CHAPTER-II

REVIEW OF RELATED LITERATURE
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2.1 INTRODUCTION

Every piece of ongoing research needs to be connected with the work already done, to attain an overall relevance and purpose. The review of literature thus becomes a link between the research proposed and the studies already done. It tells the reader about aspects that have been already established or concluded by other authors, and also gives a chance to the reader to appreciate the evidence that has already been collected by previous research, and thus projects the current research work in the proper perspective.

A large part of review of literature actually needs to be done even before the research project is formalised. This is essential to make sure that you are not repeating the work that someone has already done earlier. Sometimes, if the research proposed by you has already been undertaken earlier, then it provides you an option of modifying your work by adding a new perspective or altering some of the methods of research to obtain a perspective that will be different from earlier works and thus more valuable. Occasionally, your work may be exact repetition of the work done earlier, but with a different set of data or sources of facts, and purpose of the research may just be see if your results are similar to earlier works or otherwise.

A good researcher usually goes through a lot more literature than is actually incorporated in the paper. This is because different literature may have differing relevance for the current project and all of it may not worth reporting in the end, but in the initial phase, when you are looking for all aspects of an issue that could be relevant one would like to extensively explore the literature and see if any relevant findings are
already available. Some of the literature reviewed is directly relevant and hence used as a preface to explain the background of work. Then other reports may be relevant from the point of view of the project as they provide some clues to the puzzle by suggesting a hypothesis, which may be the subject matter of your research project.

Lastly, review of literature is also important to highlight difference in opinions, contradictory findings or evidence, and the different explanations given for their conclusions and differences by different authors. In some cases, an analysis of these factors can help one understand may facets of a complex issue and at other times, such analysis can lead to a new possibility that can be researched upon in the current project. Thus review of literature is a very important part of one’s research.

To summarise, there is hardly any research project which is totally unrelated with research that has already taken place. Usually every individual research project only adds to the plethora of evidence on a particular issue. Unless the existing work, conclusions and controversies are properly brought about, most research work would not appear relevant, nor will it appear important in the whole framework. Thus, review of literature is a very important aspect of any research both for planning your work as well as to show its relevance and significance.

2.2. THE ‘WHY’ OF THE RELATED STUDIES

Review of related studies is a summary embodying the findings of other researchers in relation with the problem area. It provides comparative data to evaluate and interpret the significance of one’s findings. It also should serve to clarify the problem and give a justification for the study that will be done.
The purpose of this chapter is to record briefly the findings of few research studies carried out on various topics that are related to the problem under study. An essential aspect of a research projects is the review of the related studies. Such a review represents the third step of the scientific method outlined by Dewey and other educational philosophers and the student of research will find an exhaustive survey literature of what was already been done on his problem and indispensable step in solution.

Review of related studies is an essential step in educational research. In reflective thinking the second step is survey already available data should be considered a necessary step that would enable the research to base this rational argument for justification of the study.

2.3 PURPOSE OF THE RELATED STUDIES

The following are some of the purpose of such a task. Complete survey of related studies gives to the researcher necessary insight into the problem. It enables him to put forth vigorously the rationale for the study. It helps to orient the readers with the types of research. It suggests appropriate methods to tackle the problem under study. It helps to locate data that can be used in comparative interpretation of result. With due consideration of above statements the researcher has reviewed the related literature for abroad and India as well.

2.4 REVIEW OF LITERATURE IN ABROAD

The idea of computers used as a supplement to the standard form of teacher-student presentation within the classroom has been present since the 1960s (Hansen, 1968). With the introduction of computers beyond that of the laboratory, many different hopes and educational goals were formulated. The computer could serve as a means of
reinforcing the learned concepts through drill and practice (Hansen, 1968). The computer could function as a tutor (Brady & Hill, 1984; Tenney & Osguthorpe, 1990). The computer could also be used to free the teacher from presenting remediation sessions to spend more time engaged in quality teaching time (Antonietti & Giorgetti, 2006). While these hopes and goals have been partiality realized, due to the power and functionality of the present day computers, the hopes and goals have yet to be realized to the full extent intended.

With the change and advancement of computer technology, the need to understand the effect of this new technology on student learning has grown. Fundamentally the computer and related processes within the computer has not changed (e.g. binary functioning), but the ability to apply and use these processes have grown. As the applied use of computers has grown, so have the power, speed, and management of the processes of computers (e.g. increase in hard drive size, ability to manage a bigger volume of data). Computers have increased in their ability to hold, examine, manipulate, and display information. This increase led to changes in the way that people can interact with a computer including (a) entering, (b) using, and (c) displaying information. The interface of the computer has moved from a generally text-based or command line interface (i.e. entering a command of print or run and waiting for the resulting text output) to that of a graphical interface (i.e. the use a mouse or some other human interactive device to move a graphical icon across the screen or to another location within the computer) (Berg, 2000). This movement from text-based to graphical interface has helped broaden the population of computer users. Within the classroom, the move to a generally graphical interface has allowed for greater acceptance into the classroom and has increased the potential usability of the computer for both the teacher and the student.
With all the hopes and educational goals for computers within the classroom, relatively few first-hand studies have been completed, examining the use of computers in the classroom (Campbell, Milbourne, Dugan, & Wilcox., 2006). From the late 1960s to the 1980s, published research into the use of computer and computer applications as a learning medium reached its highest level. Since that time, the body of literature has focused mainly on non-empirical topics (i.e. personal progress, descriptive and theoretical papers) (Campbell et al., 2006). The 1980s and the 1990s talked of the theoretical advantage of using a computer with the population of students with learning disabilities (Hall, Hughes, & Filbert., 2000). The non-empirical publications provide some information about what has worked in particular situations with students and teachers as well as a means communicating theoretical directions for future research. However, no empirical information is provided for overall implications for general population’s of students and their learning process.

Computer Assisted Instruction (CAI) has been examined in a variety of different settings within both mainstream and special education population of students. There appears to be gaps in the amount of research surrounding the areas of spelling, reading, and, the use of computers for behavioral interventions (Dawson, Venn, & Gunter, 2000; Hitchcock, Dowrick, & Prater, 2003). With all of the excitement and potential viewed in the use of computers in the classroom and CAI, the findings from the conducted research may be over generalized (Brady & Hill, 1984). Only a limited number of large scale studies have been conducted. A majority of the studies used small population samples of less than 10, or have utilized post-high school students.

The purpose of this review is to examine two different areas of computers within education settings. The first area is focused on the how the interface between the students and the computers has evolved through the years. The second area is focused on different
types of interventions that have utilized a computer as a source of skill acquisition or skill improvement as well as the results of those interventions.

2.4.1. **Studies conducted Abroad on Computer Assisted Instruction**

A good number of studies have been conducted on computer Assisted Instruction in foreign context. Most of the studies have made an in-depth analysis. Such studies are enumerated under this sub-head.

**Adebola Dekoya, Jones Akangbe (1992)** conducted a study on the use of instructional methods and media technology in training of extension managers and supervisors in Nigeria. The main objectives of the study were: to determine the frequency of use, obstacle to use and felt training need in the user of instructional media resources and technology and to compare the perceptions of two respondent groups of management trainers concerning the three areas of investigation. The important findings of the study were: The two respondent groups tended to be mutually agreed on six of the ten obstacles to the use of instructional media and technology for the training of extension managers and supervisors at the Agricultural and Rural Management Training Institute. The respondent groups considered not only those obstacles that are present within the system or organization but also those that the training institute has no control over. The two respondent groups only differed in one area of training need. The respondent group of faculty members with five or more years of experience in the user of audio-visual equipment differed significantly from the group with lesser years in their perception of the training need in the user of video tape recorder / player for conducting course and programmes. Incidentally, microcomputer is ranked first, among the audio-visual equipment, and the respondents sought highest training in their use. The two respondent groups consider added training in the use of microcomputer as useful for improving their efficiency on the job or in the way they conducted training programmes and sessions.
Alan Brandy berry (2002) studied on the Effectiveness of Computer-Based “Game Show” Formats in Survey Courses: A Quasi-Experiment. The confluence of computers and integrated projection systems in the classroom has opened new avenues for course content delivery in an active learning format. This paper first discusses the concepts of active learning and play in a pedagogical context. Next, the implementation and subjective results of a generic computer-based game show for delivering course content in introductory survey courses is presented. This paper then describes the employed methodology and statistically tests certain aspects of the course related to the effectiveness of this implementation. The results of this quasi-experiment using five sections of an upper-division MIS (Management Information Systems) survey course spanning three academic terms strongly support the research hypotheses that the game show format increases student learning and improves student perceptions of the overall quality of the course. The implications of this research for educators are discussed. The game show application was developed by the authors and is available for download as freeware.

Alan Gunn et al. (2003) studied on the effectiveness of computer-based teaching packages in supporting student learning of parasitology. The usefulness of providing students with information via electronic notes, a website and a self-assessment quiz was assessed in three ways. Students’ perceptions of each package were gauged through questionnaires; their patterns of use of the electronic support were monitored via the computer system and the effect of provision of these materials on performance was measured by marks in the end of module examination. The results clearly showed that computer-assisted learning packages are at least as effective in imparting information as traditional lectures and that student’s value the opportunity to reinforce their learning through interactive lecture notes and self-assessment quizzes. However, students
definitely expressed the opinion that they would not like to have too much of their lecture
time replaced by computer packages and they seemed to require the option of
‘downloading’ the information onto a piece of paper for individual use. Therefore, it
seems that the teachers who are seeking new ways to teach students must avoid overuse
of computer-based packages and use other forms of student–directed learning, such as
problem-based tutorials, as well. Also, they should include at least as much contact time
with students as in a formal lecture programme if they are to support learning effectively.

**Benaloh, Lauril Anne Blake (1994)** conducted a study entitled teachers, students
and instructional software: What works well when and why. This research was an
exploratory study based on teacher and student evaluations of different teaching styles
while using instructional software. Three teaching styles (monitoring, co-ordination and
mediating) were used with each of three software packages in three grade 5 classes. The
classroom teachers and 18 students, selected to represent different preferred learning
styles were interviewed as to what they felt were the advantages and disadvantages of
each style / software dyad. Contrary to expectations, the effectiveness of the three styles
did not seem to depend on the primary instructional style of the teacher or on the
preferred learning styles of the students. Rather, these results suggested that, for optimal
effectiveness, all three styles should be used with every instructional software
programme. The mediating style provides demonstration of software, allows the teacher
to highlight the important concepts, and shows the students what achievement is possible.
Co-coordinated activities provide additional time and contexts for students to learn the
concepts. The monitoring style shows students to work with the concepts at their own
pace. Demonstrating these styles to teachers in their classes seemed very useful for
encouraging them to use the styles themselves.
**Dobbins, Renee, (1994)** undertook a study to measure the effectiveness of math computer assisted instruction with remedial students and students with mild learning / behaviour disabilities. The purpose of the study was to compare the performance of third and fourth grade students with mild learning / behaviour disabilities and selected disabilities when using the computerized programme. ‘math concepts and skills’ as measured by the in – line analysis provided by the programme. The major findings of the study were: There was a statistically significant difference between the gain scores of students with mild learning / behaviour disabilities and students in the chapter I programme when repeated measurement of gain scores were analysed over the three month period. There was a statistically significant difference within the group of students in the Chapter I programme when repeated measurement of gain scores were analysed over the three month period. There was not statistically significant interaction between the two groups of students and time when repeated measurement of gain scores were analysed over the three month period.

**Elmore, Partricia Venshew (1992)** made an analysis of fifth one computer modules designed to enhance the knowledge, skills, and attitudes needed by teacher education students. This study analyses and report the findings of students’ reactions to a set of 51 computer modules called Performance Element Modules (PEMs). These modules focused on selected knowledge, skills and attitudes needed by teacher education students. The main objectives was to assess whether students will accept the 51 computer – assisted modules as viable instructional tools. The major findings revealed a mean score of 7.73 for ‘user friendliness’ of the computer. For involvement and interaction of the computer programme (modules) a mean score of 7.3 was reported. Did the modules help students correct a lack of information or improve a skill? a mean of 7.12 was reported which was interpreted as an indication that the modules were viable instructional aids.
Imhanlahimi et. al (2008) studied on an Evaluation of the Effectiveness of Computer Assisted Learning Strategy and Expository Method of Teaching Biology. The study assessed the effectiveness of computer assisted learning strategy and expository or traditional method of teaching biology using lumen Christi International high school, Uromi, Edo State Nigeria as a case study. The study which was a true experimental design: randomized, two groups, pre-test, post-test control group, involved sixty (60) senior secondary class one (SSC 1) students of the high school. The instrument for the study consisted of six essay questions based on three selected topics from SSC 1 curriculum. Data were analyzed using t-test statistics and analysis of variance (ANOVA). Results showed that expository method of instruction was superior to computer assisted learning strategy in teaching biology. Besides students taught through co-operative or interactive computer assisted learning strategy achieved significantly higher than those taught through individual computer assisted learning strategy. Recommendations were offered based on the result of the study.

Linda et.al (2010) studied on availability, effectiveness, and utilization of computer technology by high school mathematic teachers. The design for this study was descriptive-comparative. First, it sought to provide a demographic profile of the participants. Second, it sought to determine significant differences among teachers with different years of experience on the levels of availability, effectiveness, and utilization of computer technology. It also sought to determine significant differences among teachers in different size school districts on the levels of availability, effectiveness, and utilization of computer technology. The survey instrument was developed and administered to 74 math teachers. Results showed that teachers are having problems accessing computers and a strong need for more curricular-based software exists. Data showed that computer technology is helpful in instructional procedures and in the student learning process.
Nilgün Tosun (2006) studied on the effect of computer assisted and computer based teaching methods on computer course success and computer using attitudes of students. The purpose of this research was to investigate the effects of the computer-assisted and computer-based instructional methods on student’s achievement at computer classes and on their attitudes towards using Computers. The study, which was completed in 6 weeks, was carried out with 94 sophomores studying in formal education program of Primary Teaching Department of Education Faculty at Trakya University. The participants were distributed into experimental and control groups by pre-test post-test control group design. A computer attitude scale, a level-designation test and a practice test were used to collect the data. To evaluate the data, t test was used in the program of SPSS 12.00. According to the study results, the students receiving computer-assisted instruction during their computer classes showed higher success on the practice test than the students taking classes with computer-based instructional methods. Additionally, a considerable difference has not been seen in the attitude of the students towards using computers from the other standpoints of the study.

Nishino, Alan Koki (1994) undertook an exploratory investigation to determine the effects of a multimedia computer – based science learning environment and gender differences, on achievement and attitudes and interests of students in an eighth – grade science classroom. This study employed an exploratory investigative approach which utilized a quantitative two-by-two experimental factorial design. An analysis of covariance was utilized to adjust for any initial differences. The purpose of the study was to determine the relationship of a multimedia computer based science learning environment and gender differences on achievement and attitudes and interests of students in an eighth grade science teaching methodologies while the experimental group received instruction science teaching methodologies while the experimental groups
received instruction using a multimedia computer based science learning environment. The relationships found were, students in the experimental classroom has a significantly higher post text mean score in ‘self concept’ than the students in the traditional science classroom. Female students in the experimental classroom had a significantly higher post-test mean score on ‘self perception as a student’ than both the males and females of the traditional sciences classroom and the males of the experimental classroom. Students in the experimental classroom had a significantly higher post-test mean score on the Hueneme Computerised Instruction Test on science than the students in the traditional classroom.

Oğuz Serin (2011) studied on the effects of the computer-based instruction on the achievement and problem solving skills of the science and technology students. This study aims to investigate the effects of the computer-based instruction on the achievements and problem solving skills of the science and technology students. This is a study based on the pre-test/post-test control group design. The participants of the study consist of 52 students; 26 in the experimental group, 26 in the control group. The achievements test on “the world, the sun and the moon” and the Problem Solving Inventory for children were used to collect data. The experimental group received the computer-based science and technology instruction three hours a week during three weeks. In the analyses of data, the independent groups t-test was used at the outset of the study to find out the whether the levels of the two groups were equivalent in terms of their achievements and problem solving skills and the Kolmogorov-Smirnov single sample test to find out whether the data follow a normal distribution and finally, the covariance analysis (ANCOVA) to evaluate the efficacy of the experimental process. The result of the study reveals that there is a statistically significant increase in the
achievements and problem solving skills of the students in the experimental group that received the computer based science and technology instruction.

Ramazan Basturk (2005) studied on the Effectiveness of Computer-Assisted Instruction in Teaching Introductory Statistics. The focus of this study is to demonstrate and discuss the educational advantages of Computer Assisted Instruction (CAI). A quasi-experimental design compared learning outcomes of participants in an introductory statistics course that integrated CAI to participants in a Lecture-only introductory statistics course. Reviews of participants’ identical midterm and final exams scores demonstrated that participants in Lecture-plus-CAI section obtained higher averages on midterm and final exams than participants in the Lecture-only sections and these higher averages likely were because of their better performance on concepts and practices that were taught in both regular lecture and CAI course. In addition, when the topics of the introductory statistics course moved from descriptive statistics to inferential statistics, the learning gap between Lecture-only and Lecture-plus-CAI is increased. Findings suggest participants’ learning capacity of the introductory statistics could be improved successfully when CAI used as a supplement to regular lecture in teaching introductory statistics course.

Regser, Gail Renee (1991) conducted as study on effects of computer education on students’ achievement, attitude and self – esteem. This study was designed to a) examine the effects of computer education on students’ achievement, attitude and self – esteem and b) investigate the relationship between success with computer instruction and personality characteristics, IQ, age and attitude towards school. The major findings of the study were, there were interesting students’ gains in effective areas such as attitude and self esteem. Students receiving computer instruction agreed more strongly with positive
attitude statements. There were no sex related differences in achievement, attitude and personality characteristics.

**Robert, Michael (1994)** made a comparison in the effectiveness of the delivery of an interactive computer – assisted instruction module to a traditional lecture / lab delivered module. This study examined the use of a computer based multi - media interactive learning system to determine if the learning of a conceptual predictive technological concept was more effective with interactive computer assisted instruction (ICAI) or with traditional instruction (TI). The main findings was, that learners in the experimental group (ICAI) that scored 3 or 37.3% (19/51) on the pre-test had a significantly higher adjusted mean post-test score than learners in the control group.

**Schmidt, Susan Carol (1991)** made a study on technology for the 21st century: The effects of an integrated distributive computer network system on student achievement. The effects of an integrated distributive computer network system with Wasatch ILS courseware on reading, math and language achievement of sixth grade students were investigated over a period of eight months. Major conclusions reached were that the integrated distributive computer network system was more effective than traditional instruction in increasing reading, math and language achievement for low achieving students. It was as effective as traditional instruction in increasing achievement for high achieving students. It has had positive effects on students’ motivation, attitude, instructional task persistence, and the organization, quantity and quality of student writing.

**Tenyankam Mc Donald (1994)** made a study on learner controlled lessons in co-operative learning groups during computer based instruction. This study investigated the effects of studying alone or in co-operative learning groups on the performance of high
and low achievers. The study also examined the effects of computer based instruction using either learner or programme control. This study concluded that both high and low achievers in the co-operative treatment increased achievement on programme controlled and learner controlled computer lessons. The learner controlled co-operative learning group made more options while checking their concept learning, and spent more time interacting with the learner controlled computer based tutorial, than the learner controlled individual learning group.

**Winter, Christina Surrence (1994)** devised a strategy for identifying when interventions should occur in computer assisted instruction. The main purpose of the study was to develop, describe and demonstrate a system for assessing the normative or expected progress of pupils who are engaged in learning through computer – assisted instruction. A model is built which would enable an instructor to intervene and needed in the student’s learning, thus encouraging early intervention of pending learning problems.

### 2.4.2. STUDIES CONDUCTED ABROAD ON TEACHING LEARNING MATHEMATICS

Studies conducted abroad on teaching mathematics are presented under this subheading.

**Benhow, Camilla Persson (1992)** Studied ‘Academic Achievement in Mathematics and Science of Students between Ages 13 and 23: Are There Differences among students in the Top One Percent of Mathematical Ability?’ The predictive validity of the mathematics subtest of the Scholastic Aptitude Test (SAT-M) was investigated for 1996 mathematically gifted (top 1 percent) seventh and eighth graders through academic achievements assessed over 10 years. The SAT-M appears to have predictive validity for differentiating highly able seventh and eighth graders.
Blune, G.W. (1984) made “A review of research on the effects of computer programming on Mathematical problem solving” and concluded that learning of computer programming has effects on thinking skills or other cognitive skills or other cognitive skills such a Mathematics. The effects are generally restricted to problem solving skills most similar to those involved in the programming itself.

Bob Lumpkins et.al (1991) conducted an experimental study on “Effectiveness of Instructional Equity for Low Achievers in Elementary School Mathematics”. The major purpose of this study was to test the effect of an innovative programme designed to help low – achieving fourth and fifth grade students to increase their achievement in Mathematics. Attention was also given to the effect of this programme on other achievers to determine whether their achievement would be positively or negatively affected. The findings of the study clearly suggest the conclusion that this programme was effective with both low and normal achievers. Factors such as the grouping strategies, lesson plan designs and extended class period for mathematics, instructional methodologies and teacher expectations played a vital role.

Brookhart, Susan (1995) Studied ‘Effects of the Classroom Assessment Environment on Achievement in Mathematics and Science’. The effects of classroom assessment environment (CAE) variables on yearly achievement in mathematics and science in grades 7 through 12 were studied through the Longitudinal Study of American Youth (LSAY), using cohorts of approximately 3,000 students each in the 7th and 10th grades who were followed for 4 years. While the LSAY did not include all CAE variables of theoretical interest, it did include reasonable approximations of many. The direction of CAE effects was consistent for some variables and inconsistent for others. Percent of homework corrected and returned to students has a negative effect whenever it appeared. Hours of homework on time had positive effects when they appeared. Percent of class
time used for testing and evaluation has significant effects only on mathematics achievement two negative and one positive). Frequency of oral reports has a significant negative effect for science, while frequency of written reports and mixed effects. Results do show some CAE effects, and CAE theory does explain some, but no all, of these effects. Results support the beginnings of a theory explaining the relationship between classroom assessment and students achievement.

**Brookhart, Susan (1997)** studied ‘Effects of the Classroom Assessment Environmental on Mathematics and Science Achievement’. Data were obtained from the 1987-1991 Longitudinal Study of American Youth for this study of secondary students. Beyond the expected effects of gender, socio-economic status, reading ability, and prior achievement, homework effects were found for mathematics achievement; and homework and assessment format effects were found for science achievement.

**Bulgren, Janis, et.al (2000)** studied ‘The Use and Effectiveness of Analogical Instruction in Diverse Secondary Content Classrooms’. They explored the use of analogies while teaching important concepts in secondary content classrooms containing students of diverse abilities. Measures included 1) student’s knowledge of concepts 2) the numbers and types of analogies teachers used, and 3) teacher and student satisfaction. Results revealed that teacher use of the routine led to increased student retention and expression of information.

**Calhoun, et.al (1997)** made a study on “The Mathematics Reform Movement: Assessing the Degree of Reform in Secondary Mathematics Classrooms”. This paper explores the nature and status of the mathematics reform movement (focusing on California’s initiatives) in America’s public schools, the connection between the reform movement and constructivist epistemology, the development of an assessment tool for
measuring the degree of reform present in a secondary mathematics classroom, and the potential for investigating the relationship between the degree of reform and student achievement. Data analysis supports the notion that measuring the degree of reform is possible and several instruments have a statistically significant degree of correlation with the expert rating. A discussion of future considerations is included and cautions against the use of rhetoric about reform now that research based methods are available to measure the degree of reform.

**Confrey, et.al (2002)** made ‘A Content Analysis of Exit Level Mathematics on the Texas Assessment of Academic Skills: Addressing the Issue of Instructional Decision – Making in Texas’. High stakes tests are increasingly used to monitor systemic improvements in mathematics and teachers are expected to rely on the results of such tests to adapt their instructional practices. Texas Assessment of Academic Skills (TAAS) were examined over a period of three years to examine to what extent its results can be used to guide instructional decision – making. The results of an expert content analysis of the 10th grade TAAS mathematics test for 1999, 2000 and 2001 revealed that the problem solving objectives mask significant content emphases. Further the variation in raw scores by objective across grades and years to show this information is not reliable enough to guide changes in instruction. The sampling of topics within the objective to gauge the distribution across topics attempted unsuccessfully to account for changes in difficulty using a combination of changes in sampling, item characteristics and composition of distracters. This leads us to question the utility of providing teachers raw data by objective and points to the urgency of developing better methods to link content analyses and psychometric methods of scoring.

**Delon (1970)** conducted a field test of Computer Assisted Instruction in I grade Mathematics and found that a CAI programme significantly increased the Mathematics
achievement of disadvantaged I graders. However by the beginning of the following II year the differences between the CAI and the control classes had completely disappeared.

**Field, Dennis Wayne (1999)** made a study in ‘Comparison of Applied Mathematics Skill Levels for Students Enrolled in Applied versus Traditional Courses at Secondary Schools’. Linear modeling of data from 591 low a secondary students (grade point average, state percentile rank, and Work Keys test scores) revealed disparities in prior academic achievement and Work Keys math scores between students in applied academics and students in traditional academic courses.

**Goodlad (1984)** opines in ‘A place called school proposals for the future’ that homogeneous grouping based on achievement or ability tends to favour middle and high groups, but it all too often does not help the low groups. Moreover, once a student is assigned to a particular ability group in reading or mathematics in the first grade, a strong probability exists that he or she will never be reassigned to a higher ability group for the remainder of the student years in school. Hence, the gap in academic performance between low and high achievers increases each day.

**Gustin, et.al., (1994)** investigated ‘Mathematical and Verbal Reasoning as Predictors of Science Achievement’. Analysis of the relative contribution of age, gender, and verbal and mathematical reasoning abilities (measured by subtests of the Scholastic Aptitude Test) as predictors of success in accelerated secondary science courses found that a composite of verbal and mathematical reasoning ability was the most powerful predictor and verbal reasoning ability was the strongest single predictor.

students from grossly under-resourced schools as well as for placing students into a diversifying first – year curriculum. The study highlights the process by which the test questions were developed and piloted further it discusses the reliability of the test and correlations with subsequent mathematics performance.

**Haller and Colleagues (1993)** concluded, ‘While large schools offer more advanced courses than do small ones, those offerings appear to have to influence on average levels of student achievement’ In other worlds, according to these researchers, a more narrow in rural curriculum in mathematics did “not” depress higher – order mathematics thinking (as measured on the LSAY tests). The researchers “did” find a positive relationship (“r” = + .38) between proportion of students enrolled in more advanced courses and achievement levels. A problem with the Haller study is that national averages obscure a great deal of variation – specifically regional and state achievement variation – in mathematics test scores. State and regional variation require critical analysis for several reasons. First, the ultimate authority for schooling rests with states, and management of their school systems can differ sharply. Second, regions of the nation exhibit sharp differences in economies, cultures, ethnicities, and the structure of schooling. Third, despite an average exhibiting parity of mathematics achievement, rural areas exhibit overall differences from the national norm that are still important to policy and administration (e.g., differences in school and district size). Without attention to these sources of variation, educational research cannot inform improvement efforts. Fortunately, within this small literature, Fan and Chen (1999) examined the issue of “regional” variation in mathematics achievement, whereas Lee and McIntire (2000) addressed “State” variation in their study.

**Howley, Craig (2003)** made a study, on ‘Mathematics Achievement in Rural Schools’. This study examines the best evidence available on mathematics achievement in
rural schools and offers recommendations for further research. Findings on the mathematics achievement of secondary students are presented, based on analyses of the National Assessment of Educational Progress (NAEP) in 1996 and 2000, the Longitudinal Study of American Youth in 1987-89, the National Educational Longitudinal Survey of 1988, and NAEP for 1992 and 1996. Nationally, no mathematics achievement gap was found between rural students and students in non-rural, suburban, or urban classifications. A rural, non-rural achievement gap was found in 40 percent of states—half the time it favored rural students. Conditions of schooling accounted for a large proportion of the variance associated with state-level achievement gaps. These findings refute charges of rural inferiority in relation to national averages. School and system characteristics are listed that might influence mathematics learning and that should be researched in the rural context.

NAEP Reports of Rural Mathematics Achievement

In both 1996 and 2000, the National Assessment of Educational Progress (NAEP) mathematics scores of students in rural and small-town schools exhibited some statistically insignificant negative differences from the national average at all grade levels tested. Although insignificant differences are sometimes interpreted as harboring practical significance, about a consistent pattern in the directionality of such differences (i.e., positive or negative), such inferences are unwarranted. Two inferences about NAEP trends do seem warranted, however. First, across 25 years of testing and regardless of locale definition, there has been little change in increase or decrease in the mathematics performance of rural students. Second, with rare exceptions, the recent performance of rural students at all NAEP grade levels barely differed from the national average. They observed, insignificant differences are small, they sometimes favor rural and small-town schools, and they harbor no practical implications.
Current Research on Mathematics Achievement in Rural Areas

NAEP reports consist largely of descriptive data; seldom do they test hypotheses or develop fine-grained explanations of the accurate descriptions they provide. Only empirical studies with an explicit base in theory can offer such explanations. The extent of research literature is thin, but three recent quantitative studies provide a surprisingly comprehensive picture of mathematics achievement among rural students. Haller and colleagues (1993) examined the 1987-1989 mathematics scores of 10th grade students on tests administered by the Longitudinal Study of American Youth (LSAY). The Haller team sought to explain the lack of statistically significant findings in previous inferential studies (not summarized in this Digest) as a possible case of inappropriate testing: the result of using norm-referenced tests with reputedly inauthentic items not deemed to represent higher-order thinking. Rural schools, after all, offered fewer advanced courses than other schools, and such a shortcoming might yield deficient higher – order thinking among graduates of rural schools. The researchers characterized the LSAY mathematics test as more reflective of higher-order thinking.

Mason, Lucia (2003) studied that the ‘High School Students’ Beliefs about Mathematics, Mathematical Problem Solving, and Their Achievement in Mathematics’: This cross-sectional study examined Italian high school student beliefs about mathematics and mathematical problem solving by exploring the use of a 36 item self – report questionnaire. The study reported that a substantial replication of the instruments, with exception of one scale, was no reliable. It found that the four scales predicated achievement in mathematics of different extents.

Maccoly, Jacklin (1974) conducted that sex differences were well established with three cognitive constructs: Mathematical performance, verbal ability and spatial
visualizing ability. Those differences appeared fairly consistently in early adolescence in over 50% of the students.

Olszewski-Kubilius et al. (1990) studied on ‘Predictors of Achievement in Mathematics for Gifted Males and Females’. The article explores the value of three categories of factors in predicting achievement in fast-paced mathematics classes for 108 high ability adolescents: ability, previous experience and exposure to the content area, and individual student characteristics. Previous experience variables were the most important in predicting learning outcomes.

Slavin (1985) conducted that the study on ‘Team Assisted Individualization combining co-operative learning and individualized instruction in mathematics and found TAI to be very effective in increasing student mathematics achievement. In 6 studies involving students in grades III to VI, Students in TAI classes gained an average of twice as many grade equivalents in Mathematics computation as traditionally taught students. That is, where traditional classes achieved the expected one year gain. TAI students achieved the equivalent of 2 years gain.

Star, et. al (2002) conducted a study on ‘Assessing Students’ Conceptions of Reform Mathematics’. As the use of National Science Foundation (NSF) sponsored reform – oriented mathematics curricula has become more prevalent across the U.S., an increasing number of researchers are attempting to study the “Impact” of reform. In particular, mathematics educators are interested in determining whether reforms are having the desired effects on students, particularly with respect to the learning of mathematical content and the improvement of attitudes about mathematics. In this effort, researchers have used a variety of methods, and have looked at a variety of variables, in order to assess the impact of reform. In many cases, such research assesses reform by
looking closely at students’ scores on tests or their strategies for solving certain kinds of problems. For example, Riordan & Noyce (2001) assessed reform’s impact by comparing students’ scores on standardized achievement tests. Other researchers have used structured interviews, classroom observations, and more interpretive or ethnographic methods to assess the impact of reform. Both of these methodologies are useful in assessing the impact that reform mathematics curricula are having on students. An alternative evaluation of the impact of reform that has not been as widely used is through the use of survey instruments. Surveys have been widely and reliably used to assess students’ motivation (Pintrich, Smith, Garcia, & McKeachie, 1993), beliefs and attitudes (Kenney & Silver, 1997), and interest (Killer, Baumert, & Schnabel, 2001). We propose to add to this literature by using a survey to study the impact of reform on students’ conceptions of mathematics.

**Street, Peter (2001)** studied that ‘The Role of Motivation to the Academic Achievement of Gifted Secondary Students’. This qualitative study investigated the role of motivation in academic achievement by gifted secondary students in five Australian schools. Results found that “personal pleasure in achievement and long-term goals” was the most significant motivational factor, positive links with a teacher was a high occurrence factor, and competitive environments maintained motivation.

**Silson, et.al (1993)** studied that ‘The Predictive Validity of Student Self-Evaluations, Teachers’ Assessments, and Grades for Performance on the Verbal Reasoning and Numerical Ability Scales of the Differential Aptitude Test for a Sample of Secondary School Students Attending Rural Appalachia Schools’. For 301 students in grades 8 through 12 in 4 rural Appalachian schools, the ability of several School – related variables (including self – evaluations, teachers’ evaluations, and grades) to predict performance on 2 scales of the Differential Aptitude Test was studied. Teacher
perceptions and student self-evaluation are moderately valid predictors. The preliminary study for the International Study of Educational Achievement (IEA) forum of the United States (1961) has identified ten categories of behavioural outcomes in mathematics as listed below.

1. Ability to remember or recall definitions, notations
2. Operations and concepts.
3. Ability to interpret symbolic data
4. Ability to put data into symbols
5. Ability to follow proofs
6. Ability to construct proofs
7. Ability to apply concepts to non-mathematical problems
8. Ability to apply concept to mathematical problems.
9. Ability to analyze problems and determine operations which may be applied.
10. Ability to invent mathematical generalization.

**Wood’s item Banking Project in England (1968)** evolved that the five levels of mathematics behaviours based on Bloom’s Taxonomy of Educational objectives. They are given below:

1. Knowledge and information: Recall of definitions notations, concepts.
2. Techniques and skill : Computations, manipulation of symbols
3. Comprehension: Capacity to understand problems, to translate symbolic forms, to follow and extend reasoning.
4. Application of appropriate concepts in unfamiliar mathematical situations.
5. Inventiveness reasoning creativity in mathematics.
The National Longitudinal Study of Mathematical Abilities (NLSMA) model developed by the School Mathematics Study Group (SMSG) in 1969 consists of four cognitive levels in mathematical outcomes. James W. Wilson who was involved in the classification schemes of the National Longitudinal Study of Mathematical Abilities (NLSMA), the Standard Project of School Mathematics Advisory Committee (SMAC) and the National Assessment of Educational Progress (NAEP) incorporated the above classification schemes and expanded the classification of mathematical outcomes by including in affective outcomes too.

2.5 REVIEW OF LITERATURE IN INDIA

2.5.1. STUDIES CONDUCTED ON COMPUTER ASSISTED INSTRUCTION

Computer education and computer assisted instruction have come into the arena only very recently in Indian context. Though India has marked a milestone in the computer field which is reckoned all over the world, researches on CAI are still of preliminary in nature. Only very recently this has attracted the attention of the researchers. Recently encouraging studies have been made on the attributes as well as on the effectiveness of CAI as instructional strategy. Such studies are listed out under this sub – head.

Jagjit Singh (1993) probed that into Integrating Computers in Education. The main objectives of the study were, to provide prospective teachers with basic information about a range of computer application, to identify ways the computer may improve the teaching – learning process, to introduce and build on the concept of integrating computers in the classroom and to emphasis the idea of co-operative learning culture within a technological environment. The study concluded that, it is important that technology be used to help children think critically and creatively and to engender a co-
operative learning environment. By teaching the Education Students to use technology wisely, it is hoped that future teachers will successfully incorporate technology into their classrooms and add to that definite push that we in educational institutions are already experiencing.

Jayachandran (2007) studied on Computer Assisted Language Learning (Call) As a Method to Develop Study Skills in Students of Engineering and Technology at the Tertiary Level. The language teacher, who has the prime objective to develop study skills in learners, seeks to make an effective use of the computer-assisted language learning method. An analysis of the methods discussed so far leads the researcher to conclude that it is ultimately the teacher who has to be more innovative, more resourceful, and more thoughtful to create awareness in students about the importance of the study skills in English and to provide opportunities to practice the language by using CALL.

Kanmani et. al (2009) studied on the effectiveness of CAI package in basic electronics teaching. In the experimental and control groups, 22% of the students had high level of gain score. There was a significant difference between the control and the experimental group students in the gain scores. Hence, the experimental group students are better than the control group students in the gain score. It is inferred from the finding that the experimental treatment is effective to the students. There is a significant difference between the control and the experimental group students in attainment of knowledge level objective in the gain scores. Hence, the experimental group students are better than the control group students in attainment of knowledge level objective in the gain scores. There is a significant difference between the control and the experimental group students in attainment of understanding level objective in the gain scores. That is the experimental group students are better than the control group students in attainment of understanding level objective in the gain scores. There is a significant difference between
the control and the experimental group students in attainment of application level objective in the gain scores. Hence, the experimental group students are better than the control group students in attainment of application level objective in the gain scores. There is significant association between the habit of journal reading and gain score of control group students. Hence, the control group students gain score and their habits of journal reading are closely associated.

Madhur Gupta (1989) studied that the two strategies of Computer assisted Instruction in chemistry. The main objectives of the study were, to design two strategies of computer – assisted instruction, to study the relative effectiveness of two strategies of computer assisted instruction in chemistry and to compare the mean retention scores of two strategies of computer assisted instruction in chemistry. The study concluded that the students under the first strategy scored significantly higher than the students under the strategy II in terms of their mean gain scores and mean retention scores in the criterion test.

Mridula (2001) studied on Science Teaching through Computer Assisted Instruction. Students were given rating scales or rubrics to rate the usefulness of various features included in the presentation. Most students reacted very positively to these features. The response of students to CAI has been overwhelmingly positive. It led to greater inter-student interactions. ‘t’ tests for comparison of pre and post-test means have revealed that CAI has in every case led to increased achievement. Its efficacy has never been found to be less than regular classroom teaching or regulated self-study from textbooks. In 92% cases, it has proved superior. While visually enhanced and non-enhanced presentations were equally effective in bringing about learning, the former led to better long-term retention. Differences were observed in the way girls viewed the presentations as compared to boys. Girls were far more systemic, followed a linear mode
of viewing, and took much longer to view the presentations. Teachers who saw the presentations were keen on using them in their classrooms.

**Rama Kondapalli (2005)** studied on Transformational Value of ICTs in Teacher Education:Leanings from India. This study focuses on the success stories of Indian Teacher Education Institutions in ICT application, integration and use for and in the teacher training programmes, on issues and challenges associated with use of ICT in enhancing teacher quality and enabling and enhancing the ICT use in the associated schools. It also attempts to put forward the new opportunities and benefits to the system. This paper also attempts to look at the efforts put in by Government of India, the corporate interventions and the institutional efforts in Integrating ICT in teacher education with an aim to bring a transformation in teaching learning and improving teacher quality. To some extent attempt has also been made to look at the challenges the institutions and the Governments may come across in implementing and integrating the ICT at various stages of teacher preparation and the perceived threats.

**Reddy and Ramar (1995)** concluded that the study to Assess the Effectiveness of computer assisted instruction in teaching science to slow learners. After the experiment, the slow learners in the experimental group evinced better mean gain than the control group slow learners. Also, they could narrow down the gap between them and the normal group students. The narrowed down gap between both the groups may be ascribed to the effectiveness of CAI. But the authors are silent over the feasibility of CAI in Indian school setting where most of the schools do not have even a single computer.

**Sarupria, (2005)** studied that Status, Issues and Future Perspectives of Computer Education in Senior Secondary Schools. (i) Computer Education Programme (CEP) started in a majority of schools in Rajasthan after the class project in 1986 and was being
run on the contract basis in two-third of the schools. (2) Most of the schools had computer laboratories with basic computer facilities, but there were certain issues that need immediate attention like; status of contract computer teachers in terms of salaries, teaching experience, permanent appointment of staff and in-service training; budget for CEP; dissatisfaction of students towards the quality of study materials; lack of correlation between theory and practice; guidance given by teachers during practical classes; and the ICT policy of the state of Rajasthan for implementing CEP in schools. (3) The status of CEP was particularly poor in government and rural schools when compared with private schools and urban schools respectively. (4) Students possessed high level of interest in CEP and an average awareness towards Internet. (5) Most of the experts predicted a promising future of CEP in schools by 2012 AD in all respects except hardware maintenance and availability of computers for all students. (6) Experts did not foresee any substantial improvement in the status of CEP in rural government schools.

Sivakumar, et. al (1994) conducted a study on Effectiveness of Computer Assisted Instruction, Laboratory Centered Instruction and Conventional Classroom Teaching in Technical Education. The objective of the study was to compare the relative effectiveness of CAI, LCI and classroom teaching in terms of the achievement of polytechnic students. The main finding was that the direct learning experience given through laboratory centered instruction is far superior to self – instructional strategy and conventional classroom teaching. As students remember the experience gained through the direct experience for a longer period of time, it is recommended that the teachers adopt such strategies in regular classroom teaching.

Stella (1993) conducted that the study on Effectiveness of computer Assisted Instruction with Special Reference to underachievers. The objectives of the study were, to find out the effectiveness of the CAI Software with special reference to underachievers, to
find out the impact of the teacher support system on the achievement of underachievers, to find out the relationship between the achievement of the experimental group and the variables like sex, locale, study habit, maths study attitude and achievement (over, under) level and to find out the interaction effect of treatment and the variables on the achievement of the experimental group students. The study concluded that, the teacher effectiveness is an important criterion that would affect the success of the teacher support system. Since they study has established the significant impact of teacher support system on the underachievers, CAI may further be used for those with poor study habits, and low and average IQ. The study has shown a favourable result with regard to these.

Thube et. al (2003) studied on the effectiveness of computer assisted teaching of geometrical optics at undergraduate level. Computer is an educational tool mostly used in designing and running experiments, exchange of information, visualization and so on. In class room the computers can be used to promote learning. This paper reports an effort of developing a computer base resource material using Microsoft Power Point named as PPRM. The PPRM contains sequences from everyday life, step by step diagram development; mathematical steps highlighted with different colour combinations, previous examination questions with solutions etc. This is expected to be an effective teaching aid. Primarily the development efforts are focused on Optics as a subject. Care has been taken to ensure all round development of students’ visualization, understanding and retention. The paper describes the development aspects of the resource material and the educational research carried out to study its effectiveness in teaching.

Vadiraj Udupa et. al (2009) studied on Evaluating Effectiveness of Traditional Learning versus Computer Assisted Learning in Orthodontics. The objective of the current prospective randomized study was to evaluate effectiveness of traditional lecture as compared to CAL process on study model analysis for undergraduate dental students.
The study comprised of forty students randomly allocated to two groups stratified on pre-test GPA scores. One group received traditional lecture and the other received the CAL module. The effectiveness was assessed immediately and ninety days after the teaching process by paired ‘t’ test. There was significant improvement in the knowledge gained in both groups however difference between the two groups were statistically insignificant immediately after the teaching process. After retention period it was observed that the CAL group retained the knowledge significantly better than the traditional lecture group. It was concluded that CAL can be an effective teaching aid and should be seen as complimentary to other contact teaching methods more suited for clinical skills and attitudes.

**Vasudha Kamat, et. al (2005)** studied on Enrichment of learning experience of rural children through Interactive Multimedia. In general, this study has found that learning through interactive multimedia is feasible and is a viable alternative to the traditional classroom which has proved to be limited in achieving the necessary needs of the students in the modern learning context. Students were positive towards active learning and were confident in enforcing self-paced strategy. This is a viable learning strategy and should be encouraged for rural learners as well.

### 2.5.2. STUDIES CONDUCTED ON TEACHING AND LEARNING MATHEMATICS

Various studies have been undertaken applying different instructional strategies to teach mathematics at different levels. Such studies are summed up under the sub heading.

**Bhardwaj (1987)** conducted a study on ‘Standardization of a comprehensive Diagnostic Test and preparation of Remedial Material in Mathematics for middle
standard students of Haryana’. He found that there was significant improvement in achievement of the students after they had gone through the remedial exercises.

**Chitkara (1985)** concluded that study on “The Effectiveness of Different strategies of Teaching on Achievement in Mathematics in Relation to Intelligence, sex and personality” with the following objectiveness.

(i) Whether achievement in Mathematics was affected by different strategies of teaching.
(ii) Whether different strategies has differential effects on achievement of male and female students.
(iii) Whether levels or intelligence interacted with teaching strategies in terms of achievement.
(iv) Whether personality acted as a potential factor in selection of teaching strategy.

His findings were:

(v) All the three strategies, namely (a) lecture discussion (b) inductive drill (c) auto instruction group discussion, were found to be equally effective in terms of achievement in mathematics disregarding levels of intelligence sex and personality type.

(vi) Boys and girls of superior ability did not show any significant difference between their means cores on achievement in Mathematics.

**Das and Barga (1968)** conducted a study on “Effect of Remedial Teaching in Arithmetic with grade VI pupils”. He investigated that the CBC in General was found to be more effective than the existing curriculum in developing cognitive competencies in the methodology of teaching of Mathematics.
Dharmaraj (2001) in his study on “Learning Difficulties in Mathematics” has pointed out areas where the students encounter problems in learning mathematics, and he has studied in depth the awareness of teachers about the learning difficulties in mathematics. After a through investigation, he arrives at conclusion that the students experienced difficulties in learning concepts such as

1) Analytical Geometry
2) Differential calculus
3) Integral calculus
4) Probability

He further points out that, in spite of the voluminous literature available, still some teachers do not have adequate awareness about the learning difficulties of students in mathematics. He concludes that in service training and orientation programmes will go along way in enabling the teachers to identify the problem areas and to devise appropriate instructional strategy to overcome the problems of the students.

Doshi (1989) conducted “A study of Achievement and Cognitive preference styles in mathematics of Class X students”. The major findings were:

1. The majority of arts and commerce students manifested the R-P-A-Q order cognitive preference styles.
2. The questioning style among different groups of students and teachers was found to be the last.
3. Rural female students were more inclined to check the Recall (R) style as compared to rural / urban male students.
4. There was an insignificant relationship between cognitive preference styles and achievement in mathematics.
5. Knowledge scores were positively correlated with questioning at the low level.

Gakhar (1986) studied “Home variables as Determinants of Mathematical Concepts Learning” with the following variables.

1. Father’s presence or absence
2. Family size
3. Birth order
4. Father’s income
5. Parent’s education

He concluded that some variables such as father’s presence or absence; family size and birth order are not related to significant variations in mathematical achievement, but the variables such as father’s income and parent’s education are potentially effective in causing significant differences in the learning of mathematical concepts.

Grewal (1982) studied ‘Achievement Motivation and Anxiety as Related to Academic Success in Mathematics’ with the following objectives.

1. To investigate how the measure of anxiety affects the success in mathematics.
2. To find out the effect of achievement motivation on achievement in mathematics.
3. To study the relationship between the measures of achievement motivation, anxiety and success in mathematics.

The findings of the study are furnished below. The group with single level of anxiety shows poor academic performance in mathematics. The group with low – level anxiety tends to achieve higher. On the other hand, the group high in achievement performance much better than a group low in achievement and vice-versa. It was finally concluded that
subjects with low anxiety and high motivation have better academic achievement in mathematics than any other combination of anxiety and motivation.

Girija Devi Thampurathy (1994) explored the socio-economic status of creative high achievers and create low achievers in mathematics with the objective.

(i) The high achievers in mathematics differed significantly from low achievers on eight of Murrays needs.

(ii) Several scales of EPPS discriminated between the high and low achievers in mathematics and could be used as possible non-academic predictors and achievement in mathematics.

Gupts (1972) found out in his study of 180 boys and 176 girls of standard VII that attitude towards mathematics improves significantly, when command over basic skills improves.

Hariharan (1992) investigated into ‘Attitudes of High School Students towards Homework and their Achievement in Mathematics’, with the following objectives.

1. To measure the attitudes of high school students towards homework in mathematics.

2. To measure their academic achievement in mathematics and

3. To find out the relationship between the attitudes of high school students towards homework and their achievement in mathematics.

The study arrived at the following conclusion:

1. Girls were better than boys in their attitude towards homework.
2. Urban students were higher than rural students in their attitude towards homework.

3. Private school students were higher than the government school students in their attitude towards homework.

4. The attitudes of high school students towards homework were related to their achievement level in mathematics.

**Husen to their Postlewaita (1986)** reported that a consistent finding of many investigations is that teachers who like mathematics and do their best to make it interesting can definitely create favourable attitude and positive students’ motivation in the subject.

**Jain (1982)** found that no sex differences were noticed among the group offering in I.Q creativity and level of intellectual developments. He ascertained that there is significant relationship between the score of each problem and the total problem solving ability. He suggested that the teaching should help the students in doing problems by asking logically sequenced questions.

**Jain and Burad (1988)** made a study on ‘Low Results in Mathematics at Secondary Examinations in Rajasthan’, to find out the causes related to low results and to give suggestions to remove them. The studied conducted that 1) non-availability of mathematics teachers due to late appointment and frequent transfers, lack of appropriate classroom black boards and other physical facilities, irregular attendance of students, teachers’ habit of leaving the headquarters daily, and lack of residential facilities in some difficult areas were the administrative causes. 2) A low standard in the lower classes, non-availability of text books, lack of timely correction of homework, an overburdened and uninteresting curriculum, lack of child – centered teaching, overcrowded classrooms, lack of sufficient periods for the subject, use of ‘pass books’ and guidebooks’ by most of the
students, scarcity of teaching material for mathematics, and lack of proper supervision were the academic causes.

**Jeganathan and Soundaraja Rao (1977)** investigated the ‘Reasoning and problem solving abilities in High School Students in Coimbatore’. Their sample consisted of 300 pupils from seven different management schools in rural and urban areas. They were administered two tests viz problems solving and verbal reasoning tests. In addition to these two tests a short questionnaire was also used to collect personal data. The findings of the study are as follows:

1. There was a highly significant correlation between verbal reasoning and the reasoning involved in problem solving.
2. There existed a highly significant positive relationship between problem solving scores and reasoning involved in the solving process.
3. There was a highly significant positive relationship between problem solving scores and verbal reasoning.
4. There was no difference in the problem solving ability between boys and girls. Girls were superior to boys in verbal reasoning.
5. There existed a highly significant positive, relationship between the ability in problem solving and the performance in the school examinations.
6. There was no significant positive relationship between the ability in verbal reasoning and the performance in the school examination.

**Kasat (1991)** conducted an ‘In – depth Study of the Causes of the Large Failures in Mathematics at S.S.C. Examination of Marathi medium High school students in Palghar Tahsil’, with the following objectives.
1. To find out whether low intelligence and poor numerical ability are the reasons for failures in mathematics, and


The study arrived at the following conclusions.

1. Low intelligence, poor numerical ability, poor comprehension and recall ability, no interest in mathematics and poor study habits were the causes of the large failures of boys and girls.

2. It was found that techniques like the Dalton Plan and group work were not followed by the teachers while teaching.

3. The teachers found that the mathematical curriculum was no child – centered. Topics such as percentage and shares were difficult in arithmetic; the circle, circle-arc and area, similarly, were difficult to teach in geometry.

4. Percentage, rational algebraic expression, variations, probability and statistics were difficult topics in mathematics.

5. The parents being illiterate could not help the children at home. There were no finances for audio – visual aids in the schools.

Lalithamma (1973) studied the ‘Factors Affecting Achievement of Secondary School Pupils in Mathematics’. The study revealed that there was positive relationship between the achievement in mathematics and Socio-economic status as was evidenced from significant contingency co-efficient obtained while relating the two variables.
**Majula Soundarajan (1994)** conducted an experimental study on “Developing the problem solving Ability of XI Std. Students in solving problem in Differential Calculus” with the following objectives.

1. To identify and categorize the problem in solving strategies in solving problems in differential calculus among XI students.
2. To identify the impact of problem solving session on their problem solving ability.

The study concluded that there was no significant mean difference between the pre-test and post-test scores of control group students and there was significant mean difference between the Experimental group and control group students in the post-test mean scores.

**Maria Ara Selvi. (1996)** Studied the ‘Effectiveness of Educational Audio - Video Cassettes in Learning Mathematics’. The main objective of the study is to develop audio and video cassettes to teach Mathematics for the students of class VIII. Other objectives were:

1. To find out the achievement of the students in mathematics when they were taught through traditional method.
2. To find out the achievement of the students in mathematics when it was taught through appropriate audio and video cassettes.

The implications of the study were:

1. Audio and video cassettes can be used for auto learning. Thus it can cater to individual differences.
2. Teachers have a great responsibility to prepare and present them to the students.
3. The services of subject resource persons can be made available to a wide range of students’ population in the form of audio and video cassettes.
4. As the students expect that teachers should add more to what they know, this method can fulfill their needs.

5. Audio and video cassettes can be developed on various subjects prescribed for various standards by NCERT, SCERT and even by commercial agencies, so that the schools can easily procure them for their ready use.

6. Since this method enhances the achievement of the students especially the below average and the average students it will minimize wastage and stagnation in our school system.

Mondkar (1984) made a study on “Factor Analysis of some Tests in Number systems in the Mathematics syllabus prescribed from June 1972 for Std. VIII”. He found a conclusion that the ability to learn number system was chiefly composed of three factors, (viz) General intelligence, Number Factor and perceptual factor.

Nagarathinam (2006) studied ‘Problems in Learning Mathematics for XI Standard Students’. The major findings of the study are:

1. The majority of the students faced problems in learning mathematics due to lack of interest, complexity of the concept, lack of speed and accuracy, lack of other or extra support systems.

2. The girls face more problems than the boys.

3. Tamil medium students face more problems than the students in English medium.

4. The day scholars face more problems than the hosteller.

5. The mixed (co-education) school students face more problems than the unisex school students.

6. Unaided school students face more problems than the other school students.
7. Government School students face more problems than the aided school students.

8. The other school system students face more problems than the State Board system students.

**Patel (1984)** made “An Investigation into the Mathematical ability of pupils of classes IX and X in the context of some cognitive and effective variables’. He came to the conclusion that there was significant difference between mean scores of pupils of Urban and rural areas. Hence norms for these two areas were established separately.

**Ramar (1994)** investigated into the “Effectiveness of Multimedia Based Modular Approach with special references to Low achievers”’. The results of the study proved that multimedia based modular approach was more effective than the traditional lecture method in teaching all the subjects of Standard VII to the low achiever. The study also revealed that this multimedia based modular approach enable the low achievers to cope with normal students to a considerable extent.

**Rao Raghavendra (1986)** made ‘An investigation into the relative effectiveness of teaching mathematics’. He gave a conclusion that there was no significant difference in achievement in mathematics when taught by the guided discovery and expository approaches.

**Rao (1983)** conducted ‘A comparative study of programmed learning and conventional learning methods in the instruction of mathematics’. He found that the mean performance scores of the programmed learning group and conventional group on the achievement test were less than the normative means of the test.

**Reddy and Ramar (1995)** conducted an experimental study to assess the effectiveness of multimedia based modular approach in teaching mathematics to low achiever. The main objectives of the study were:
1. To develop multimedia based modules for standard VIII mathematics.

2. To find out the achievement of low achievers in standard VIII while taught through traditional lecturer method.

3. To find out the achievement of low achievers in standard VIII when mathematics is taught through multimedia based modular approach.

Major findings of the investigation were:

1. The experimental group low achievers significantly improved their achievement in mathematics after the experiment.

2. The multimedia based modular approach enabled the experimental group low achievers to cope with normal students in learning mathematics to a great extent.

3. The effectiveness of the multimedia based modular approach was proved by the narrowed down gulf of difference between the achievement in mathematics of the normal students and that of the experimental group low achievers.

4. Multimedia based modular approach had an edge over the traditional lecture method in advantage and effectiveness.

Reddy, et al., (2000) devised special teaching techniques to enhance the achievement of slow learners in mathematics. They have laid down

1) Content sequence

2) Use of Concrete manipulative

3) Pacing of content coverage

4) Modes of presentation
They also give guidelines to teachers to make adoptions in presentation of instruction. Adaptation in presentation in instruction can be, made by the teachers in three ways.

Realizing the importance of devising instruction so as to suit to the gifted students who usually aspire for professional courses, the same authors suggest the following techniques for enhancing their achievement in mathematics. These techniques have been verified to be effective in teaching gifted and talented students in general education.

i) Self-directed learning

ii) Curriculum compacting

iii) Learning centers

iv) Independent Study

v) Learning contracts

These techniques will enable the gifted student to make use of the full potentials and to make the utmost achievement. The suggestions made by these authors have provided adequate guidelines to devise special instructional strategy for this study.

Reddy, et.al., (2000) in their book on ‘Learning disabilities’ have enumerated the problems areas in mathematics and they have provided useful guidelines as to how to tackle those specific complex concepts. Their suggestions include.

i) Importance of Number Readiness

ii) Importance of Number Relationships

iii) Highlighting Decimal Nature and inter-relatedness.
Ramar (1994) studied ‘The achievement of low achiever’ in mathematics. He prepared modules for the selected units of mathematics and supplied to the students in the form of a handbook. After the experimental period, the low achievers have significantly increased their achievement in mathematics. They made a rate of progress amounting to 73%.

Rastogi (1986) studied on ‘Mathematical abilities: Problems and importance’ pointed out nine mathematical abilities taken out from mathematical thought.

1. An ability to formalize mathematical material, to isolate the type from content, to abstract from concrete numerical relationships and spatial forms and to operate with formal structure.

2. An ability to generalize mathematical material to detect what is of chief importance, abstracting from the irrelevant, and to see what is common in the externally different problems.

3. An ability to operate with numerals and other symbols.

4. Ability for sequential, properly segmented logical reasoning, which may result in the need for proof substantiation and deductions.

5. An ability to shorten the reasoning process to think in curtained structure.

6. An ability to reverse a mental process (to transfer from a direct to a reverse train of thought)

7. Flexibility of thought and ability to switch from one mental operation to another, freedom from the binding influence of the common place. This characteristic thinking is important for the creative work of a mathematician.
8. A mathematical memory, a memory for generalization, formalized structures and logical schemes.

9. An ability for spatial concepts, which is directly related to the presence of a branch of mathematics such as geometry.

In short, it is the fact that success in performing a mathematical activity requires a certain combination of personality traits. Some abilities without being combined with an appropriate orientation of personality or of its emotional volitional sphere cannot in themselves result in high achievement, even when they are of high level.

**Rosaly (1992)** studied ‘The Relationship between Attitude of Students towards Mathematics and Achievement’, with the following objectives.

1. To construct and attitude scale to measure the attitude of high school students towards learning of mathematics.
2. To construct an achievement test in mathematics, and
3. To find out the relationship between attitude and achievement in mathematics.

The study concluded that 1) the attitude of high school students towards leaning mathematics and their achievement in mathematics were related, 2) urban girls had a more positive attitude towards mathematics than rural girls, 3) similarly, urban boys had a more positive attitude towards mathematics than rural boys, 4) girls were higher than boys in their achievement in mathematics and 5) urban girls were higher than rural girls in mathematics.

**Singh (1986)** made, ‘A study of some possible contributing factors to high and low achievement in mathematics of the high school students of Orissa’. The main findings were:
1. Achievement in Mathematics was positively and significantly related to Intelligence SES and study attitudes.

2. Intelligence study attitude and SES contributed in this order of importance to discrimination between the high and low achieving groups.

Somasundaram (1980) conducted ‘A comparative study or certain personality variables related to over-normal and under achievement in secondary school mathematics. They study shows that the variables of social standards, introversion, families relations, test anxiety and community relations discriminated between under achievers and non under achievers.

Sumangala (1995) investigated into ‘Some Psychological Variables Discriminating between High and low Achievers in Mathematics’. The objective of this study was to see whether some psychological variables like mathematics, aptitude (and its components), attitude towards mathematics and self concept in mathematics could discriminate significantly between high and low achievers in mathematics and if so, to find the extent of relation of these variables with achievement in mathematics. The main findings were that high achievers and low achievers were significantly different with regard to each of the independent variables. The mathematics aptitude of high achievers is favorable when compared to that of the low achievers and the self – concept in mathematics of high achievers is ‘higher’ when compared to that of the low achievers in mathematics. Achievement in mathematics is related not only to cognitive variables like intelligence, aptitude etc., but also to the affective variables like attitude towards mathematics and self – concept in mathematics.

Sundaravalli (2005) studied on ‘Problems of Teaching Mathematics at Secondary Level in Rajapalayam Taluk’ and arrived at the following conclusions.
1. Utilizing community resource for Mathematics teaching was a major problem faced by the high school mathematics teacher. This problem would be solved by providing in service and refreshment courses to teachers as to how to mobilize community resources and also utilize them for mathematics teaching in an effective way.

2. Publishing a mathematics manuscript and magazine was another serious problem represented by the high school mathematics teachers in Rajapalayam Taluk. This problem could be solved by conducting a separate workshop with the assistance of subject experts as to how to prepare mathematics manuscript and also how to publish the same so that High School teachers will be benefited.

3. The problem of conducting exhibitions is schools may be due to lack of interest among the students, as mathematics is a difficult subject for most of the students. So this problem could be solved by crating interest in the subject and then by making it easy to learn.

**Thind (1990)** investigated into ‘Effect of Parental Education and Occupation on the Mathematical problem Solving Ability of Students of Grades VII and IX’ with the following objectives:

1. To determine the effect of parental education and occupation on the mathematical problem – solving ability of Grade VII and Grade IX rural and urban students.

   The studied concluded that 1) the education of the father had no effect on the problem – solving ability of rural as well as urban children.

2. The mother’s education has no impact on rural children’s problem – solving ability whereas the problem – solving ability of urban children was affected by the mother’s education. 3) The father’s occupation indicated no effect on both rural
and urban children’s problem – solving ability. 4) The occupation of the mother also showed no effect on rural and urban children’s mathematical problem – solving ability.

2.5.3. STUDIES CONDUCTED ON SLOW LEARNERS

Najma Iqbal Malik et al., (2012) studied on Effect of Academic Interventions on the Developmental Skills of Slow Learners was a single-group pre-test and post-test design; it was conducted to see the effectiveness of academic interventions (Shaw, 2005) on developmental skills (adaptive, personal-social, communication, motor, and cognitive) of slow learners having borderline intelligence. Eight slow learners were identified through subjective ratings based on teacher’s appraisal and attained achievement scores in respective grades and scores attained on Raven’s Colored Progressive Matrices (CPM; Raven, Court, & Raven, 1977) during screening. Boys (n = 6) and girls (n = 2) of ages ranging from six years to six years and 11 months of age were purposefully selected from two private-sector schools of District and Tehsil Sargodha, Punjab, Pakistan. Developmental skills of slow learners were measured by Battelle Developmental Inventory (BDI-2; Newborg, 2004); assessment and screening was followed by academic intervention. Quantitative analyses revealed that academic interventions were highly effective in enhancing the developmental skills of slow learners’ adaptive, communication, and cognitive developmental skills. However, these interventions remained silent and failed to show any positive effect on personal social and motor skills.

Sangeeta Malik (2009) investigated that the impact of intervention training on mental abilities of slow learners, 40 slow learners of 5-6 years old of Hisar district were selected. These slow learners were divided into two categories i.e. experimental (20) and control group (20). Impact of intervention training revealed marked improvement in
mental abilities of experimental group. Most of the children of pre-testing stage were in the category of low to moderate mental abilities. After intervention the experimental group performs better in all the activities of verbal, perceptual performance, quantitative and memory aspects of mental abilities.

**Burgner, Dawne (2010)** concluded that have been conducted related to students identified as slow learners who are enrolled in general education classes. In this research study, the definition of a slow learner describes the student as one who has not been identified as a student with a learning disability. The purpose of this study was to investigate how three Illinois middle schools addressed the academic and social needs of students identified as slow-learning students who did not qualify for access to special education services.

The literature review introduces research studies and historical information that focus on education legislation, characteristics of the slow-learning student, and the academic and social needs of the slow-learning student. A qualitative case study approach was used to examine a pilot program that focused on addressing the needs of slow learners and was implemented by the schools as a portion of their Response to Intervention (RtI) plans. Data were collected through interviews, classroom observations, and document reviews provided by the participants: three administrators, three general education teachers, and three members of the special education support staff. Findings revealed that school teams that consisted of a group representative of the entire staff displayed high levels of collaboration. The findings showed that teachers who were successful in working with slow learners had developed skills to address students' cognitive and motivational needs. The findings also indicated that school teams that had maintained an interactive communication process were able to develop interventions through a collaborative process. Implications arose from the findings to indicate that by
working toward continual improvement of the collaboration process and keeping the lines of interactive communication open, school teams should be able to provide the foundation for slow learners to raise their levels of academic achievement and improve their organization and social skills. While this study focused on the work of the adults who are involved in the planning and implementation of an intervention program for the slow learner, future studies that focus on the effectiveness of the interventions and the perceptions of the slow learner would be appropriate.

Daniel Willingham, John Wiley (2011) revealed that ‘What can we do for slow learners’ The point of this chapter is to emphasize that slow learners are not dumb. They probably differ little from other students in terms of their potential. Intelligence can be changed.

This conclusion should not be taken to mean that these students can easily catch up. Slow students have the same potential as bright students, but they probably differ in what they know, in their motivation, in their persistence in the face of academic setbacks, and in their self-image as students. I fully believe that these students can catch up, but it must be acknowledged that they are far behind, and that catching up will take enormous effort. How can we help? To help slow learners catch up, we must first be sure they believe that they can improve, and next we must try to persuade them that it will be worth it.

Krishnakumar et al., (2011) concluded that the significant number of children with scholastic backwardness in normal schools are slow learners. The aim of the present study was to evaluate the effectiveness of an individualized education program (IEP) for slow learners, modeled on resource room training in normal schools.
Burgner, Dawne (2010) Few research studies have been conducted related to students identified as slow learners who are enrolled in general education classes. In this research study, the definition of a slow learner describes the student as one who has "not" been identified as a student with a learning disability. The purpose of this study was to investigate how three Illinois middle schools addressed the academic and social needs of students identified as slow-learning students who did not qualify for access to special education services. The literature review introduces research studies and historical information that focus on education legislation, characteristics of the slow-learning student, and the academic and social needs of the slow-learning student. A qualitative case study approach was used to examine a pilot program that focused on addressing the needs of slow learners and was implemented by the schools as a portion of their Response to Intervention (RtI) plans. Data were collected through interviews, classroom observations, and document reviews provided by the participants: three administrators, three general education teachers, and three members of the special education support staff. Findings revealed that school teams that consisted of a group representative of the entire staff displayed high levels of collaboration. The findings showed that teachers who were successful in working with slow learners had developed skills to address students' cognitive and motivational needs. The findings also indicated that school teams that had maintained an interactive communication process were able to develop interventions through a collaborative process. Implications arose from the findings to indicate that by working toward continual improvement of the collaboration process and keeping the lines of interactive communication open, school teams should be able to provide the foundation for slow learners to raise their levels of academic achievement and improve their organization and social skills. While this study focused on the work of the adults who are involved in the planning and implementation of an intervention program for the slow
learner, future studies that focus on the effectiveness of the interventions and the perceptions of the slow learner would be appropriate.

Khasnavis, Gerald (1979) stated that the slow learners in the elementary social studies classes have been mostly ignored because of (1) improperly trained teachers in this area; (2) overcrowded classrooms; and (3) inadequate instructional resources. Our article proposes that the teachers first identify the slow learners. Then, apply the following useful approaches: Child-centered education; Established rules in the classrooms; Simplified textbooks and instructional materials; Focus on familiar current events; use of: the Unit approach, the Inquiry approach, Community Resources, Dramatic Plays and Role Playing, Self-directed free time, Student Research, Field Trips, Story Telling, Debates, Political Cartoons, Educational Television and Radio, Art, Games, Bulletin Boards, Scrap Books, Inductive Approach, Verbal Praise, and Tradebooks. Mostly, slow learners are more successful when allowed to participate in classroom activities at their own level.

Sugapriya, Ramachandran (2011) reported that using models along with verbal instructions while teaching make all sensory organs involved and enhance the power of understanding and learning process. In this study they evaluated the visual memory in slow learners by teaching with computer animated models and assessed their improvement in academics by conducting summative examinations. They analyzed 60 first year MBBS students, 30 students who scored less than 40% consistently in formative examinations and failed in summative examinations, with an attendance of more than 60% were in the experimental group and 30 students who scored less than 40% consistently in formative examinations and failed in summative examinations but had a regular attendance were in the control group. After ethical clearance and consent from the participating students, we conducted small group tutorials for the control group and
sessions using computer animated models for the experimental group in the first week. We exposed both the groups to lectures for 5-7 weeks. After 8-10 weeks, we conducted written exams in the form of multiple choice questions for both the groups and analyzed their results statistically using student's t’ test. There was a significant improvement in academic performance in slow learners in the experimental group than those in the control group. This present study suggests that teaching the slow learners with computer animated models is an excellent strategy of teaching compared to verbal instructions which improved their learning process and academic performance. Slow learner's are also known as slow bloomers. There is nothing wrong with being a slow bloomer. Some flowers grow and bloom super fast. Some persons seem to be soaking but they build their foundation with care and skill. The sun rises one morning and bloom. Likewise slow learner's bloom in a major way. A slow learner is not a diagnostic category. It is a term people use to describe a student who has the ability to learn necessary academic skills, but at rate and depth below average of the same age peers. In order to grasp new concepts, a slow learner needs more time, more repetition and often more resources from teachers to be successful. Reasoning skills are typically delayed, which makes new concepts difficult to learn: Slow learners have traditionally been identified as anyone with a full scale IQ one standard deviation below the mean but not as low as two standard deviations below the mean. He learns slower than average students and will need additional help to succeed [1-6]. Teachers would teach to the majority by the class and the slow learners were often left behind. Keeping them in mind this study was aimed in improving slow learners by teaching with model & charts.

Sangeeta Chauhan (2011) stated that human resource development should be at the focus of any educator for a developing country like India which has abundant human resources. In the Indian system of educational, it is observed that the human resources-
teachers and learners are underdeveloped and perform less than their capabilities. The
learners and underdeveloped in the sense that they are not achieving in tune with their
capabilities. Even some of the most efficient teachers are not adequately equipped to
identify and guide the backward students like slow learners to reach their optimum levels.
As a result, the institutions in tune are not able to send their products into society as fully
developed learners. To ensure this we need special educational programmes for backward
children like slow learners.

**Lata Pujar, Gaonkar (2008)** conducted a study on instructional strategies to
accelerate science learning among slow learners was carried out in Dharwad city during
2004. The sample consisted of 122 slow learners identified by using screening methods.
The experimental group students were taught by using different instructional strategies
and control group students were taught through conventional method of teaching. The
intervention was carried out for a period of four months. The results indicated that the
teaching through models for slow learners was found to be the most effective
instructional strategy followed by charts, picture book, individual instruction and peer
tutoring.

**2.6 AN OVERVIEW OF RESEARCH REVIEWED**

A critical study of the research woks done so far reveals that only a attempts have
been made to assess the effectiveness of Computer Assisted Instruction. The same state of
affair is seen in the foreign context also. It has been confirmed that CAI programmes are
effective with regard to achievement of cognitive objectives mostly at knowledge,
understanding and application levels as well as development of certain learning skills.
Immediate gain and retention of newly acquired information’s have been found up to
expected level among students using CAI Programmes. The CAI has been found very
effective in the case of school level as well as at college level subjects covering different areas such as science, mathematics, languages, social sciences, home sciences etc.

Though there are large numbers of studies on the effectiveness of CAI, only some studies have been undertaken in India on computer application and on effectiveness of computer assisted instruction for slow learners. In India it is an emerging area of research in educational technology. The major focus of the studies on computer assisted instruction has been on development of CAI software for different subjects at school and college stages; studying their effectiveness in terms of achievement, teachers’ and students’ reaction towards CAI; comparisons of CAI with traditional method of teaching and uses of computers in different areas like daily teaching, management of education, library, examination and guidance activities but not on different types of learners.

All studies conducted on the effectiveness of CAI indicate favourable results in terms of achievement of instructional objectives. Moreover, the CAI materials have been found to be superior to traditional mode of teaching. In all cases, greater learning gains have been evinced (Stella, 1993; Mahajan, 1992; Elmore, 1992; Robert, 1994; Schemidt, 1992; Benaloh, 1994; Nishino, 1994).

The Review of related Research reveals different programmes of CAI and the achievement of students in general. But adequate studies have not been made to study the effectiveness of CAI in teaching mathematics for slow learners. Moreover, sufficient studies have not been undertaken slow learners.

We are passing through an era of auto instruction and improved educational technology. To keep pace with the developed countries we have to accentuate the human resource development to a great extent and, that too, at the earliest possible time. This envisages special instructional strategies to boost up the performance of slow learners in
mathematics which is the Queen of all sciences and which influences the learning of other sciences. Since auto instruction is the trend of the time, it will be very much in the interest of student population to undertake more researches on CAI application in teaching various subjects. The present study is an earnest attempt to develop CAI programmes and to measure their effectiveness in teaching mathematics to the slow learners where it helps them to be a productive human resource for our country.

The statement of the problem of the study is presented in the forthcoming chapter.