CHAPTER-II
REVIEW OF RELATED LITERATURE

2.0 Introduction

2.1 Research on Mathematics Education
2.1.1 Research in High failure rates in Mathematics
2.1.2 Research for improvement of learning and teaching of Mathematics

2.2 Research on Individualised Instruction

2.3 Research on Programmed Instruction

2.4 Research related with Computers in Education
2.4.1 Use of Computers in Education
2.4.2 Evolution of Computer Application in Education
2.4.3 Computer Based Instruction (CBI)

2.5 Research on the effectiveness of Computer Assisted Instruction
2.5.1 The Research Studies in Abroad
2.5.2 The Research Studies in India

2.6 Conclusion
CHAPTER - II

REVIEW OF RELATED LITERATURE

2.0 INTRODUCTION

A research work is not meaningful without a thorough analysis of related works. Search for related literature should be complete before proceeding with the actual conduct of the study. According to J.W. Best (1977) a fabularity with the literature in an problem area helps the research to discover what is already known, what others have attempted to find out, what method attacks have been promising and what problems remain to be solved.

Practically all human knowledge can be found in books and library. So extensive use on the library and thorough investigation of related literature or essential in planning and carrying out the kind of searching involved.

It has been already stated in the previous chapter that the present study is an attempt to develop instructional material and computer software package for teaching Mathematics to class IX standard students. Hence this chapter is devoted to the review of related literature. The studies have been grouped into the following topical sequence.

Research studies dealing with:

2.1 Mathematics Education
2.2 Individualised Instruction
2.3 Programmed Instruction
2.4 Use of Computers in Education
2.4.1 Evolution of Computer application in Education
2.5 Effectiveness of Computer Assisted Instruction
2.5.1 Research Studies in Abroad
2.5.2 Research Studies in India

2.1 Research on Mathematics Education (1988-92)

We shall describe the research done during this five years and summaries the main finding of the research the strength and weakness of the research. The trends that the research indication that is needed and the steps to be taken.

2.1.1 Research in High failure rates in Mathematics

* Jain, S.L. and Burad G.L. (1988) have found the following causes as responsible for low results in secondary Mathematics. Non availability of Mathematics teachers, due to late appointment and frequent teachers transfers; lack of appropriate classrooms, black boards and other physical facilities, irregular attendance, low standard in the lower classes, non-availability of text books, lack of timely correction of homeworks, overburden and uninteresting curriculum, lack of child-centered teaching; insufficient period for teaching Mathematics and lack of suitable teaching aids.

* Chel, M.M. (1990) has examined the problem of under achievement, gaps in knowledge of concepts difficulties in understanding of mathematical language, lack of openness and flexibility in teaching difficulty mathematisation of verbal problems and interpretation of
mathematical results, the abstract nature of Mathematics fear and anxiety on the part of the students.

- Kasat, B.S. (1991) has made an in-depth study of the causes of failures. He found that most of them had poor intelligence, poor numerical ability, poor comprehension and recall ability, no interest in Mathematics, poor study habit, lack of help from parents and teachers and difficulties in certain topics in Mathematics.

2.1.2 Research on Improvement of Teaching and Learning of Mathematics

The improvement can be brought through studying the characteristics of effective teachers of Mathematics through the use of computers, computer assisted instruction and programmed learning through analysis of errors committed by students. And development of efficient remedial packages to reduce the same through improving the attitudes of students towards Mathematics. Through understanding the styles of learning of high achievers, average achievers, and low achievers through study of cognitive factors underlying the learning of Mathematics through the study of dependence of learning Mathematics on the personality and temperamental characterisation of the students, through the use of audio-visual aids, enrichment material, and number games through the study of SES and environmental factors like fathers and mothers' education and profession, types of school etc. in learning of Mathematics, through development of special teaching material for Mathematics for special groups, through development of packages of divergent type problems and skills of problem
solving and through comparison of different social and psychological factors on learning of Mathematics.

* Biswas, J. (1988) has studied creatively in Mathematics as a function of study habits (SHM). Preparation of teacher's impression about their performance in Mathematics (PPTM). It was found that pupils creativity in Mathematics is a linear function of each variables SHM and PPTM.

* Kratoon, F. (1988) has studied relationship of mathematical aptitude with interest and vocational preference are influenced of the father; in general boys prefer vocation related Mathematics.

* Nagar, N. (1988) has examined the usefulness of computers in teaching Mathematics, which can be taught more effectively through computers and the status of computer aided teaching of Mathematics.

* Deshmukh, V. (1988) finds small but positive and highly significant correlation between mathematics learning and responsible and ascendant temperaments. He also finds low but negative and highly significant correlation between Mathematics learning and there temperamental dimension viz. sociable, accepting and impulsive.

* Pandhari, A.S. (1988) has studied the effect of language, memory and persons on students' learning of Mathematics. He found that all these influence learning but the type of the students' instruction does not affect the learning.
* Doshi, P.C. (1989): The study revealed no significant relationship between cognitive preference styles and Mathematics.

* Raman, J. (1989) found that the errors most of the students committed were conceptual errors followed by computational errors, entry behaviour errors and perceptual errors.

* Pal, A. (1989) has considered the dependance of achievement in mathematics viz. self concept, anxiety, attitude and academic motivation.

* Guruswamy, S. (1990) has developed a remedial package. It is claimed that the remedial package leads to considerable in errors.

* Krishnan, N.J. (1990) has found that there is no significant relationship between identification of problem solving streges (JPSS) and either applications of problem solving strategies (APSS) or achievement of problem solving in Mathematics (APSM) through the last two are significantly correlated.

* Sarala, S. (1990) found that the number of errors are informed by sex, locality of the school, management of the school, intelligence, study habits and socio-economic status.

* Thisid, S.K. (1996) has found, rather unexpectedly that socio-personal factors such as education of father and occupation of father and mother have no significant effect of the problem solving in Mathematics of school children.
Yadav, R.S. (1990) found that all three factors, age (A), socio-economic status (SES) and school environment (SE) have significant effects in the concept formation in Geometry.

Mishra, R. (1991) has shown that with appropriate learning strategies even arithmetically disabled can learn addition and substraction.

Nalayani, S. (1991) has examined the effectiveness of using number games to teach arithmetic, so eight of the comparison made five have shown significant improvement due to supplementary use of number games.

Wagh, S.K. (1991) has developed a multi-media instructional system for remedial purpose for fractional numbers and has expectably found this package leads to better understanding than the conventional remedial methods.

Bhagawat, S.A. (1992) has prepared a package of divergent production type problem in Mathematics and has found that the use of this package significantly helps in the development of divergent thinking abilities.

Hariharan, D. (1992) found that the girls, urban students and private school students have a more positive attitude towards homework in Mathematics than others and that students with this positive attitude towards homework have better achievement in Mathematics.

Prabha (1992) has found that programmed learning of mathematics is superior in convention learning of Mathematics.
* Singh, R.D. (1992) has discussed the relative merits of teaching Mathematics through computer assisted instruction and conventional methods of teaching computer assisted instruction was always found superior.

* Setia, S. (1992) has found that the rapid average and slow learners, differ significantly in their intellectual and socio-economic status levels and that the intelligence SES personally and adjustment of rapid, average and slow learners cluster with achievement in modern Mathematics.

2.1.3 Evaluation of Curricula

* Dash, P.C. (1996) studied the effects of instruction using innovative self learning activity sheets on problem solving different types of problems on multiplication and division was found to be effective.

* Deshmukh, V. (1997) designed alternative strategies and support activities as well as instructional material to facilitate learning of unit in Mathematics. It was found that if the child learns through games he does not feel the stress of learning.

2.2 Individualised Instruction of Independent Study

Instruction is said to be individualised when it successfully taken into account the differences in the learning aptitude found in students of a given age or grade. Critics have charged that conventional teaching ignores such differences and have often proposed replacing it with a more individualised approach, some have recommended alternative forms of
classroom organisation, such as ability grouped classes, non graded classes, programmes of rapid promotion and open classrooms. Others have recommended extensive use of individualising technological side, such as programmed instruction, computer based teaching, individualised assignments, learning module, learning contracts and individual projects. According to Kulik (1982) all of these alternatives have been discussed as "Individualised instruction."

A similar but not synonymous term "Independent study" but also been used in this respect. Some authors have made a clear distinction between "Individualisation" and independent study. For example, Alexander and Hines (1967), Dressel and Thompson (1973), Della-dora and Blenchard (1979) indicated that learning can be individualised instructions can be highly, or even entirely, teacher controlled. Dressel and Thompson (1973) suggested that individualisation can be a first step toward independent study, but the independence learning needs to progress beyond the stage of individualisation.

Other authors pointed to a closer relationship between individualisation and independent study or learning. For example, Macdonald (1967) identified three conceptualisations of independent learning. One conception emphasised the independence of students in learning some material, a second conception, called Individualised instruction provides a variety of ways for students to achieve the same general goals. The third conception of independent choice of the learning task. The first two conceptions are largely teacher controlled whereas the
third conception indicates greater responsibility and greater independence for the students.

According Kulik's report on individualised systems of instruction given in the fifth edition of Encyclopedia of Educational Research (1982) among the best known of the individualised systems are Keller’s personalised system of instruction (PSI); Poslethwait's audio-tutorial approach (AT); Individually prescribed instruction (IPI); Programme for learning in accordance with Needs (PLAN); and Bloom’s learning for Mastery (LPM).

Alexander and Hines (1967) conducted survey of thirty six secondary schools on independent study. Their conclusions were similar to the conclusions of Thompson and Dressel (1970) at the college level. Inspite of considerable interest in the concept, only 1% or 2% of the schools actually had independent study programme. Alexander and Hines (1967) identified five patterns of independent study in the secondary schools of the united systems.

(1) Independent study privileges or option that provide choices, (2) Individually programmed independent study in which the student is guided, but not tutored; (3) Job-oriented independent study that prepares students for a particular job; (4) Seminars in which students engaged in independent study come to share their studies; (5) question type programme designed to develop special aptitude and talents. In their updated study Alexander and Burke (1972) reported a greatly increased use of the label “Independent study.” The authors concluded that the use
of independent study had been increased in the secondary schools; and evidence although still count, was beginning to indicate its potential inspite of the rather limited practice. Interest in the concept has remained high, perhaps because of its potential benefit to students.

The advantages of independent study as a process and goal of schooling cluster in two categories: (1) achievement and cognitive learning (2) process and effective growth. It has been noted that pro-active students supported by independent study, learn more and better that reactive students (Alexander and Hines, 1967; Gibbons and Philps 1979; Hubbel, 1976; Knowles, 1975; Steward, 1980). Intrinsic motivation from this active role is thought to increase and as a result learning becomes more personalised and meaningful (Brown, 1968; Henny, 1978). Self directed learning emphasizes the development of higher cognitive behaviour (Henny, 1978) and offers opportunities to study topics beyond the regular curriculum (Alexander and Hines, 1969; Brown, 1968). Alexander and Hines, 1967; Knowles, 1975 concluded from their study that not only did students achieve in the area of independent study but they also achieved better in other courses. Thus, independent study helps students become competent in as many areas and export in at least one field (Brown, 1968; Gibbons and Phillips, 1979).

Moore (1973) has begun to develop a unified theory of independent learning and teaching. Communication in the case must be by print or electronic or other impersonal means. He has proposed three sub-systems to his theory; a communication system, the student an autonomous learner role of the teacher as helper not a controller.
Between 1960 and 1970s many individualised systems were developed for all novels of education in many developed countries. These systems were used in college classrooms for the first time in the USA and they were used once again in elementary and secondary schools. Besides the individualised instruction programmes mentioned earlier, individualisation of rate of instruction has been achieved to a high degree in "probing the natural world." A Junior high school curriculum developed by the intermediate science curriculum (ISCS) at Florida State University some additional individualisation of content has also been accomplished through remedial and enrichment "excursions" in ISCS course, which showed positive results (Morrill, 1971).

Mini courses for undergraduate Biology at Purdue University (Jenkinu and Russel, 1971) were developed and used. Many of these individualised instruction courses used programmed learning material quite successfully.

There is much research evidences that personalised system of instruction (PSI) is an effective instructional technique than the conventional one.

Some of the special characteristics of self instructional material, as listed by Gagne et al (1974) are it caters to more realistic goals of learner; it attains a given goal it makes a variety of materials and resources available so that individual competencies and backgrounds are taken care of. It allows for individual pace of work; the learner faces no failure; and it provides consistent individual feedback through regular assessment. These points have been listed by Sherman (1967) and Johason
and Johason (1970) who not only have developed self instructional material (SIM) of their own, but have suggested guidelines for developing such material. Similarly Skinner (1968), Leith (1969) Bocstar (1974) and Briggs (1974) have emphasised on the need for self-propelled learner.

Providing support to SIM and individualised programme, Gogne (1974) stated that teaching may, most commonly, be a group activity but learning taken place within an individual. This observation places emphasis on the internal conditions of learning, viz. the students desire to learn, willing on to follow directions, attention to the task, attempts to recall relevant information or skills, and receptivity to guidance from teacher.

According to Kulik (1982) current educational policies have resulted in more diverse classroom and schools. Baring major change educational policy, it appears that in the eighties and nineties their classroom, and Principal will be dealing with increased diversity within their schools. The tree most viable models for education of the individual in the eighties and nineties appear to be remediation, diversified instruction and diversified instructions with multiple objectives. Individualised instructions could include all these.

Review of evaluation finding at the elementary and secondary levels are for less consistent in their conclusion about individualised system. Some reviewers have reported clear learning gains from individualised systems, other reviewers have reported little, or no effect or even negative effects on learning from individualised system. Harkley (1977) carried out a meta-analysis of results of individually paced approaches into
mathematics instructions in elementary and secondary schools. Included among the studies are 51 on individualised systems. Those 51 papers report results from 139 separate compressional. Hartley (1977) found that the average effect reported in these studies is small, and effects are negative in approximately 30% of all studies.

In their experiments in which various modes of self-pacing were compared with traditional methods. Arlen and Westhury (1976) and Koen (1973) reported results that favoured the use of self-paced materials. On the other hand, Hughes and Reid (1975) and Bensavi and Silberetan (1981) have reported finding that favoured the conventional methods over the various individualised techniques used and yet many studies have shown no significant differences. The occurrence of their conflicting results seems to suggest that different teaching strategies are effective for different types of students and courses. After literally hundreds of studies, therefore, the effectiveness of individualised elementary and secondary school teaching is still open to question. Some reviewers have pointed out a favourable pictures of results; some reviewers have drawn negative conclusions. Favourable effects may restricted to certain methods. Certain fields or different reviewers may simply be familiar with selected parts of the literature of an rate, future studies and synthesis will have to explain with different reviewers disagree so sharply in their conclusions about elementary and secondary individualisation.

With respect to personalised system of instruction (PSI) there is much research evidences that PSI is a more effective instructional method than
the traditional techniques (Kellar, 1968; Alba and Panny Puckar, 1972; MacNichael and Corey, 1969; Writer and Kent, 1972) and within the PSI methodology there have been a number of improvements based on empirical research. However, very few studies have investigated the effect of combination of traditional methods with PSI on test performance. Only few studies on PSI have used lectures in their courses. For example, Sheppard and MacDermol (1970) and Born et al (1972) employed lectures in combination with PSI but only for purposes of control, some other like Keller (1968), Lloyd, Carlington, Lowry, Burgen, Evler, Knowthon (1969) found no evidence for reinforcing effect of lectures unless material related to subsequent tests was discussed during the lecture.

Despite their criticisms, the use of traditional method in education has continued with at least some degree of effectiveness. An important question then concerning these two instructional methods (TM, PSI) whether learning can be facilitated by combining various aspects of TM with PSI. Very few have suggested such combinations of traditional method and PSI on final examination scores. The variables investigated were use of lectures, group discussions, mid-term examinations, mandatory laboratory projects and readiness tests. A comparison of final examination scores, showed that the group which received PSI combined with enrichment provided with TM scored significantly higher than did the group instructed only by PSI.

In our set up where there is a prescribed syllabus to be completed by each students and final external examination, complete individualisation
score to be difficult but a combination of traditional and individualisation of rate of instruction may more effective.

In India no study has been mentioned under the heading of "individualised instruction" in any survey of educational research. In the field of educational technology some of the researches are confined to the area of programmed learning.

At NCERT, Mathur (1982-83) tried an alternative to the present system which he called Individually Guided System of Instruction (IGSI). In the IGSI programme the entire XI class physics syllabus of CBSE was split into 21 parts and 21 self instructional units were developed with the help of experienced physics teachers and educators. For each unit, the students were provided with a study guide containing introduction, objectives, suggested procedure for achieving the objectives, notes, problems and self assessment (Mathur, 1983).

The IGSI was tried out for XI class physics in some selected public schools for a whole academic year. On comparison with traditional teaching of physics to Class XI, it appeared what there were favourable results. In Delhi public schools the students' results were almost the same in IGSI and traditional class. But remaining four experimental sections of Kendriya Vidyalaya, Delhi Cantt, Kendriya Vidyalaya, Ambala Cantt, Navyug School, Delhi and Springdales School, Delhi showed 10, 15, 13 and 17 percent gain in marks respectively due to IGSI. The students reactions of IGSI were also reported favourable response to the questionnaire given. The students said that they gained quite a bit of self
confidence and mastery. Near the end of the year two out of three students recommended IGSI to other students (Mathur, 1983). Some limitations of the study are also discussed. Development of such material can also be tried out in Biology.

2.3 Programmed Instruction

The impulse that led to the reinvention of individualised system in the 1960s was basically a technical impulse, a desire to use machines to increase the teaching efficiency. The impulse came from psychological revolution in education. In his classic article, “The science of learning and the art of teaching”, Skinner criticised conventional teaching methods and argued that mechanical devices could make teaching more effective (Skinner, 1954).

He predicted that such devices would increase student memory of material to be learned and would reduce the amount of punishment, frustration and burden in schools. In Skinner’s view, teaching machines would transform education. They would make teaching efficient and learning enjoyable.

Though the form “programmed learning” is not that old in the field of Psychology and Education, the concept certainly in, it is as old as Socrates.

Pressooy (1927), Peterson (1931), Little (1934), Angell and Treyer (19489), Johnson (1949) and Pressey (1950) with a host of other scholars report experimental findings pertaining to the assessment of instructional
effectiveness of programmed learning done with help of a punch board device and the usual class teacher. Most of these studies claim superiority of programmed learning group over the control group i.e. the usual class teaching group.

Skinner (1954) gave further concrete shape to add the superiority of programmed learning over the conventional teaching. Skinner enumerates 50,000 contingencies (concepts) which are normally needed by a fourth grade or to learn arithmetic. In a group situation, where the teacher is expected to cater to so many contingencies for pupil, adequate findings of these is humanly, as well as physically impossible comparing machine instruction with that imparted through text-books. It was found that the former did 78% better than the latter (Skinner and Holland, 1958). Porter (1959) supported the results of Skinner and Holland (1958) through experimental findings and suggested the complete adoption of the stimulus response devices i.e. programmed learning.

Blyth (1959) reporting on Hamilton College project found ‘a programme of questions and answers’ as the most effective teaching aid and a teaching machine using micro films for individual use as the most effective presentational mode for the programme. Besides saving on time spent in organisation of curriculum preparation, evaluation and diagnosis, they found phenomenal increase in the classroom efficiency by at least one-third, both in terms of time spent on instruction, and the level of achievement acquired by each and every pupil, as well as a great reduction in the range and number of individual differences. Even a
modest increase of 12.5% gain in terms of time, would enable a student to learn at 14 what he would have acquired at 16; with a significant cumulative effect all along. Though Blyth found programmed learning to be superior still the relative effectiveness of a mechanical mode of stimulus presentation and a text book with or without a human agency remains a matter of conjecture only.

Two experiments by Smedalund (1961) yielded data demonstrating the acquisition of the concept of conservation without any of the external reinforcement and thus presented a challenge to the Skinnerian system.

Keislar (1961) obtained differences between the post experimental scores of the experimental and the control groups. The result contradicts the claim of the superiority of the programmed learning method over the conventional method of teaching. Evens, Claser and Homme (1959), while evaluating the relative effectiveness of sequenced learning in programmed text book format with conventional text book presentation of the material, found the former group asking higher achievement across the exhibiting lessor variability in performances than the conventional group.

Cronbacn (1962) described a ‘programme’ as a pre arranged sequence of experimentation and questions, a ‘programme’ whether for a brief unit or for an extra course, is a carefully planned progression of ideas beginning with elementary notions and working upto relatively complex theories or applications.
According to Skinner (1968) a programmed instruction is simply a matter of breaking the material to be learned into easy steps in a logical order with no gaps making sure the students understands one step before moving to another and then incidentally making sure that he is successful. Thus programmes originated by Skinner (1959) have been of low error rate. Because of the low error rate required in these programmes little can be learnt about error correction from studies involving linear programme (Gilman, 1969). Intuitively, it seems probable that feedback would aid learning and eliminate students' misconceptions. Feedback and knowledge of results are important factors in automated instruction because they relate to the principle of reinforcement which, in turn, is based on results obtained from many experimental studies of the law of effect. The law stated “responses accompanied or followed by certain events (called reinforces) are more likely to occur on subsequent occasions, whereas responses not followed by the class of events subsequently showed a lessened probability of occurrence (Cilman, 1969).

There are numerous styles of writing programmes. The Skinner's model, linear programme strategy and the underlying theory do not satisfy every one. Nevertheless to make a comparison would certainly involve fruitless disputes. Many of the conflicting arguments fall away as soon as one actually gets down to writing a programme. It becomes clearer when composing the sequences that the theoretical aims or the prospects held out by the various types of programmes are one thing and the techniques required for their realisation quite another. It would be a mistake,
however, to use existing difficulties or the performances as a decisive reason for deciding that linear or branching programmes are better before even attempting to produce any such programmes.

The question is "should linear and branching programming be prepared?" while comparing, Skinnerians (Linear) against the Crowderland (Branching) it has been realised that they were often talking about different things, the former was attaching the issue on theoretical grounds and vice-versa. An experiment was conducted consisting of assembling and arranging sample lessons and then comparing the results obtained by the two methods. The significant differences of efficiency was noted and this satisfied many people (Poostar, 1974).

One important aspect of programme learning in the defining of instructional objectives before writing the programme. There are many reasons for doing so first of all it specifies the terminal behaviour which is aimed at the learner as well as the instructor to help in properly planning the final sequence of the programme. Skinner (1958) observed that defining the instructional objectives is the first step in the design and implementation of a programme. This has been further emphasised by Gagne and Paradise (1961), Mager (1961), Cook and Pschner (1962), Evens, Homme and Giasor (1962) and Jenkins and Neisworth (1973).

A number of studies have been conducted to study the effectiveness of providing behavioural objectives before starting instruction. Morse and Tillman (1972), Duchastel and Merrill (1973), Nomald and Robert (1975) are among those who have conducted researches to investigate the
effectiveness of behavioural objectives. Sharma (1934) found that the prior knowledge of behavioural objectives seem to have more significant effect on the performance on the criterion test irrespective of the styles of the programming.

Holliday (1983) concluded from his study that over prompting students by providing them with strong hints to answer questions can do learner more instructional term than good.

Anderson (1970), Anderson and Faust (1967), Anderson, Faust and Roderick (1968) using classroom process materials also investigated a strong prompting procedure employed some self instructional programmes to assist students in locating correct answer before responding to programmed questions. (Examples given was from BSCS pattern and processes (1965) “when an egg is released from the ovary, the wall of the uterus is this When an egg is ..... from the ovary, the wall of the uterus is .......”. It was noticed that if the target response is too easily located students often without understanding the question content, may answer correctly. Some studies therefore reported that strongly prompted versions of programmed material results in slower recall scores compared to unprompted versions. Numerous experimental studies (Clynn and Divesta, 1979p Markle and Copie, 1976) and reviews of research (Riohards, 1979; Vilson and Koran, 1976) have discussed the specific facilitatory and inhibitory learning effects of adjunct study questions, while some others have explained these findings in terms of selective attention (Anderson, 1970; Mc.Conkie, 1977; Wittrock and Lumsdaine, 1977). On one hand
facilitatory hypothesis derived from this model predicted that adjunct questions could focus the students attention on the question information presented in the passage. On the other hand inhibitory hypothesis predicted that other adjunct question treatments interfered with learning. When questions specifically diverted students attention by strongly or mildly suggesting hints, or overprompting because of the physical location of desired answers in the passage.

Moriber (1969) used a programmed course for college physics and that found immediate questions of knowledge was significantly greater among subjects receiving programmed instruction compared to controlled group who attended lecture demonstration lessons. There was no significant difference it means retention scores, however, Vinocent Dernowaski also reports that immediate learning was greater for programmed instruction than for the traditional technique (Watch, 1972). These findings support predictions from learning theory that immediate reinforcement and small steps as presented in programmed lessons enhance immediate acquisitions of knowledge (Moriber, 1969).

The adjunct programming can be a link between the programmed instruction and a good text book. It combines some of the progressive features of programmed instruction. With the comprehensiveness of text book. An adjunct programme may be one of the two types: (1) the text itself is kept intact and the programme is supplied as a separate unit or (2) sections of text book are extracted verbation and used in the programme as the basic information (Espich and William, 1967).
Cowan and Siddiqui kept the textbook intact in their studies (Siddiqui, 1979), Cowan (1964) developed an adjunct programme for PSSC Physics (1960 first edition), at the University of Texas in 1962. This material was used later in his 1964 research study “Development of New Auto Instructional Units and an analysis of their effectiveness in teaching modern physics in a small high school.” Cowan did not use qualified physics teachers in the experimental classes. Teachers in the experimental classes had no background in physics and they were acting only as adult supervisors. The written assignments too were sent to Cowan at the University of Texas at Austin for correction and grading. Cowan found that there was no significant differences in the mean level of achievement in PSSC physics between student using programmed material and students not using such materials.

Cowan auto-instructional materials were revised for PSSC (1965 second edition) text by Siddiqui (a) 1973, (b) 1974 at Florida State University in 1972 which he later used in his 1973 research study. “An analysis of the effectiveness of the use of Auto-Instructional materials in the teaching of PSSC physics by qualified physics teachers.” He found that students using Auto-Instructional materials, and supervised by a teacher achieved significantly higher in PSSC physics compared to the students not using such materials, but taught by their physics teachers in a conventional way (Siddiqui, 1974; Siddiqui, 1979). This shows that auto-instructional materials used to teach physics under the guidance of their teacher are more effective than the conventional way of teaching. Similar
results could possibly be expected if programmed instructional materials in Biology are also used.

In India researches in the field of educational technology were largely confined to the area of programmed learning as indicated in the 2nd survey of Research in Education by Each (1979). Leith (1969), in his paper “Second thoughts on programmed learning” has indicated that many of “critical features of programmed learning have been modified and with them the techniques and range of applications.

The needs of programmed learning had been shown in Indian soil in the early 1960s. By 1965 NCERT started disseminating the idea of programmed learning to educationists teachers etc.

The second survey of research in education categorised the researches done in this area in the following manner:

1. Programmed approach vis-a-vis Traditional approach to teaching.
2. Different forms of programmed learning material.
3. Different uses of programmed learning materials.
4. Programmed learning and instructional media.
5. Programmed learning for different subjects.
6. Programmed learning and individual differences.

Many studies were done as comparative studies of programmed learning approach and traditional approach.
The programmed learning materials used for those studies were mainly in the subjects like Mathematics, Geography, and languages. The experimental group, in the study of Shah (1964) was given a programme on “Solving Equations.” Sharma (1966) administered a programme in Algebra through this technique. Desai (1968) studied the effectiveness of programmed learning material on teaching of Gujarati in class IX. An intensive study was made by Shah (1969). She programmed the whole syllabus of Algebra for Class VIII and the experimental group studied the whole syllabus of Algebra through this technique.

Krishnamurthy (1972) developed a programme in physics on ‘Thermometer’. Kapadia (1972) developed and validated a programme in Physiology on “Heart and Blood Circulation” in English as well as in Gujarati. The findings of all these studies revealed that the group taught through the programmed material achieved higher on the past-test as compared to the group which was taught traditionally. These findings were not limited to the urban areas only. The studies by Sharma (1966) and Sharma (966) included samples from rural areas also. The study conducted by SIN SIN (1979) confirmed the findings of above researchers.

The effectiveness of programmed learning approach was not only studied in terms of immediate scores on the past-test. But it was studied in terms of retention too. Sharma (1966), Kulkarni (1969) and SIE (1970) found that the retention scores of the experimental group were better than those of the control group.
Shah (1964) introduced another variation in her study. She had three treatment groups in her study. The first experimental group was given the programmed material and was asked to study on its own. The second was helped by the class teacher along with the programmed material and the third control group was taught by the traditional method of teaching. The finding that the group taught through programmed material along with the teachers help failed to do better, is very interesting, research is needed to verify the results.

The two approaches viz. programmed learning and traditional teaching were compared in terms of one more variable ie. time taken to learn a particular topic. Shah (1964) and Shah (1969) found that the experimental group achieved more in class time. This indicates that programmed learning approach is effective not only in terms of immediate and delayed achievement, but also in terms of time taken to learn a particular topic.

Apart from the empirical evidences the effectiveness of the approach was judged by analysing the pupils' reactions. Desai (1956) found that the pupils preferred to study through programmed learning approach to the traditional approach.

Pandya (1974) studied the effectiveness of programmed learning strategy in learning Physics and found that the achievement of the experimental group was more.

Reddy (1975) compared the programmed learning with conventional learning in the instruction of languages. There were some definite
advantages found in the programmed learning method over the conventional method.

Mehta (1973) developed and validated a programme in English for developing reading ability at the initial stage. The performance of the experimental group studying with self instructional programme was found to be much superior to that of the teacher taught group with respect to both acquisition and retention of reading skill in English.

Kulkarni (1969) and studies taken by SIE Gujarat (1970) reported that students using programmed materials for revision and significantly better than students who adopted other methods of revision. Programmed learning technique was also used for remedial teaching in two Indian studies.

Joshi (1972) used programmed material for remedial teaching for 1st year degree students. Shah and Kulkarni (1972) need programmed materials for under achievers in Algebra among the students of class VII in rural area. Both the studies indicate improvement in achievement.

The programme in each of the subjects and especially in the field of biology are very rare and very few are reaching the classrooms in our country. This is supported by the following extract on “research needs in programmed learning and educational technology” given in the second survey of research by Buch (1979).

“A perusal of research studies in programmed learning shows how limited the researches are in this area. The aspects of programmed
learning covered by the researches surveyed are also very limited not to talk of their quality except for a few studies including these conducted at doctoral level the others are very sketchy, hardly leading to any generalised conclusion.

One of the ways suggested for strengthening research programme is to have a pool of programmes in different subjects, adopted in different regional languages to be used by learners at various levels.

Hundreds of studies have composed the effectiveness of programmed and conventional instructions in schools setting and just over half came out in favour of conventional teaching (Ebeling, 1981; Kulik, Kulik and Cohan, 1980). Other alternative teaching methods have shown more impressive records in the schools (Hartley, 1973; Kulik and Cohan, 1980).

While there is considerable divergence in the conclusions regarding programmed instruction as a superior teaching tool, the findings generally are in agreement that it is at least as effective as conventional teaching methods are (Siemankowaski, 1969).

In our set up programming the whole course is not practicable but if our teachers could have well sequenced and well tested programmed instructional material in some topics in Biology as well as in other science subjects. It would be a great help to teachers, since they are heavily burdened and they hardly get time to specially help the students who really need their help, with programmed instructional materials available. Students could do their own learning and could cover at least a
part of their course on their own, under the guidance of their teacher, if needed. In that case the teacher can devote his time and attention teacher more important objectives of teaching the subject.

2.4 Researches related with Computers in Education

Different researches have been conducted in the field of computer education in abroad as well as in India. As far as India is concerned, very little work has been done in the field of computer. Work regarding to the computer in education is still in experimental stage. However, the researches on computer can be classified into five categories and presented following.

2.4.1 Use of Computers in Education

The history of use of computers in education begins in 1960. Table 1 provides a brief information on history of use of computers in education. It is not described chronologically as the development ideas rarely follows an orderly path in time. The main underlying theme is the trend from rigid computer oriented approaches towards more sensitive learner oriented ones. Each approach is described in general terms and illustrated by a specific example.
### 2.4.2 Evolution of computer application in education

#### Table-2.1: Evolution of computer application in education

<table>
<thead>
<tr>
<th>Approach</th>
<th>Distinguishing characteristics</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Program</td>
<td>Deviation from behaviourism&lt;br&gt;Systematic presentation, reinforcement and selfpacing</td>
<td>Lst (1979)</td>
</tr>
<tr>
<td>Branching program</td>
<td>Corrective feedback, adaptive to student response, tutorial Dialogues, use of author languages</td>
<td>Ayscough (1977)</td>
</tr>
<tr>
<td>Generative computer assisted learning</td>
<td>Drill and practice, use of task difficulty measures, answering student questions</td>
<td>Palmer and Oldchoeff (1975)</td>
</tr>
<tr>
<td>Mathematical models of learning</td>
<td>Use of statistical learning theories of limited applicability, response sensitivity</td>
<td>Laubsch and Chiang (1974)</td>
</tr>
<tr>
<td>TICCIT</td>
<td>Team production of courseware 'mainline' lessons, use of TV and minicomputers, learner control</td>
<td>Mitre Corporation (1976)</td>
</tr>
<tr>
<td>PLATO</td>
<td>Multiterminal interactive system, visual displays 'open shop' approach concern over cost</td>
<td>Bitzer (1976)</td>
</tr>
<tr>
<td>Stimulation</td>
<td>Computer as laboratory, Interactive graphics, typically small programs</td>
<td>Mckenzie (1977)</td>
</tr>
<tr>
<td>Games</td>
<td>Intrinsically motivating audio visual effects, often lacking educational aims</td>
<td>Malone (1980)</td>
</tr>
<tr>
<td>Problem solving</td>
<td>Computers as milieu, Programming by children, derivation from Piaget's theory and Artificial Intelligence</td>
<td>Papert 1973)</td>
</tr>
<tr>
<td>Emancipatory models</td>
<td>Computer as labour saving device, task oriented: use of microcomputers and public information system</td>
<td>Lewis and Tagg (1981)</td>
</tr>
</tbody>
</table>
2.4.3 Computer Based Instruction (CBI)

Recent success in computer based instruction (CBI) have fuelled interest in an expanded role for computerized instruction. Based upon a comprehensive meta analysis of computer based learning, Kulik, Banggert and Williams (1983) suggested that the typical computer based instructional program produced a gain of 0.5 standard deviations over similar ‘conventional’ instructional programs for secondary school students. Computer based instruction results in a saving of instructional and learning time [(NREL) study (1980), Forman (1982), Kulik and Kulik (1985)].

2.4.4 Research on the effectiveness of Computer Assisted Instruction

A review of past CAI investigations reveals a number of important findings. Among them are the following:

1. CAI has been shown to be most effective in the areas of Science, Mathematics and foreign languages. Because of the nature of the subject matter, it has been less effective in reading and the language arts (Fisher, 1983; Merton, 1983).

2. CAI is at least as effective as traditional instruction and may actually lead to significant improvements in some subject areas (Holmes, 1982).

3. Children are highly enthusiastic about working with computers and academic motivation usually improves (Spencer and Baskin, 1983; Merton, 1983; and Fisher, 1983).
4. Students learn intended content at a faster rate, in some cases upto 40 percent faster when computers are used (Fisher, 1983; Gleason, 1981; Hofmeister, 1982 and Orlansky, 1983).

5. CAI appears to be most effective when used with either low achieving or high achieving groups rather than with entire student population (Fisher, 1983).

One reason for the effectiveness of CAI may lie in the fact that the computer is able to deliver focused instruction at a level of student need. According to Mason (1982), between 75 and 80 percent of a reading teacher's instructional time is spent giving directions and supervising students as they complete worksheets in noncomputer environments.

2.5.1 Studies on CAI in Abroad

Johnson, Johnson and Starre (1986) studied the effects of computer-assisted cooperative, competitive, and individualistic instruction in terms of achievement, student interaction, and attitudes. Seventy four eighth grade students were randomly assigned to conditions, stratifying for sex and ability. A 3x2 ANOVA was used to analyse differences between the conditions and between males and females.

The results of the study indicated that when computer assisted cooperative, competitive, and individualistic learning were compared, computer assisted cooperative learning promoted (a) higher quantity and quality of daily achievement, (b) accuracy of recognition of factual
information studied and (c) greater success in operating a computer programme. Students in both the cooperative and competitive condition performed higher on an achievement test than the students in the individualistic condition.

Sue (1986) carried out a study to investigate differences in recall and trials to criterion in a verbal learning task. A traditional method of presenting paired associated verbal learning was compared to a microcomputer interactive method when subjects were asked to learn CVC (consonant-vowel-consonant) trigrams of high or low intralist similarity. From the basic paired-associated learning task, high and low similarity lists of ten pairs were used. Both lists contained ten high frequency words used by Horowitz (1962) and matched with CVC trigrams. The trigrams appearing on both lists were matched according to their association value as determined by Archer (1960). The recall method of presenting the paired associated lists were utilized throughout the study in both the interactive (microcomputer) presentation and the traditional (5mm slide) method. There was no significant difference between microcomputer and slide treatments on verbal recall. There was also no significance effect in total number of trials to criterion on interactive and traditional treatment group. However, there was a significant difference between groups exposed to low similarity lists. The groups exposed to low similarity lists performed significantly better on verbal recall.

James (1987) carried out a study to see the effect of computerized tutorial programme on high school juniors and seniors, in terms of ACT scores.
The students were randomly assigned to an experimental group and a control. The control group used a text book approach to prepare the ACT and the experimental group used, a computerized tutorial. The results of the study showed that the experimental group scored significantly higher on ACT composite scores than the control group. No significant difference was seen in the ACT composite scores between juniors and seniors. A significant relationship was found to exist between a student background in mathematics and their ACT sub-test score in Mathematics. Students with the practical background scored significantly higher on the sub-test than those lacking the prescribed Mathematics background.

Matsumoto and Baba (1987) developed a sample Computer Aided Instruction programme for teaching addition of fractions with unlike denominators. The objective of the effort was to achieve the idea of individualization of instructions. It was found that students achieved more.

Niemice and Walberg (1987) carried out a critical examination of CAI (Computer Aided Instruction) and synthesized what was known about CAI at all levels of implementation. Evidences indicated that (i) CAI could teach as good as live teachers or other media could, (ii) there was a saving in time to learn, (iii) students responded favourably towards Computer Aided Instruction, that the computers could be used to accomplish impossible versatility in branching and individualizing instruction, because true natural instructional dialogue was possible and (iv) the computer could virtually perform miracles in processing performance data. The most valuable finding was that many students gained mastery status in a short period of time.
Richard (1987) carried out a study to ascertain the current status of computer supported writing activities in identified exemplary programmes within the state of California. A descriptive research design was employed. Utilizing an initial questionnaire from which the study sample was drawn to survey directors from each of the Teaching Education and Computer Centers, Language, Arts, and California writing projects. A second questionnaire was then implemented to query identified teachers who used computers during the writing process. Results showed a significant positive correlation between teachers' perceptions of success in writing instruction and use of computer supported writing activities. Particular teachers had feeling that computer supported writing increased students motivation to write and willingness to edit and revise their work.

Carol (1988) investigated the effects of presentation sequence (adaptive and inclusive) and generalisation formulation within rational sets of coordinate concepts and rules in computer based instruction.

Fifty five Florida state University students from Bio non-majors course were randomly assigned to four treatment groups (1) inclusive SME, (2) inclusive formulae, (3) adaptive SME, and (4) adaptive formulae.

A 2x2 ANOVA results showed significant differences between the adaptive and exclusive groups, however, significant differences were not found for retention. Further analysis revealed that the adaptive groups answered 35 percent of examples and needed 30 percent less time to complete the assignment while scored only five percent lower on the retention test.
Hugh (1988) carried out a study to examine the effects of computer-assisted instruction on the academic gains of students of sixth, seventh, and eighth grades in the subject area of maths and reading in a selected school of district. Findings showed that the students receiving direct CAI had significantly higher academic gains in both reading and maths when compared with the students of control group who were taught without the benefit of computers. When considered in conjunction with grade level, ability level, sex, ethnicity and socio-economic status, all had a significant effect on the academic gains of students using CAI. Only ability level, when considered in conjunction with grade level, had a positive effect on the academic gain of students receiving CAI in reading.

Woodward (1988) investigated the effectiveness of computer stimulation in enhancing student learning in a unit of health. The study involved 30 mildly handicapped students who were randomly assigned to one and two instructional groups: (a) structured teaching group and (b) a combination of structured teaching and a computer stimulation group. Post-test results indicated significant differences on basic facts and concepts that were reinforced by the stimulation. These differences were retained on a maintenance test given two weeks after the post-test. The most significant differences were on the test that measured problem solving skills. The results showed that the combination of structured teaching and computer stimulation was effective in teaching not only factual level of knowledge, but higher cognitive skills as well.
Cosmos (1988) have conducted a study in which two groups of students were gone through different treatment. Fifty-two 11th and 12th grade students were subjects of the research (ages 15 to 18), Twenty three students were assigned to the computer Based Individualized Instruction (CBII) which was called experimental group and twenty-nine students were assigned to the Traditional Group Institution (TGI) class called as control group.

Galnski (1988) studied the relationship between the use of microcomputer in Problem solving situation. ("The factory" Kosel and maths problem solving abilities) of seventh and eighth grade students of two private elementary schools. The study reviewed association of special ability, computer experiences and sex of the students with the changes in levels of students analysis, synthesis and maths problem solving abilities. Students were pre and post tested for two levels of critical thinking (analysis and synthesis), and levels of special abilities were given by using the Scott-Forsman Developing Cognitive Abilities Test (DCAT) (Beggs and Mouw, 1980). The test was a validated Mathematics problem solving test to demonstrate changes in the students ability to solve problem in Mathematics that corporate the levels of analysis and synthesis. Pre testing included a researcher designs computer experience instrument. Two groups (experimental and control) of at least 30 students were randomly assigned from each of the two schools for study.

Result of the study demonstrated that, the use of "the Factory" and traditional maths instruction was not significantly better than traditional
maths instruction plus other varied computer activity in enchanting junior high school students abilities to solve maths problems, analysis or synthesis information. Sex and computer experience were not associated with the change in maths problem solving analysing or synthesis ability. Spatial ability was weakly associated with the change in these variables.

Byrum and David (1989) investigated the effects of CAI on one-to-one and small group learners in terms of post-test scores. Subjects were 72 females and 14 males undergraduate students from instructional design classes at a mid-western state university. Subjects were randomly divided into two groups the original CAI program was given to one group and the treatment or the CAI programme revised using the small group method, given to another group.

Result indicated a significant difference to learner’s post-test scores on the CAI products revised using the two methods of formative evaluation over the original versions. There was a significant difference between post-test scores of the CAI products revised based on one-to-one or small group method of formative evaluation.

2.5.2 Studies in CAI Programme in India

As described earlier computer is quite new in Indian Education System. The investigator has come across the following studies conducted in computer Education in India.

Pravakar (1989) developed software for Computer Aided Instruction and studied its comparison with traditional method of teaching. The
objectives of the study were as follows: (1) to study the effectiveness of CAI for teaching “Semiconductor” in terms of achievement and reaction towards CAI material. (2) to compare the achievement of class IX students taught through CAI material with those studying through traditional method by considering pre-test as co-variate and by considering intelligence as co-variate; (3) to compare the achievement of male students taught through CAI material with female students by considering intelligence as co-variate. (4) to study the influence of treatment, sex and their interaction on achievement; (5) to compare the reaction towards CAI material of class XI students with those of class XII students by considering post-test as co-variate. Sample comprised of 58 students (12) from class XII and 46 from class XI selected randomly from three English medium schools at Indore. Results of the study were as follows: (1) The CAI was found to be effective in terms of achievement of the students belonging to class XI and XII. (2) The CAI material was found to be effective in terms of reaction of students belonging to class XI and XII. (3) The CAI material was found to be suitable to teach semi-conductor topic well to both classes XI and XII. students when pretest was considered as co-variate. (4) The CAI material was found to be significantly superior to the traditional method but no significant difference was observed when groups were matched with respect to intelligence. (5) The treatment, sex and their interaction did not influence the achievement. (6) Both class XI and XII students were found to have equally favourable reaction towards CAI material when the groups were matched with respect to post-test.
Beryah (1989) carried out a study on development of computer based library management system software. Objectives of the study were as follows: (1) To develop computer based library management system software. Sample comprised of 60 B.Ed. students selected alternately out of 120 B.Ed. students (1988-89) of SOE DAVV, Indore (MP). A library user questionnaire (LUQ) was constructed by the investigator.

Suggestions of the respondents with frequencies and percentages were as follows: (1) There should be easy access to the books (20.33%). (2) Books should be issued more efficiently (20.33%). (3) List of books present in the library should be made available subjectwise (3.5%) (4) The number of books which are used frequently should be available subjectwise (4.7%), (5) The status of the books should be known immediately (8.13%). (6) List of the issued books should be available (8.13%). The computer based library management system developed was found to be quite feasible and practicable.

Bharodway (1990) studied “Development of computer Aided Instructional Material on Microbes for class VIII.” Objectives of the study were (i) to study the effectiveness of computer aided instructional material for teaching microbes in terms of achievement, (ii) to study the reactions of students towards computer aided instructional material. Class VII students of Bright School, Indore were used for the study. CAI was found to be effective and interesting. Students reacted favourably towards CAI.

Mishra (1990) studied the “Development of Computer Aided Instruction software on Educational Technology for M.Ed.” The main objectives of the study were:
(1) To develop computer based evaluation software on educational technology (2) to study the reactions of students towards computerised testing for the study the M.Ed. students of IOE DAVV, Indore (1989090) were considered as sample post-test experimental design were employed.

Following were the findings of the study: (1) The computer based evaluation was objective, accurate, valid, reliable and comprehensive, (2) CBT was efficient and well organised. (3) computerised testing reduced the work load of teachers. (4) A computerised test can be used again and again (56). The mode of response and level of questions in computer based evaluation were appreciable (6) Computer based testing with respect to time and resources in economic was subject to future exploration. (7) Confidentiality could be mentioned while testing through computers in subject to further examination. (8) The non-English medium students faced difficulties while responding in English medium through computers. (9) A limited numbers of computers was an impeding factor in testing a large number of students. (10) The students were not trained in handling the computers for evaluation. (11) There was automation of evaluation through computers. (12) The students reacted favourable towards CBT. (13) Different students attempt different parallel items while testing through computers. (14) The scoring on the items and evaluation data-processing were done fast. (15) CBI facilitates the instructional proces to a large extent.

Mahapatra (1991) developed software package for teaching “Structure of Atom and Chemical Bonding” to class IX students and compared it
with traditional teaching. The objectives of the study were as follows: (1) To develop computer assisted instructional material and study its effectiveness in terms of students' achievement on criterion test. (2) To compare the adjusted mean achievement score of students studying through CAI with those students studying through traditional method by taking intelligence as co-variate. (3) To compare the adjusted mean abstract reasoning score of the students studying through CAI with those students studying through traditional method by taking intelligence as co-variate. (4) To compare the reaction of introvert with those of extrovert students studying through CAI. Sample comprised of 40 students from class IX were selected randomly from two English medium schools.

Results of the study were as follows: (1) The CAI was found to be effective in terms of achievement. 70% students achieved more than 60% marks on criterion test. (2) The CAI material was found to be effective in terms of achievement as compared to traditional method of teaching taking intelligence as co-variate. (3) It was found that the abstract reasoning score of the students studying through CAI was not found to be significantly higher than the traditional method of teaching group taking intelligence as co-variate. (4) The extrovert and introvert students have no significant change in their reactions towards CAI.

Adhikari (1992) studied "Development of Computer Aided Instructional Material on Cell and Cell reproduction for class IX."
Objectives drawn for the study were (1) to develop computer aided instructional material on cell reproduction and study its effectiveness in terms of (a) achievement of students (b) reaction of students studying through computer aided instructional material. (2) To compare mean achievement scores of the students towards the computer aided instructional material and traditional method by taking intelligence as the co-variate. The design of the study was pre-test post-test control group design. 40 students were taken for experimentation.

The findings of the study were (1) The computer aided instructional material was found to be effective in terms of achievement of students. (2) Students showed positive reaction towards computer aided instructional material. (3) Computer aided instructional material is effective in terms of achievement when both the groups were matched on intelligence.

Mahajan (1992) conducted a study "Development of Computer Based Question Bank Software for selection into Computer Education." A Computer based question bank was developed by the investigator on areas, namely, logical reasoning, arithmetical reasoning, English language ability, general awareness, and data interpretation. Science group scored significantly higher than Arts group in computer entrance test when pre-B.Ed. entrance test was considered as co-variate. Male and females did not differ significantly on achievement in computer entrance test when pre-B.Ed. entrance test was considered as co-variate. Maths and non-maths groups did not differ significantly on achievement in computer education when pre-B.Ed. entrance test was considered as co-variate.
Stella (1992) studied the impact of Computer Assisted Learning (CAL) material developed on the topic “The Language of sets in Mathematics upon the under achievers, normal achievers and over achievers. Sample was consisted of 147 students of class VII of Kanchi Kamakoti Matriculation School, Tiruchanapalli, Tamil Nadu. Main findings of the study were: (1) the CAI was an effective individualised instructional technique that helps under achievers of each, their optimum expected level of achievement. (2) it was found to be more effective for under achievers than both normal and over achievers in terms of achievement. (3) It was clearly seen that some of the normal achievers could be helped to become over achievers and the over achievers too could be helped to score better; though their gain was not found statistically significant.

Singh and Gupta, M. (1993) developed “Computer Assisted Instruction in Chemistry.” The main objectives of the study were (1) to design two strategies of computer assisted instruction (CAI) in Chemistry. Strategy I was consisted CAI plus teacher assistance with strategy-II was consisted only CAI. (2) To study relative effectiveness of two strategies in Chemistry. (3) To compare mean retention scores of two strategies of CAI in chemistry. (4) To study the opinion of students towards CAI. The design of the study was pre-test and post-test experimental design. 60 students of class VIII were used as sample.

The major findings of the study were (1) students of strategy-I scored significantly higher than the students of strategy-II in terms of their
mean gain scores and mean retention scores on the criterion tests. (2) Girls of both the strategies scored significantly higher than the boys of both the strategies in terms of their mean gain scores and mean retention scores on the criterion test. (3) Girls of strategy-I scored significantly higher than the girls of strategy-II in terms of their mean gain scores and mean retention scores on the criterion tests. (4) Boys of strategy-I scored significantly higher than the strategy-II in terms of their mean gain scores and mean retention scores on the criterion tests. (5) Students of both the strategies revealed highly favourable opinion towards CAI in terms of percentage of favourable responses. (6) Girls of both the strategies revealed more favourable opinion towards CAI than the boys in terms of the percentage of favourable response.

Shinde (1993) developed computer software for assessing research aptitude of education students. The objectives of the study were as follows: (1) To develop software for administering, scoring and numerical interpretation of research aptitude test. (2) To compare the mean achievement scores of research aptitude test through computer and paper-pencil test. (3) To determine the parallel test reliability of computer based test. The investigator selected 66 sample (33 male and 33 female) from different class of students of Institute of Education, DAVV, Indore. Data was collected by administering CBT and PPT. Data was analysed using Mann Whitney test.

Findings of the study: (1) The mean achievement scores of Hindi and English medium students on computer based test in English did not
differ significantly. (2) The mean achievement scores of Hindi medium paper-pencil group was significantly higher than that of English medium computer group. (3) The mean achievement score of Hindi medium students through paper-pencil test in Hindi was significantly higher than the mean achievement score of Hindi medium students on computer based test in English. (4) The mean achievement score of English medium students on computer based test and paper-pencil test did not differ significantly. (5) The computer based test was reasonably reliable.

Miss Kalamadi M.B. (1998) studied on “The development and evaluation of userfriendly micro computer software is an aid to school children in English Composition Writing.”

The objectives of the study

(1) To evolve an instructional programme in modular style incorporating the userfriendly features that assist school children in composition writing in English.

(2) To establish the effectiveness of the programme so developed through a suitable process.

(3) To develop a micro computer software using available expertise.

(4) To tryout and evaluate the micro computer software in terms of student gain and performance related measure.

The investigator developed microcomputer instructional modules to suit the need and evaluated the same. The statistical procedure used mean, SD and t-test.
Finding of the study is: (1) Micro-computer facilitated learning English composition using writing for the students (2) Effective individualised instruction is possible. (3) The students have achieved more with the help of micro software.

2.6 Conclusion

From above cited researches it can be that although majority of studies reported that the computer aided instruction could develop the achievement of students yet it may not be considered as a generalized statement, because there are so many variables which affect the achievement and all the variables have not been considered in the experiments. Further even the studies did not employ the common design. The research evidences cited above on the relationship between students characteristics and their achievement through computers are inconsistent and also insufficient. Some of the variables remain untouched hence the need is felt to do further researches in this area. As far as India is concerned few research have been conducted in the area of computer assisted instruction. As computer in education is a new emerging trend in India there is a scope for designing new experiments in the field. Keeping this in the mind the present study has been undertaken.

***