instruction administered
by a computer and its roots has in programmed instruction and in the behavioural theories
of learning. CAI programmes stress drill and practice exercise, others teach students facts
and concepts. It gives instant knowledge of results and provides immediate feedback
which are very essential for slow learners to ameliorate their learning process. In this
method every student can learn at his own rate. Students will have no pinch of inhibition
when they learn through CAI. The feeling that they are not preyed upon by the
supervisors and the free and relaxed readiness to learn themselves at their own rates, give
the slow learners an impetus to learn and to manifest their best. Hence, this method is
only means to achieve our pre-established behavioural objectives.

From the above discussions it is evident that there is a growing need for
Multimedia instructional packages for mastery level learning and the need is in fact
greater when the middle school slow students are involved in the teaching learning
process. The present study is an earnest attempt in this regard to develop Multimedia
instructional packages for the Mathematics subject in middle school syllabus and to
measure the effectiveness of Multimedia instructional package in teaching mathematics for slow learners at middle school level.

The review of related literature is presented in the next chapter.