CHAPTER II- REVIEW OF RELATED LITERATURE FOR THE STUDY

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2.01 Purpose of the review

Koul, L (2008) stated the following purpose,

"Review of the related literature; besides, allowing the researcher to acquaint himself with current knowledge in the field or area in which he is going to conduct his research, serves the following specific purpose:

- It helps the researcher to understand particular trend and locate the gaps in research areas of his/her interest.
- The review of related literature enables the researcher to define the limits of his field.
- By reviewing the related literature the researcher can avoid unfruitful and useless problem areas. He can select those areas in which positive findings are very likely to result and his endeavour would be likely to add to the knowledge in a meaningful way."

Educational technology is an important aspect of educational system. It is extensively used to provide effective teaching learning process in the classroom. Realizing the importance of CAI as an instructional tool various researches were conducted and its effectiveness was tested. In this section investigator has provided available related literature keeping the present study in view. A total of 61 studies have been reviewed to develop a holistic perspective of the objectives and findings of these studies and to arrive at the implications to support the present study.

The researcher has reviewed various national studies conducted in the area of present study, which enabled the researcher to think in the line of the study.

The order of arrangement of review of related literature

1. Research on high failure rates in mathematics
2. Review of related studies in mathematics for improvement of Learning and Teaching of Mathematics
3. Studies conducted for mathematical weakness
4. Review of literature related to PLM
5. The related literature in the field of Computer Assisted Instruction conducted in India
6. The related literature in the field of Computer Assisted Instruction conducted in abroad

2.02 Research on high failure rates in mathematics

(Jain & Burad 1988) in their study, Low results in mathematics at secondary examinations in Rajasthan. Problem of the study: The study centres upon the problem of low results in compulsory mathematics at the secondary level examination in the state of Rajasthan. Objective: To find out the causes related to low results and give suggestions to remove them. Methodology The sample of the study comprised rural and urban boys and girls of 100 government and private schools with lower results than those of the private students of Rajasthan. The heads of the institutions, the subject teachers and the students of those schools were also involved. The tools used to collect data included questionnaires for subject experts, for heads of the institution, for subject teachers and for students. Major Findings: (1) Non-availability of mathematics teachers due to late appointment and frequent transfers, lack of appropriate classroom blackboards 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 textbooks, lack of timely correction of homework, an overburden and uninteresting curriculum, lack of child centred teaching, overcrowded classrooms, lack of sufficient periods for the subject, us of 'pass books' and guidebooks by most of the students, scarcity of teaching material for mathematics, lack of proper supervision were the academic causes.

(Kasat, 1991) conducted a study on "In-depth study of the causes of the large failures in mathematics at S.S.C. examination of Marathi medium high school students in Plaghar Tahsil", for M.Phil., Edu. Pune: Indian Institute of Education. Problem: The study attempts to identify the causes of the large failures in mathematics at S.S.C. examination of Marathi medium high school students in Palghar Tahsil. Objectives: (i) To find out whether low intelligence and poor numerical ability are the reasons for failures in mathematics, and (ii) to find out the student-related, teacher–related, subject-related, parent-related and school-related reasons for the failures in mathematics. Methodology: The sample of the study comprised 200 students (100 boys and 100 girls) of 25 Marathi medium high schools of Palghar Tehsil, between October 1988 and October 1989, who had failed in mathematics, Standardized tests of numerical ability and a self-made questionnaire for teachers were used to collect data. The collected data were treated with percentages,' t' ratio, frequency distribution, frequency polygon, mean, median, mode, standard deviation, quartile deviation, kurtosis and skewness. Findings: (1) Low intelligence, poor numerical ability, poor comprehension and recall ability, no interest in mathematics and poor study habits were the cause of 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 mathematics curriculum was not 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.

2.03 Review of related studies in mathematics for Improvement of Learning and Teaching of Mathematics

(Wagh, 1991) conducted a study on, Development of a Multimedia Instructional System for Remedial Measures in Fractional numbers for his PhD Education in Shivaji University. The problem is the study relates to the development of a multimedia Instructional system for remedial measures for class VIII students in fractional numbers. Objective of the study are (1) to develop a multimedia instructional system for remedial measures in fractional numbers, according to the multimedia instructional system for developing compulsory skills and (2) to compare the results of this approach to those of the traditional approach of remedial teaching and thus to find the difficulty levels of skills experienced by the students in fractional numbers. The methodology of the study: One hundred and twenty students of standard VIII (60 boys and 60 girls) were selected randomly from the secondary schools of Sangh district in Maharashtra. The tools used in collecting data included a Survey Test, a battery of English Diagnostic test, Structured Interview, questionnaire and lesson observation rating scale. The data were analysed using the mean, SD, analysis of variance and t test. Major findings of the study were (1) In fractional numbers and in their operations , students were found to commit common errors in the basic process, cross- multiplication, the terms used, and in mixed operation in addition, subtraction, multiplication and division. (2) The facilities, resources and raw materials for the instructional material were available but were not used in schools.

(Moila, 2006) in his study, the Use of Educational Technology in Mathematics Teaching and Learning: An Investigation of a South African Rural Secondary School for his M.Ed dissertation. The purpose of the study was to investigate the use of ICT in Phusela secondary school in Mathematics teaching and learning and to develop some strategies on the use of ICT in Mathematics teaching and learning for similar rural schools like Phusela Secondary Schools. Research questions were to what extent are ICT tools used in Mathematics teaching and learning at Phusela secondary school? What are teachers' and

learners' perceptions on the use of ICT tools in mathematics teaching and learning? How do learners' achievements in Mathematics compare to ICT tools usage in terms of the SOLO taxonomy? Researcher used mixed qualitative and quantitative method. Researcher used CASE study and found that only a handful of educators attended training on educational technology integration in teaching learning. There were also other problems that contributed to training not being done as planned. Due to financial constraints, online training could not be done and thus the face-to-face training was extended for a longer period.

(Anthony & Walshaw, 2009) in their study Characteristics of Effective Teaching of Mathematics: A View from the West have stated that in New Zealand a collaborative knowledge building strategy—The Iterative Best Evidence Synthesis Program—has been implemented at policy level. Drawing on findings from the mathematics Best Evidence Synthesis Iteration, and more recent research studies, this paper offers ten principles of effective pedagogical approaches that facilitate learning for diverse learners. In examining the links between pedagogical practices and a range of social and academic student outcomes we draw on the histories, cultures, language, and practices for the New Zealand context and comparable international contexts. The ten principles of effective pedagogy of mathematics are (1) An Ethic of Care: Caring Classroom Communities that are focused on Mathematics goals help develop students' Mathematical identities and proficiencies. (2) Arranging for learning: Effective teachers provide students with opportunities to make sense of ideas both independently and collaboratively. (3) Discourse in the classroom. (4) Mathematical language: The use of Mathematical language is shaped when the teacher models appropriate terms and communicates their meaning in a way that students understand. (5) Mathematical tasks (6) Making Connections: Effective teachers support students to create connections, between different ways of solving problems, between mathematical topics, and between mathematics and everyday experiences. (7) Tools and representations: Effective teachers carefully select tools and representations to provide support for students' thinking.(8) Teacher learning and knowledge. (9)Building on students thinking. (10) Mathematical Communication.

(Aguele.L, 2010) conducted a study on Effectiveness of Selected Teaching Strategies in the Remediation of Process Errors Committed by Senior Secondary School Students in Mathematics. The purpose of the study was to determine the effectiveness of selected teaching strategies in the remediation of process errors committed by students in mathematics in senior secondary schools. The study employed the quasi–experimental design. Sample for the study consisted of two hundred and seven (207) students drawn from six senior secondary

schools randomly selected from the three hundred and sixty senior secondary schools in Edo State. The Diagnostic Test on Mathematics (DIATOM) was used to collect data for the study. Data collected were analysed using analysis of covariance (ANCOVA) and z-test for two population proportions. Results of data analysis revealed that the direct instruction was a more effective strategy for the remediation of process errors committed by students in mathematics. Sex and school location were shown not to have had any significant influence on the effectiveness of either strategy. The study recommended that enough practice activities should be given to students during class sessions to assist them develop mastery of content taught.

2.04 Studies Conducted for Mathematical Weakness

(Chel M. , 1990) in his work diagnosis and remediation of underachievement in compulsory mathematics of madhuyamik examination in West Bengal for his PhD., Sc. Univ. of Calcutta. Problem: The study attempts to diagnose and suggest remediation of underachievement in the compulsory mathematics of the madhyamik examination in West Bengal. Objectives: (i) To identify different kinds of difficulties related to underachievement of students in mathematics from classroom observation from classroom observations of mathematics lessons. (ii) to seek out the types of errors which are identified from the performances of the students in their answer scripts. (iii) to find out the factors, according to the opinion of students, teachers and guardians, that are responsible for underachievement in mathematics at secondary school level, (iv) to know the extent to which the procedure of evaluation is responsible for underachievement. (v) to know the reinforces and noises in communicating mathematical principles to learning, (vi) to find out the remediation programme that should be suggested for students, teachers, and other for obtaining better achievement in mathematics at secondary level, and(vii) to find out what should be the role of the authority or management in implementing the remedial programme. Methodology: The sample comprised urban, semi-urban and rural students of Classes VI to X of West Bengal. The case study method was used in collecting the data. The statistics used to treat the collected data were mean and rank differences correlation. Major Findings: (1) The main difficulties faced by students included, concept gaps, confusion in understanding mathematical language, stereotype way of presenting contents and lack of openness in teaching. (2) The major mistakes found in the performances of students and teacher trainees in the areas include mathematisation of verbal problems, interpretations of mathematical results and learning new topics in mathematics. (3) Underachievement was caused due to lack

of understanding of the mathematical concepts of the earlier stage, and the abstract nature of mathematics. (4) Errors are caused due to the versatility and variability of contents. (6) Reinforcers in the channel of learning were readiness, interest, active involvement, use of effective materials of instruction and learning efficiency.

(Sashidharan, 1992) in his work on "Learning intellectual skills as an educational outcome in relation to students entry characteristics and quality of instruction" found that the initial deficiencies have a long term damaging effect because the content of education is organized in such a way that learning in each class is depend on prior learning. Weakness of students in mathematics can be major factors, which cause the gap between the expected achievement and actual achievement in mathematics. This hinders to achieve desirable outcomes in the instruction process of mathematics.

(Jayasree, 1997) identified the difficulties experienced by the pupils of standard VIII in expanding algebraic expression using identities with the help of a diagnostic test. The study revealed that the level of attainment is poor in the case of classification of open and closed sentences, finding the always-true sentences and product numbers using identities. The study also revealed that there is no mastery of the rules of signs and many pupils do not seem to have a clear grasp of identities.

(Vasudevan, 2003) conducted a Diagnostic Study to identify the difficulties experienced by pupils studying in Standard VIII, in the computation of negative numbers. The study revealed that majority of the students faced difficulty in carrying out the fundamental operations involving negative numbers due to the lack of clarity on rules of fundamental operations.

(Yasoda, 2009) conducted a study on problems in teaching and learning mathematics. The objectives of the study were (1) to identify the difficulty areas in secondary level mathematics as perceived by the pupils and teachers. (2) to identify the problems faced by the pupils in learning mathematics and by the teachers in teaching mathematics. (3) To study the attitudes of pupils towards learning mathematics and of teachers towards teaching the subject.(4) To study the variation in the problems and attitudes of the pupils of sub groups depending upon their personal and demographic variables. (5) to suggest the suitable strategies for the improvement of teaching-learning mathematics at the secondary level. The findings of the study were in VIII class text book the chapters 'commercial mathematics' and 'mensuration' are the most difficult chapters for the students whereas for the teachers along with the above two chapters 'triangles and polygons' and 'circles and concurrent lines of triangles' are respectively are most difficult chapters. Students are facing problems in

understanding the mathematical language, symbols and relation between different concepts in mathematics.

2.05 Review of literature related to Programmed Learning Material (PLM)

(Kulkarani & Yadav, 1966) conducted a comparative study of teaching by different methods of programming of different levels of pupils, department of Psychological Foundations, NCERT, New Delhi. The study attempted to know which method of programming could have better impact on instruction for the development of an ability for a given group of students, i.e. Branching, linear and simple programmes(without providing immediate knowledge of results) were tried out on below average, average and above average students. Investigators studied the relative effectiveness of different types of programmes on the development of knowledge, comprehension and application objectives for "solving simple equations". The sample consisted of class VI students of an English Medium school in Delhi. Three matched groups on the basis of marks obtained by the students in the last examination were formed. These groups were then administered the different styles of programmes on 'solving equations'. The treatment lasted for a week. To analyse results 'treatment levels' design of analysis was followed and F values were computed. The main findings were F values for the treatment were 3.15 and 5.14 respectively, which obviously showed that the treatment effects did not seem to be significantly different. Findings showed that the treatment effects did not seem to be significantly different; to arrive at certain conclusions replications with better control were needed.

(Sharma, 1966) conducted a study on "A comparative study of outcomes of teaching of Algebra by conventional classroom and method of programmed instruction", Government Johari higher secondary school, Ladnun Rajasthan. The study aimed at comparing the programmed method of teaching algebra with the conventional classroom lecture method, with a delayed post-test to study the relative retention under the two methods. The sample consists of 80 students of class IX who were divided into upper middle and lower groups on the basis of marks in the terminal examinations and then they were randomly assigned to an experimental and control group. Besides usual pre-test and post-test a delayed post-test was also administered to study the effectiveness of the two methods in terms of retention. The findings of the study showed that (i) the mean achievement of the experimental group taught through PLM was 2.5 point higher than that of the control group taught by the teacher through the lecture method.(ii) the obtained mean gain was significant at .01 level. (iii) Sixth per cent of the experimental group secured cent per cent on the test, whereas only twenty per

cent of the control group could reach that high standard. (iv) the experimental group had a minimum score of four whereas the control group showed a minimum of zero and (v) the delayed post-test also showed better retention by the experimental group.

(Shah, 1969) conducted a study on "To Develop Auto Instructional Programmes in Algebra for standard VIII and to find out their Effectiveness in Relation to Different Variables" for PhD, Education, Gujarat University. The purpose of the study was (i) To examine the potentialities of the auto instructional programmes as a practical solution to some of today's critical problems in education and (ii) to make the teachers conversant with the techniques of preparing auto-instructional programmes. The hypothesis of the study were (i) the total mean score achieved by experimental group, learning through auto-instructional programmes would be greater than that of control group taught by the conventional method, with a saving of time in learning, (ii) learning through auto-instructional programmes would work better with low achievers than the high achiever and (iii) the students of previous grades (grades below VIII) if they possessed the pre-requisite knowledge required for learning new topics (algebra). The involved the comparison of experimental and control groups. The control group was taught by conventional method and the experimental group was allowed to learn by auto-instructional method.Four schools of Ahmadabad were selected for the experiment. Two comparable classes of each school were taken for the research purpose. The auto-instructional programme covering the whole syllabus of algebra of standard VIII were developed. The whole syllabus of algebra was divided into seven units; a self-test which could give the idea of achievement of students as well as teachers, was prepared and given by the programmer to both the groups at the end of each units. The total mean score as well as the test wise mean scores of both the groups were compared to find out the effectiveness of auto-instructional programme. In order to study whether the programmed learning works better with low achievers, two way analysis of variance was utilized. Four classes of standard V of all the four groups under experiment were allowed to learn algebra through auto-instructional programme prepared for class VIII. The results of the study were (i) the total mean score achieved by the experimental group was higher than the total mean score achieved by the control group (ii) the average time taken by the experimental group was less than the average time allotted to the control group (iii) the order of difference between mean achievements for the two methods changed with the achievement levels.(iv) with some explanation of few technical terms, the standard V students can learn through the programme easily and could answer the 'self-test' given at the end of each unit quite satisfactory, but,

taking almost double time to go through the same content learnt by the students of standard VIII.

(Patel, 1975) developed Auto Instructional Programmes in Geometry for Std. IX and to find out their Effectiveness in relation to different variables for PhD Edu in Gujarat University. Fourteen classes of fourteen rural and urban high schools formed the sample of the study. The tools used in the study were (i) The Desai's Intelligence Test , the Kuppuswamy's Socio-Economic Status Scale, test of entering Behaviour, test of terminal behaviour , opinnionaire for students and interview schedule for interviewing teachers. The findings of the study were: (i) the PLM proved to be more effective than conventional method (ii) high and low IQ groups of students performed better with PLM than with conventional teaching (iii) the average time taken by the group learning through PLM was less than that of the group taught by the traditional method (iv) students from different strata of the society performed better with PLM than with conventional teaching.

(Patel A. , 1977) developed and tried out Auto Instructional Programmes in Some Units of Geometry for Class VIII and to study its Effectiveness in the Context of different Variables for PhD Education in SPU. The major objectives of the study were (i) to develop PLM in some units of Geometry for class VIII (ii) to compare the achievement in mathematics of students having different reading abilities, and learning through PLM and traditional way of teaching. The sample consisted of 810 students of class VIII studying in fourteen schools of Kaira District. The sample was selected in view the following criteria, strength of the school etc., the achievement of students was measured through teacher made test. For data analysis mean, SD and t test were used. It was found that the auto instructional material does not work well with pupils having low n Ach.; (ii) in case of highly motivated students the material was found to be working well; (iii) learning through PLM in case of students having poor reading ability was not more effective than the conventional method but it was superior in case of students who had good reading ability: (iv) more anxious students could learn better through PLM than their counterparts.

(Seshadri, 1980) conducted a study on "An Experiment in the Use of Programmed Instruction in Secondary Schools" for PhD Education in MSU of Baroda, Vadodara. The main objectives of the studies were (i) to identify different components of the instructional strategy. (ii) to develop software material to be utilized under different components, (iii) to study the effectiveness of each component in terms of students and parents reactions and teachers observation. (iv) to study the effectiveness of instructional strategy as a whole. She developed a linear program of 2074 frames for mathematics for class IX. The entire syllabus

as also a whole academic year was covered. The components identified were introduction be teacher, programmed learning material, exercises or assignment, tutorials summary, mathematical games or group activity, post-test and discussion of performance of post-test and feedback sessions. The tools of data collection were the criterion tests, Headmasters' Association examinations, semester and comprehensive examinations, questionnaire to know learners', parents' and school authorities' reaction. Other tools used were the Raven's Standard Progressive Matrices, Junior of Motivation (JIM Scale) and Palsane's Study Habit Inventory. The statistical techniques used were t-test, product moment coefficient of correlation and partial correlation. The main outcome were A duly validated instructional strategy having reproducible PLM as the major component and with established long-range effectiveness and feasibility for using in classroom situations was developed, achievement had positive correlation with intelligence , but not so with the scores on JIM scale and Study Habit Inventory. She found that the strategy having PLM as its major component worked better.

(Pandey, 1980) conducted a study on Use of programmed Instruction on Teaching Mathematics at Primary Level for PhD Education at Pat. University. The aim of the study was to see the relative effectiveness of the traditional method without home assignment and grading, a programmed text and the traditional method with regular home assignment and grading in teaching mathematics at primary level. The sample consisted of 60 students of class IV studying in the central school at Samchi (Butan).The subjects were randomly divided into three groups. The three groups were tested for homogeneity with regard to prerequisite and age. The programmed text prepared for the purpose consisted of 2,557 frames and divided into thirty units to be covered in thirty working periods. He found that the PLM was superior to other methods and that the high and the low-income group students following the PLM were distinctively superior to those who had traditional teaching with home assignment and grading.

(Trivedi, 1980) conducted a study on "Use of Branching Variety of Programmed Learning Material as Diagnostic and Remedial Tools" for PhD in Education M.S. University of Baroda. The major objectives of the study were (i) to develop Programmed Learning Material of the branching type in mathematic for classes V, VI and VII (ii) to compare the achievement of the students by the traditional methods of teaching with that of the students studying through programmed materials (iii) to diagnose students weakness in mathematics and (iv) to use programmed materials as remedial measures. It was an experiment using experimental control group design. The subjects in the two groups were selected on a random

basis. For each class, there were 40 students in experimental group (20 boys and 20 girls) and an equal number in the control group. The two treatments were the use of programmed learning materials of the branching type and the conventional method. Two-way analysis of variance was used for data analysis. In the design, pre-test score and intelligence were used as the covariates. The tools of research used were programmed materials developed for the selected units of mathematic, pre-test, post-test and Bhatt Test of Intelligence. The experiment was conducted by the teachers who were trained to use the programmed material. The major findings of the study were (i) for class VI, the programmed learning material was more effective than the conventional method of teaching whereas for classes V and VII, both the methods were equally effective in terms of pupils achievements.(ii) in the case of class VI girls learnt better than boys through the use of programmed material, whereas in the case of classes V and VII, there was no significant difference between the mean scores of boys and girls learning through programmed materials.

(Inamdar, 1981) conducted a study on "A Study of the Effectiveness of the Programmed Learning Strategy in the Subject of Mathematics for Standard VII in relation to some Psychological Correlated" for PhD Education in SPU. The thesis aimed at studying the effectiveness of the programmed learning strategy in the subject of mathematics in standard VII. The topic for the study was the unit on Simple Interest. The candidate selected seven students from three schools, of whom three were bright, three averages and one dull according to their achievement in their previous examination. The material was tried on thirty students of standard VII. An entry behaviour test was given to the students. The experimental and control groups were formed on the basis of these test. The sample consisted of 108 boys and 100 girls in the experimental group and same number of boys and girls in the control group. The experiment was conducted in twelve periods. The performance of the group was studied in relation to some psychological correlates such gas general ability reasoning ability, reasoning ability and motivation towards school. Analysis and interpretation of the data were done to find out the relation between general ability and performance in achievement test in the PLM and the relation between motivation towards school and performance in achievement in PLM. It was found that the programmed learning technique was superior to the conventional technique.

(Shah, 1981) conducted a study on "To Develop and try Programmed Material in Mathematics for students of Class V in Gujarat State" for PhD Education in Gujarat Vidhyapeeth, Ahmedabad. The purpose of the study was (i)to develop programmed materials on various units of the mathematics syllabus of class V and (ii) to try the same on children of

class V from a few selected schools. The sample includes seven primary schools of Malpur, Bayad and Kapadvanjwere PLM was tried and four schools of Malpur which were taken as control group. The sample consisted of 250 students for PLM and 200 students for control group. For every unit criteria test was used. Questionnaire was used for students and teachers to know their reactions towards the programmed materials. The total time of the study was twenty four hours and forty minutes. Findings (i) the total mean score achieved by the experimental group was higher than the total mean score achieved by the control group (ii) the average time taken by the experimental group was less than the average time allotted to the control group. The reactions of the students and the teachers were favourable.

(Suthar , 1981) conducted a study on "A study of performance on Programmed Learning Material in relation to some Psychological Characteristic for PhD Education in SPU. The major objectives of the study were (i) to develop PLM in algebra of students with different study habits, learning through PLM and traditional way of learning.(iii) to compare the achievement of algebra of students with different reasoning abilities. (iv) to compare the achievement of students having positive and negative attitudes. Researcher developed algebra programme for class VIII covering set theory, rational numbers, real numbers powers and indices, equations and problems, and graphs. Study habits, attitude towards mathematics, learning abilities, motivation towards school, learning and entering behaviour were also analysed. The PLM emerged superior irrespective of different variables.

(Davies , 1982) conducted a study on "Effects of Different Modes of paring in programmed Learning of Mathematics on the Performance of Underachievers" for PhD Education in Madras University. The objectives of the study were (i) to test the differential effects of the three pairing modes in PLM, on the achievement of underachievers in mathematics. The sample consisted of 1092 students of standard IX drawn from ten randomly selected schools. The tools used were achievement test in mathematics, questionnaire on interest in mathematics, participation in extracurricular activities and academic self-concept (developed by the investigator). A PLM in statistics in Tamil was prepared and validated. The statistics used were t test, F- ratio, chi square test, ANOVA, multiple regression and factor analysis were used for data analysis. The main findings of the study were, the underachievers had 78% individual gains, underachievers in teacher's choice and mixed pairs gained significantly in the post test and had significant residual gains over the predicted level of performance in mathematics.

(Rao, 1983) for PhD in Education, Osmania University, conducted a comparative study of PLM and conventional learning methods in the instruction of mathematics : a

psychological approach. The objective of the study was: (i) to find out the efficiency of PLM over the conventional learning method in the instruction of mathematics in school education. (ii) to determine the variation in learning gains in the pupils in the rural urban dimension. (iii) to determine whether there was any difference in learning due to sex variation of the pupils (iv) to investigate into variations in achievement gains of the pupils in mathematics owing to variation in their general mental ability level under Programmed Learning Instruction. (v) to find out the differential learning gains in the pupils owing to school climate, with special reference to private and government management of institutions. The design was an experimental cum field investigation. Two matched groups of students were exposed to PLM and conventional classroom teaching .The subjects were matched in the rural-urban sex IQ, state of instruction and management of schools. A sample of 300 students from grade V and 296 students from grade X were taken, equal number of students were assigned for PLM group and conventional learning groups in both the grades. The tools employed for data collection were the Hyderabad State Bureau of Education group test of Intelligence (1980) and interview schedule to know the attitude of students, and achievement tests in mathematics of students of grade V and X. The findings of the study were: (1) the mean performance scores of the PLM groups and conventional groups on achievement test were less than the normative means of the tests. (2) the mean performance scores of all the PLM groups were higher than those of the corresponding conventional learning groups. (3) The mean performance of urban subjects was superior to the performance of the rural subjects under the PLM; irrespective of grade (4) the mean performance scores of groups of subjects of high, average and low level of general mental ability were in the order of their categorization.

(Bhatia, 1992) conducted a study on identification and remedy of difficulties in learning fractions with Programmed instructional material in Indian Educational Review. Problem: The study tests the effectiveness of programmed instructional material as a remedial teaching tool. Objectives (1) to develop programmed instructional material on fractions for students of class V. (2) to use programmed instructional material a remedial tool. (3) to test the effectiveness of programmed instructional material in class room teaching for students of class V and (4) to test the significance of difference between the traditional method of teaching and teaching through PLM. Methodology: A sample of 50 students was selected from two M.C.D primary schools of Karol Bagh New Delhi twenty five students from each school; four criterion tests were administered as tools to collect data. The collected data were treated by using mean, SD and t-test. Major findings: (1) Teaching and learning through PLM

could definitely help both students and teachers. (2) Students receiving the PLM did better in post-test as compared to the other group. (3) The PLM worked effectively as a remedial tool. (4) PLM not only helped the students to learn better but also helped the teacher to know how the students learn better.

(Thatte, 1998) conducted a study on "An Experimental Study of the Relative Effectiveness of Programmed Learning and Learning Through Audio Visual Aids with reference to certain selected topics from the syllabus of Science for Std. V to VII in Greater Bombay" under University of Mumbai, Mumbai. Objectives of the study were 1. To compare the mean achievement scores of the students of Std. V, VI, and VII studying through AV Aids method, Programmed Learning Method and Traditional method.2. To study the effect of treatment, sex, and their interaction on achievement. Sample of the study was eight Schools of Greater Mumbai were selected in all. Twenty four different classes were considered and the total number of students was 1381. Tools of the study were the question papers set by the investigator based on the topic were used as tools for data collection. Data were analysed using Central tendencies, percentile and percentile ranks, SD, ANCOVA and t test. Findings of the study were 1. AV aids method was found to be significantly more effective than the Programmed Learning Method and the Traditional method in terms of achievement at Std. V, VI, and VII. 2. Programmed Instruction Method was found to be significantly more effective than the Traditional Method in terms of achievement at Std. V, VI, and VII. 3. Programmed Learning Method and Audio Visual Method are more successful when the classes are small, at the same time they are more effective for average students. 4. Male students and female students, both, equally benefited through the AV method as well as Programmed Learning Method. No significant effect of interaction between treatment and sex was found on the achievement of student.

(Tare, 2001) conducted a study on "A Study of the Effectiveness of Branching Variety of Programmed Instructional Material as Diagnostic and Remedial Tool in Chemistry for Secondary Classes in Jabalpur Division" in Rani Durgavati University, Jabalpur. Objectives of the study were 1. To compare the achievements of the students of urban and rural areas of Jabalpur Division by the traditional method of teaching with that of studying through branching frames of programmed learning in Chemistry Subject. 2. To diagnose the weakness of the students of urban and rural areas with the help of PLM. Research Design used Experimental and Control Group Design was used for the purpose of this study. Sample 280 students were selected from different Government Higher Secondary Schools of urban and rural areas of Jabalpur Division. Tools and Techniques: A branching programme was

developed on Atomic Structure and Chemical Bonding and pre-test and post-test were constructed by the investigator. Data Analysis: ANOVA and t-test were used for data analysis. Findings 1.The achievement of the experimental group was found significantly greater than the achievement of the control group. 2. The achievement of the urban girls through PLM was found significantly higher than that of the urban boys. 3. No significant difference was found in the achievement of boys and girls of rural areas in the post-test on atomic structure and chemical bonding. 4. 135 boys out of 180 and 64 girls out of 99 wanted to continue the study with the PLM on both the topics. 5. The weakness of individual students were diagnosed and removed when branched frames on both the topics were administered.

(Ramani & Patadia, 2012) conducted a study on "Development and Try-out of the Programmed Learning Material in Mathematics for class XI students studying in schools affiliated to Gujarat Secondary and Higher Secondary Education Board (GSHSEB)". The objectives of the study were 1.To develop programmed learning material in mathematics for XI standard students. 2. To implement the developed programmed learning material in mathematics to the XI Std. students studying in one of the English Medium Schools following the syllabus of GSHSEB. 3. To study the effectiveness of the developed programmed learning material. The methodology of the study was posttests only control group design, groups were matched using comparable mean and standard deviation, correlated t test was used for data analysis. The sample size consisted of fourteen students of XI standard. PLM was found to be effective in teaching probability to XI standard science stream s students as the achievement test score of experimental group students was found significantly higher than the achievement test score of the control group students.

2.06 Related literature in the field of Computer Assisted Instruction conducted in India

(Nagar, 1988) conducted a study on effectiveness of computers in teaching mathematics in school for his M.Phil., Education University of Delhi. The study attempts to ascertain how best a teacher can use the computers to improve learning in the classroom. The objectives are (1) to examine the usefulness of the computer in teaching mathematics. (2) to examine areas/aspects of mathematics which can be more effectively taught with the help of computers and (3) to examine the trends regarding the use of computer-aided teaching of mathematics. The methodology of the study: This study is based on survey of studies, which include; mainly, three projects and ten research studies conducted independently. The major findings are (1) Computer Assisted teaching (CAT) of mathematics benefited both the teacher and the learner. (2) CAT encouraged individualisation and practice without burdening the

teacher with repetitive and monotonous activity. (3) CAT helped the learners to use their creativity by exploring new areas not covered by the syllabus. (4) computer awareness was not sufficient in schools for CAT. (5) In India, we have gone in for the theoretical rather than the practical aspects of computer-based education. Project CLASS was not enough computers in schools, and not enough awareness regarding the computer. The computers that were available were not being put to the best possible use. Teachers had a great un trust of the computers and perceived it as an inconvenience rather than as an aid. Their negative attitude was a great hindrance in popularising the use of computer literacy in the educational system, especially at the secondary level of education.

(Jeyamani P. , 1991) conducted a study on effectiveness of the simulation model of teaching through Computer Assisted Instruction(CAI) for M Phil Education from Avinashilingam Institute of Home Science and Higher Education for Women, Coimbatore. The problem was to study effectiveness of the simulation model of teaching Physics to standard XI students through Computer Assisted Instructional Material. Objectives of the study were: (1) to find out the effectiveness the simulation model of teaching as compared to the traditional method and (2) to utilize the growing use of computers in education. Methodology of the study was the sample for this investigation consisted of students of standard XI of the two schools selected. The pre-test-post-test method was used. Mean, SD, and t test were used to treat the data. Major findings were: (1) the experimental group obtained a higher mean than the control group. (2) the sex-wise comparison proved to be insignificant, (3) There was no significant difference in learning level between Tamil-medium and English-medium students. (4) on the basis of the research findings, it was concluded that the experimental group performed significantly better than the control group.

(Singh, Ahluwalia, & Verma,1991) conducted a study on "Effectiveness of Computer Assisted Instruction (CAI) and Conventional method of instruction". The study centres upon the problem of the effectiveness of Computer Assisted Instruction and of the conventional method of instruction in teaching mathematics, in terms of achievement of mathematics and direction of change in attitude towards mathematics of male and female students. Objectives: (i) To study the difference in mathematics achievement which occurs as a result of the difference in instructional strategy among boys and girls separately and as a group? (ii) To study the direction of change in attitudes of male and female students separately and as a group towards mathematics as a result of two different instructional strategies. The sample of the study consisted of 220 students from four selected higher secondary schools, covering the good, average and poor schools of the Bhilai steel plant, Bhilai (M.P.). Findings: (i) The

students who used the computer scored significantly higher than those taught mathematics through the conventional method. (ii) The students who used the computer showed significantly highly favourable attitude towards mathematics than those who did not use the computer (iii) Achievement in mathematics and change in attitude towards mathematics were found to be independent of the sex factor.

(Rose Antony Stella, 1992) tested the effectiveness of Computer Assisted Instruction with special reference to underachievers -PhD Education Bharathidasan University. Problem of the study throws light on the application of CAI and the teacher support system (TSS) for the optimum development of underachievers (UA). Objectives were: (1) To develop CAI software, (2) To find out the effectiveness of CAI with TSS and CAI without TSS with references to the learners variables viz sex, IQ and achievement level and (3) To find out the interaction of the learner variables and the treatment on the achievement score. Methodology: The randomised block design was followed in the selection of the samples, with IQ as the blocking variables. The samples consisted of three groups of size 32 each composed of students of standard IX selected from Tamil Nadu State Board schools covering one rural and two urban. The underachievers in the sample were identified by using the regression analysis. The tools used included CAI software on the language of sets, achievement test, and cultural fair, intelligent test by Cattell and cattell, study habits inventory by Patel, and Mathematics study attitude scale by Sundarrajan, Mean, S.D, t-test, Chi-square, one-way and two-way ANOVA were used to treat the collected data. Major findings were: (1) Both the CAI strategies were superior to the traditional method of instruction, and CAI with TSS was more effective than CAI without TSS for underachiever (UA). (2) Except achievement level, all the other learner variables combined with the treatment had no interaction effect on the achievement score. (3) There was no relationship between the post-treatment scores and the variables 'sex','locale' and 'achievement level 'of the experimental group. In the case of the variables IQ, 'Study habits' and 'maths study attitude', the positive relationship between those variable and achievement at the pre-treatment level was found to be cancelled at the post-test. Similar results were obtained for UA.

(Singh, 1992) studied effectiveness of teaching mathematics through computer assisted instruction and conventional method of instruction on cognitive and non-cognitive variables-PhD Edu. Guru Ghasidas University. Problem: the present study aims to compare the results of computer assisted instruction CAI with the results of the conventional method of instruction in teaching mathematics in certain selected units of the mathematics curriculum. Objectives: (1) To compare the results of the two groups in mathematical

achievement. (2) To compare the results of the two groups in mathematical achievement sex wise and (3) To compare the attitudes towards mathematics of the two groups as whole and also sex wise. Methodology: The study was conducted in four higher secondary schools having facility of three to five BBC microcomputers. The students belonged to different socio-economic groups. Three units of the mathematics syllabus for class IX namely simultaneous equations in algebra, statistical representation in statistics, and triangles and their congruency in geometry were chosen for the study. The tools used in the study include rating scale by the researcher, general intelligent test of Mohsin, the attitude scale towards mathematics of Suydam, and the educational software prepared by the practising teachers. The statistical techniques used include mean, S.D and t-test. Major findings (1) The groups taught through CAI in all the schools showed a substantial progress. (2) The gains in achievement of the pupils of good schools are higher than those of pupils of average and poor schools. (3) The CAI method of teaching mathematics had proved to be more effective (4) Both boys and girls gained more from the computer treatment. (5) A significant favourable change in the attitude of the pupils of the experimental groups over the control groups was observed. (6) The change in attitude towards mathematics was independent of gender.

(Adhikari, 1992) conducted a study on "Development of Computer Aided Instructional Material on cell and cell reproduction for class IX"using BASICA software. Objectives of the study were: (1) To develop computer aided instructional material on cell reproduction and study its effectiveness it terms of (a) achievement of students, (b) reaction of students studying through computer aided instructional material. (2) To compare mean achievement scores of the students towards the computer aided instructional material and traditional method by taking intelligence as the co-variate. The design of the study was pre-test post-test control group design where 40 students were taken for experimentation. The findings of study were (1) the computer aided instructional material was found to be effective in terms of achievement of students. (2) Students showed positive reaction towards computer aided instructional material (3) computer aided instructional material is effective in achievement when both the groups were matched on intelligence.

(Das, 1998) conducted a study entitled "Exploring effectiveness of computer assisted learning materials on rhymes in different modes". Objectives of the study were 1. to develop computer software on rhymes in text, graphics-text, text-music, graphics text music, and graphics-text-music- recital modes. 2. to study the effectiveness of CALM prepared in different modes for learning the Rhymes in terms of Word meaning (lexicon), Analytical understanding, Comprehensive understanding, Writing ability, Recitation ability and LSRW

ability. Hypotheses: 1. The adjusted mean of the achievement test score on word meaning, analytical Understanding. Comprehensive understanding, writing ability, recitation ability, and language learning of the students belonging to Text, Graphics Text, Text Music, Graphics Text Music, and GTMR modes will not differ significantly when class achievement test score in English language is considered as covariate. Sample: Seven rhymes were presented in 5 different modes, namely, T, GT, TM, GTM, and GTMR to 5 different groups of students, respectively, drawn from a total of 169 students of Second Standard of Baroda High School, Baggi Khana (1996-97) on the basis of systematic random sampling. Each group comprised of 20 students. Tools and Techniques: The investigator used two tools for the study, namely, the treatment tool. The investigator used two tools for the study, namely, the treatment tool and testing tool. The treatment tool was the Computer Assisted Learning Material (CALM) on rhymes developed by the researcher in different modes. Testing tool was an achievement test developed by the investigator. Data Analysis Technique Used ANCOVA was used considering English Language class achievement test scores as covariate. Findings of the Study: 1. Composite modes of presentation may not ensure higher cognitive language learning. 2. Intelligibility of a message is a function of sender, message, medium, mode, receiver, and the environment.Implications of the study 1. It is beneficial for the learners to learn through CALM. So, CALM should be developed and used for language learning. 2. Choice of a mode of instruction should be guided by the objectives of instruction.

(Khirwadkar, 1998) conducted a study entitled "Development of Computer Software for learning Chemistry at standard XI" for PhD from M.S. University of Baroda . Objectives of the study were: (1) To develop CAL package in subject of chemistry for standard XI science students, studying Gujarat State Board syllabus. (2) To study effectiveness of the software package in terms of instructional time and achievement of students. (3) To study the effectiveness of software package of students' achievement in relation to students' intelligence level, motivational level and attitude towards the package. (4) To study attitude of the students and teacher regarding the effectiveness of CAL package with regard to aspects of the software such as content of the software, presentation of the software, examples and illustration, graphs and figures, evaluation items, Utility of the software and instruction given in the instructional manual that are provided with the software. The sample for experiment was 30 students in experimental group and 30 students in control group randomly taken. The students of experimental group were expected to teach through software package prepared for chemistry subject. The control group was taught through traditional method by school chemistry teacher. The time duration was one month for both groups. Researcher had

collected data of achievement through structured post-test and pre-test and data about attitude towards package through structured and unstructured interview schedule.The data was quantitative as well as qualitative including teachers and students' opinion about the package. The data analysis was done by ANOVA, ANCOVA and content analysis. The findings of the study revealed that the CAI package was effective in terms of academic achievement of students and instructional time, the teacher and students had positive attitude about developed CAI. IQ, academic motivation and attitude affected achievement of students.

(Zyoud, 1999) conducted a study entitled "Development of Computer-Assisted English Language Teaching for VIII Standard Students" for Ph.D. (Edu.) from M.S. University of Baroda. The objectives of study were: (1) To develop a computer assisted English language teaching program for standard VIII Gujarati medium students. (2) To study the effectiveness of the computer assisted English language teaching program on students' achievement in terms of Vocabulary, Grammar and Comprehension by taking pre-test and IQ as covariates. (3) To study the effectiveness of the computer assisted English language teaching program in terms of students' achievement of all above mentioned with respect to their intelligence, motivation and attitude. Students studying in standard VIII Gujarati medium were taken from two schools to serve as the sample for the study. Students of one school i.e. Rosary school, Baroda formed the experimental group and students of the other school i.e. GEB School, Baroda formed the control group. The experimental group consisted of 66 students and control group consisted of 46 students. The tools used in the pilot study were also used in the final experiment, namely, Pre-test, Raven's progressive matrices, Junior Index of motivation by Frimer translated into Gujarati by Desai and the post-test developed by the investigator. For studying the attitude of the students towards the package, the researcher developed and administered an attitude scale on the experimental group only after the final experiment. To fulfil the first objective of the pilot study, the investigator conducted informal interviews with the students by asking them about the difficulties they faced. ANCOVA was applied for analysing the data. The findings of study were: (1) When the computer is used to its full potential, it can create an atmosphere where the students can learn and interact with the computer without being afraid of the teacher's presence. (2) The computerized exercises can help the student become familiar with significant amount of vocabulary, grammar and comprehension because it provides effective individualized instruction.

(Yadav, 2000) conducted a study entitled "A study of the effectiveness of the Computer Software for students of standard I". Researcher had selected the purposive

sampling method for school and taken the Baroda High School, Bagikhana, as sample. Researcher had selected the sample of students of standard-I, randomly for alphabet software and animal software. For the purpose of study tools constructed and used were pre-test, semi-structure interview for teacher and informal interview and observation for students. The findings of the study revealed that developed package helped the students in vocabulary and grammar whereas no effect in comprehension was observed. IQ had an impact on students' achievement, while motivation had not found impact on it. Students were found to have positive attitude towards the package. There was a significant gain in terms of mean achievement through CAL. Also CAL has evoked positive perceptions amongst teachers and students regarding computers.

(Dalwadi, 2001) conducted a study entitled "Development of Computer Assisted Instruction in Science for the students of standard IX" from M.S. University as a part of the M.Ed. degree. Objectives of the study were: (1) To develop Computer Assisted Instruction (CAI) in science for standard IX. (2) To study the effectiveness of CAI in terms of achievement of standard IX students and (3) To study opinion of the science teachers and students regarding the effectiveness of the developed CAI. The researcher found significant gain in terms of the achievement of students through CAI on "Light". CAI had evoked positive perception among the students. Though there were students who did not take interest in CAI due to coloured graphics, but they liked presentation of text with graphics. Majority of students had enjoyed learning with CAI and suggested to prepare CAI on other topics too. The students were of opinion that coloured animated graphics, sound effect in CAI would enhance learning. The teacher has also suggested developing CAI in other area of science. Both the teacher and student encouraged the computerized self-learning instead of stereotype classroom session.

(Patel, 2001) conducted a study on learning through Computer Assisted Learning Material in relation to selected production variables and contiguity from M.S. University of Baroda, as a part of the M.Ed. degree. Objectives: (i) To analyse CALM in relation to production variables and contiguity. (ii) To study the effectiveness of CALM in terms of mean achievement of students. (iii) To study the learning through various message items in relation to production variable and contiguity. Method: The research is an experimental type. In order to study the effectiveness of the developed CALM pre-test post-test single group design was used. A single group of thirty students was selected purposely as a sample for the present study. Findings: There has been found significant gain through interaction with the Computer Assisted Learning Material on Solar system and Magnet for Standard VIII through

the computed correlated t values. The status of the CALM in terms of production variable and contiguity vis-à-vis achievement has been found quite higher, except on a few teaching points where there was need to improve upon graphics, mode of presentation, spatial contiguity of text and animation and temporal contiguity of animation and narration.

(Sharma, 2003) conducted a study entitled "A study of the effectiveness of Computer Assisted Learning (CAL) in chemistry for the students of standard XI". The objectives of the study are (1) To develop CAL in chemistry in terms of achievement of standard XI students. (2) To study the effectiveness of the CAL in chemistry in terms of achievement of standard XI students. (3) To study the opinion of the chemistry students regarding the effectiveness of the developed CAL. The researcher had found that CAL developed was effective for teaching Chemistry at standard XI. It helped the students to learn the topic of organic compound and clarified the concepts. Students were found to have a positive reaction towards the CAL. It was found to be favourable as far as the statements related to the interest, mode of presentation, content clarity and the question asked in the CAL. A chemistry teacher was found to have positive reaction towards developed CAL. Also, the data analysed revealed that teacher had given favourable statements regarding content, language clarity, mode of presentation, and clarity in graphics and evaluation procedure in developed CAL.

(Vasanthi & Hema, 2003) conducted a study on effectiveness of teaching Chemistry for 1 year B.E. students through Computer Assisted Instruction . Objectives: (i) To study the effectiveness of teaching chemistry through Computer Assisted Instruction over the traditional teaching Method. (ii) To study the effectiveness of the Computer Assisted Instruction over the traditional teaching method in pre-test scores and post-test scores. Method: The sample consisted of 60 students selected from 220 students of Sivnath Aditnagar College of Engineering, Tiruchendur, in Thoothukundi District on the basis of marks. Those students were divided into two equal groups of 30 each on the basis of marks obtained in the class test. One group was taken as the control group and the other group was taken as the experimental group. A pre-test and post-test parallel group experimental design was used. The experimental group was given the CAI software. Statistical technique like Mean, S.D and t-test computed to analyse the data collected. Findings: (i) There is significant difference between the mean gain score of the control group taught through TTM and the experimental group administrated by the CAI in all units put together. (ii) There is no significant difference between the mean scores of pre-test of control group taught through TTM and experimental group administrated by CAI in all units together (Electrochemical and bonding). (iii) There is no significant difference between the mean scores of post-test of

control group taught through TTM and experimental group administrated by CAI in all units put together.

(Helaiya, 2004) has conducted a study entitled "Developing and implementation of CAI package for teaching statistics to B.Ed. students". CAI was developed using Visual Basic Software. The objectives of the study were: (1) To develop a CAI package for teaching statistics to B.Ed. students. (2) To study the effectiveness of CAI package in statistics in terms of B.Ed. students. (3) To study the reaction of the B.Ed. students regarding the effectiveness of the developed CAI package. 16 B.Ed. Students of the Department of Education, MSU, Baroda having Computer Education specialization constituted the sample for the study. Pre-test, treatment, post-test single group pre experimental design was used for the study. The treatment was found quite effective as evident through the mean gain scores and favourable reactions. Investigator observed that CAI was effective in teaching statistics to B.Ed. students than traditional method. Students had enjoyed learning with CAI and suggested to prepare CAI in other topics too.

(Ruttanathummatee, 2004) conducted a study on Effectiveness of Computer Assisted Instruction for Primary School Students: An Experimental Study in South Gujarat University, Surat. Objectives of the study: 1. To develop Computer Assisted Instruction in the Subject of Thai language for the students of Pratom-3 and 6. 2. To know the effectiveness of Computer Assisted Instruction in the subject of Thai language developed by investigator for the students of Pratom-3. 3. To know the effectiveness of Computer Assisted Instruction in the subject of Thai language developed by investigator for the students of Pratom-6. 4. To know the effectiveness of Computer Assisted Instruction in the subject of English language developed by ONPEC for Pratom-3. 5. To know the effectiveness of Computer Assisted Instruction in the subject of English language developed by ONPEC for Pratom-6. 8. To get opinion of the teachers on CAI developed by the investigator for the subject of Thai language. 10. To get opinion of the students on CAI developed by the investigator for the subject of Thai language. Research Design: It is a developmental-cum-experimental study. Pre-test, Post-test design with replication groups was used for conducting the experiment. Two experimental groups along with eight replication groups, each consisting of 30 students were well drawn. In all 150 students of Pratom-3 and 150 students of Pratom-6 belonging to Buriram Province participated in the study. Tools and Techniques: CAI programmes on 5 units for learning each language were used for conducting the experiment. Different tools for the study, namely, criterion tests and opinionnaires have been used. Data Analysis: The data have been suitably analysed through mean, SD and t-tests. Findings of the Study: The CAI

Packages developed by the investigator on Thai language have been found effective at both the levels, that is, Pratom-3 and Pratom-6 .The CAI Packages developed by the investigator on Thai language and by the ONPEC on English language received favourable opinions both by the teachers and students.

(Barot, 2005) conducted a study entitled, "To study the effectiveness of CAI in Sanskrit for std. VIII students". The objective of the study was: (1) To develop Computer Assisted Instruction (CAI) in Sanskrit for standard VIII students. (2) To study the effectiveness of CAI package in terms of mean achievement of students in Sanskrit. (3) To study the reaction of the students regarding the effectiveness of the developed CAI package. 86 students of Std. VIII of Shree Ambe Vidyalaya, Waghodia Road, Baroda constituted the sample for the study. A single group pre-test and post-test design was employed for the study .Achievement test and reaction scales were constructed by the investigator. Flash MX, Corel Draw 11 and Front Page were used for the development of software. 't' value, frequencies and % responses were used for data analysis . Researcher has prepared CAI using Flash software. Findings of the study had proved that CAI can be used very well for remediation purpose. Prepared CAI in Sanskrit was found effective. The reactions of the students towards the developed CAI in Sanskrit were found positive.

(Pardeshi, 2005) conducted a study on "A study of the relative effectiveness of CAI and CAIPI in learning Trigonometry by English medium students of Standard IX of Baroda City" in CASE, MSU, Baroda. The objectives of the study were to develop the CAI and study its effectives in mono, diad and triad settings and its relative effectiveness in the three settings and through reactions of the students. The study was conducted in the three sections of Standard IX of Zenith High School, Baroda, dividing each section into two groups-experimental and control. The CAI was developed using Flash-MX, Directors and Corel Draw 11.0 along with the Internet. An achievement test was constructed for administering as pre-test and post-test. The data were analysed through mean, SD, uncorrelated't' and ANOVA. No significant difference has been found in the mean achievement scores of the groups in mono, diad and triad. No significant difference has been found in the mean achievement scores of the experimental group in mono, diad, triad and control groups, respectively. Significant difference has been found in the mean achievement scores of the experimental group in triad and control group. The students were found to have positive reactions towards the developed CAI.

(Parikh, 2006) conducted a study entitled "Developing and implementing Computer Assisted Learning Material for 11thstandard commerce students on subject Introduction to

book-keeping and Accountancy prescribed by GSEB". Objectives of this study were: (1) To develop CALM for "Rectification of Error" chapter selected from the 11th standard Introduction to Book Keeping and Accountancy text book of GSEB (2) To study the effectiveness of CALM package in Accounts in terms of 'Achievement of 11th standard commerce students (3) To study the reaction of 11th standard commerce students regarding the effectiveness of the developed CALM. In findings CALM was effective for 2nd objective. Students had positive reactions towards the CALM and given favourable statements related to the interest, mode of presentation, content, clarity in graphics with content and the questions asked in it.

(Thakkar, 2006) conducted a study entitled, "To develop and implement CAI for 'Organization of commerce and management' subject in standard XI as prescribed by GSEB" with pre-test, post-test experimental and control group research design. The objectives of the study were: (1) To develop a CAI for the chapter of Foreign Trade selected from the subject 'Organization of Commerce and Management' textbook of standard XI (2) To study the effectiveness of the developed CAI. The findings of the study revealed that CAI was found effective in teaching foreign trade leading to significant gain achievement in the scores of the post-test from the pre-test of experimental group. CAI was found effective in teaching foreign trade leading to increase in the mean of gain achievement scores of the experimental group than the control group. The overall reaction of the students towards the prepared CAI in commerce was found positive. CAI was perceived by majority of students to be quite interesting and motivating in learning.

(Rathwa, 2007) conducted a study entitled, "Development and Implementation of Multimedia Package for teaching Gujarati subject". Objectives of this study were: (1) To develop a multimedia package in Gujarati subject for std. VII students. (2) To study the effectiveness of the multimedia package in terms of achievement of students on whom it was implemented. (3) To study the effectiveness of multimedia package in terms of reflection of students (of experimental group) collected through opinionnaire. (4) To compare the achievement of VII grade students in the unit test conducted for experimental and control groups. Study revealed that developed multimedia package was found to be an effective and had great impact to gain better achievement of experimental group in comparison to that of control group. It was observed through opinionnaire that multimedia package was effective and students enjoyed learning.

(Patel, 2008) conducted a study on Computer Assisted Instruction in Physics for the students of standard XI. Objectives of the study were (i) To develop Computer Assisted

Instruction package on two units of physics for XI Science student studying GSTB syllabus. (ii) To study the effectiveness of the CAI package in terms of achievement of students of experimental group. (iii) To study the relative effectiveness of teaching Physics in terms of two methods of teaching Physics i.e. conventional method of instruction and CAI package for students of traditional group and experimental group. (iv) To study the relative effectiveness of CAI with reference to the sex of the students of the experimental group. (v) To know the opinions of the students of the experimental group regarding the effectiveness of used CAI in Physics. (vi) To know the opinions of the teachers of the experimental group regarding the effectiveness of used CAI in physics. Method: Multistage sampling technique was used by the researcher in the study. The pre-test post-test control group design was employed. Two schools, one in rural and another in urban area was selected to conduct the experiment. The sample for the experiment consisted of 30 students each in traditional and experimental groups. Time duration was 28 days for both groups with two chapters of class XI Physics text book for the experiment of the study. The tool used was an opinionnaire for students of both groups. Opinions of the expert and subject teacher were invited by an evaluation sheet. For the analysis and interpretation of the data the statistical technique such as mean, S.D., t -test and chi square test was employed. Findings: (i) The study has resulted in the development of a CAI program on 'motion in one dimension and two dimensions' and 'Laws of Motion' for teaching Physics to the students of Class XI. (ii) The package was found significantly effective for the students of class XI of both the groups. (iii) Comparative effectiveness of the CAI method and the traditional method was measured by the experiment and CAI method was found more effective in terms of achievement scores. (iv) In relative effectiveness of the package was equally effective in teaching boys and girls. (v) Students and teachers both revealed a favourable opinion towards CAI program.

(Patel, 2009) conducted a study on Development and Implementation of CAI to teach English grammar to standard VIII student in different modes Objectives: (i) To develop the CAI to teach English Grammar to Standard VIII Gujarat Secondary and Higher Secondary Board (GS&HSEB) students in different modes (only CAI, CAI with repetition, CAI with discussion) (ii) To study the effectiveness of the developed CAI in different modes in terms of students' achievement in English Grammar. (iii) To study the effectiveness of the developed CAI in terms of the reactions of students. (iv) To study the relative effectiveness of the developed CAI in different modes of presentation (only CAI, CAI with repetition, CAI with discussion) in terms of differences in the adjusted post-test mean achievement of the student in English Grammar. Method: The sample of the present study was selected

purposively. For it two schools of Vadodara namely, Bright day school and Kelvani school during the academic year 2008-09 were selected. From the selected schools 26 standards VIII students of only one division VIII-A of Kelvani School were taken as the Control group and 62 standard VIII students of Bright day school were treated as the experiment group. The required data were collected with the help of pre-test, post-test and reaction scale which were constructed by the researcher. In between pre-test and post-teat the researcher implemented the intervention program in the form of CAI package for ten days for two hours per day on the experiment groups and control group was taught the same topics by their teacher. After the implementation of that the researcher administrated the post-test after the span of fifteen days and the reactions of the students, based on teaching with CAI and the developed CAI itself were taken. The data were collected in three phase. ANOVA was used for data analysis. Findings: (i) The achievement of the students in English Grammar taught through CAI was found significantly higher than that of the students taught through traditional method. (ii) The achievement of the students taught through only CAI was found significantly higher in English Grammar than that of the students taught through traditional method. (iii) The achievement of the students taught through CAI with repetition and CAI with Discussion was found significantly higher than the achievement of the students who were taught through traditional method. (iv) From the three modes of the presentation of this CAI, the mode i.e. teaching through CAI with discussion was found significantly superior in comparison to other two modes. (v) CAI was also found to be effective in terms of the students.

(Vansia, 2011) conducted a study entitled Effectiveness of Computer with Peer Interaction for Math's learning in urban area. Objectives of the study were 1. To develop Computer Assisted Instruction Programme in math's subject for standard IX students. 2. To compare the achievement scores of students learning through Computer Assisted Instruction with Peer Interaction (CAIPI) for boys and girls on posttest. 3. To compare the achievement score of students learning through Computer Assisted Instruction with Peer Interaction (CAIPI) for students of high IQ and low IQ on posttest. 4. To compare the achievement scores of boys and girls group on posttest. 5. To compare the achievement scores of experimental and traditional group on posttest. 6. To compare the achievement scores for students of high IQ and low IQ group on posttest. 7. To study the interaction between sex and method of teaching on posttest. 8. To study the interaction between sex and IQ on posttest. 9. To study the interaction between method of teaching and IQ on posttest. 10. To study the interaction between sex, method of teaching and IQ on posttest. Multi-staged sampling technique was used by the researcher in this study. The experimental and traditional both

groups consisted of 52 students and both groups are equal on pretest scores. The true experimental design 'posttest control group' was employed. Conventional Lecture Method was adopted for the control group, while CAIPI were introduced as experimental group. The total sample for the experiment consist 104 students. Students in both groups learn same content topic of 'Solid Matter' through the respective instructional strategy. Experiment time duration was 30 periods in both groups. Data were analysed through the statistical techniques such as t-value and ANOVA. Findings of the study were 1. Math's learning through Computer Assisted Instruction with Peer Interaction (CAIPI) was equal effective for boys and girls.2. Math's learning through Computer Assisted Instruction with Peer Interaction (CAIPI) was more effective for high IQ student's then low IQ students.3. Effectiveness of sex was shown on mean achievement score of posttest.4. Effectiveness of teaching method was shown on mean achievement score of posttest.5. Effectiveness of IQ was shown on mean achievement score of posttest.6. Interaction effects of sex and teaching method was not shown on mean achievement score of posttest.7. Interaction effects of sex and IQ was not shown on mean achievement score of posttest.8. Interaction effects of teaching method and IQ was not shown on mean achievement score of posttest.9. Interaction effects of sex, teaching method and IQ was not shown on mean achievement score of posttest.

2.07 The related literature in the field of Computer Assisted Instruction conducted Abroad

(Suwanma, 1991) conducted a study entitle, "Construction of Computer Assisted Instruction in science on topic "Earth and Changing" for Mathoyom Suska 2". Subjects were 20 Mathayom Suska 2 students of the 1999 academic year from Spng-Kwae Witthayakom School, King-Amphur Doi-Loi, and Chiang Mai Province. The subjects took a pre-test and then they were given the post-test. Data were treated using item by objectives analysis. The result showed the efficiency of the CAI. The students mastered at 84.75 per cent criterion of objectives of the study. They were satisfied and appreciated with this CAI program.

(Hsu, 1994) conducted a study entitled "Computer assisted language learning (CALL) to see the effect of elementary language students (ELS) use of interactional modification on listening comprehension". Objectives of the study were (1) Is second language student request modification of the input they hear while working on Computer based listening exercise, and (2) If this international computerized modifies help second language students listening comprehension and language acquisition. Data were collected from 15 elementary second language students by using a single group pre-test research design. The findings revealed that second language students use the tools made available by the computer

technology to make input comprehensible and computerized modification and language acquisition.

(Nimtrakul, 1999) conducted a study entitled "Effects of computer-assisted instruction Atomic Structure in chemistry if Mathayon Suska 4 students". The purpose of the research was: (1) To construct CAI on atomic structure in chemistry of Mathoyom Suska 4 students (2) To investigate the achievements in chemistry on atomic structure of Mathoyom Suska 4 students who were taught through the CAI program and (3) To explore the learning attitude towards the chemistry of the students who were taught through the CAI program. The subjects of this study were of Mathoyom Suska 4 students of Chiang Mai University Demonstration School Maung District Chiang Mai Province during the first semester of academic year 1999. A class of students was chosen as the experimental group by clusters random sampling. The research instruments were the CAI on atomic structure in chemistry of Mathoyom Suska 4 students, the chemistry achievement test on atomic structure with reliability of 0.8210 and chemistry learning test with reliability of 0.8276. The statistics used for the construction of CAI on atomic structure in chemistry of Mathoyom Suska 4 students, were divided into two parts. One was to find the efficiency of the program by using the mean and percentage if the test between and after being taught through it and the other was to compare chemistry learning achievement on atomic structure in chemistry of Mathoyom Suska 4 students, by using t-test in form of paired-test analysed with SPSS for windows program. The statistics used for the study of learning attitude towards the CAI on atomic structure in chemistry if Mathoyom Suska 4 students were mean, standard deviation (SD) and mean population estimation (m) also analysed with SPSS for windows program. Research Finding were (1) The efficiency of the CAI on atomic structure in Chemistry of Mathoyom Suska 4 students was 93.26/92.06, which was higher than the standard criterion 85/85. (2) The learning achievement in chemistry on atomic structure of Mathoyom Suska 4 students, after being taught through the CAI on atomic structure in Chemistry was higher than that before being taught through the CAI on atomic structure in Chemistry at the .01 level of significance. (3) The learning attitude in Chemistry with CAI on atomic structure of Mathoyom Suska 4 students was at the moderate to satisfactory.

(Robkob, 1999) conducted a study entitle, "Achievement and Retention in Science of Prathom Saksa 5 Students Learned Through Computer-Assisted Instruction." Objective of the study was (1) To determine achievement of the computer-assisted instruction, created a life science unit on animals for the three subunits of the students at the fifth grade. (2) To study the stability of learning Computer-assisted instruction in a science unit on living animals for

the three subunits of the students at the fifth grade. The purpose of this study was to compare achievement and retention of Prathom Suska 5 students from at Anubaab Chiang Main School, Muang District, and Chiang Mai Province, first semester in academic year 1999. They were divided into two groups; the experimental and the control. Each group had 20 students. Both group took the pre-test after experimental group studied through CAI program themselves while the control group learned by the conventional method. At the end of studies, they were given the post-test. The retention test was applied to both groups of the students, two weeks after the post-test. Data was analysed using item by objective analysis. The results showed that learning achievement and retention of students, which studied through CAI and studied by conventional method, were differing.

(Vaisopha, 1999) conducted a study entitled "Construction of Computer Assisted Instruction in the Mathematics on topic 'Adding fraction' for Prahom Suska 5 students". The design for the study was pre-test-CAI program-post-test. Data were analysed using item-by-objective analysis. The result indicated that the subjects were able to master learning objectives of the study were off the study were with their percentage of 94.5 average. The students were satisfied and appreciated this CAI program. The finding of the study revealed that significant gain in terms of mean achievement through CAI. CAI has evoked positive perceptions amongst teachers and students.

(Salsbury, 2002) conducted "A study on comparing teacher-directed and computer-assisted instruction of elementary geographic place vocabulary". The purpose of this study was to compare computer-assisted instruction to teacher-directed instruction for teaching elementary geographic place name vocabulary. The quasi-experimental research design of pre-test, treatment and post-test was employed in this study since the students were in pre-assigned classrooms. Two classrooms received instruction for learning to identify and label 50 world places, and third class was the control group. Overall data analysis revealed significant difference between two methods of instruction when compared to each other, and to the control group. Gains in pre-test to post-tests scores were greater from computer assisted instruction. This study has reported the highly significant academic success of fourth grade students learning geographic place name vocabulary through drill, whether a teacher or a computer provides the instruction.

(Crews, 2003) conducted a case study that investigates the effectiveness of a CAI reading tutorial in helping poor readers improve their ability to read. The study was undertaken with three objectives (1) To scientifically investigate if poor readers using the CAI significantly improved their reading abilities, and assuming the CAI was effective (2) To

identify the instructional methods and strategies implemented in the CAI design (3) To theoretically explain the effectiveness of the CAI and thereby provided information of effective methods of designing effective CAI for poor readers. The study was conducted at a Title 1 elementary school in a large city in the southwest. Title 2 schools serve a high concentration of students living in poverty and as a result, receive funds to provide special educational services for low achieving and at-risk students. The 13 participating students were fourth and fifth grade students with poor reading abilities as determined by the independent assessments and observations of their homeroom teachers. The multimedia CAI program investigated supports the active cognitive participation of the learner, delivers multi-sensory instruction, and provides timely, directed feedback, teacher's phonics skills, and implements 100 per cent mastery learning. The instruction is individualized and self-paced. Results of pre-post reading comprehensive tests and interviews indicate that poor readers completing the CAI tutorial significantly improved their reading skills and the students and their teachers felt that using the CAI tutorial helped the students become better reader.

(Casanova , 2004) conducted a study entitled 'an analysis of computer-mediated communication technologies as tools to enhance learning.' The integration of computer-mediated communication (CMC) technologies into the higher educational settings have requires faculty to change their roles from the direct instructional model to a model based on constructivists' ideas. CMS instructional tools (Its) have provided a change by shifting a traditional teacher centred setting into a teacher facilitator environment. Teacher's professional development has become an important task to effectively integrate technology into their courses. Questions concerning the implementation and value of CMS technologies and their impact in higher education are not yet clear. The purpose of this research study was to determine the extent to which CMS technologies promoted the achievement of stated goals and objectives for course taught in higher education. This study was directed by three research questions (1) in what ways are higher education faculties using CMS technologies to deliver their courses? (2) What is the faculty's primary instructional intent for the CMS technologies they selected for integration into the teaching process? (3) In what ways does the integration of selected CMS technologies promote achievement of stated goals and objectives in their courses? The research study population consisted of 17 higher education faculties from the trek 21 projects at West Virginia University during the year 2001. These participants received technical training, enhanced web-designed courses, worked collaboratively and prepared instructional resources during a 7 day week period during summer 2001. The data collection was done by survey, course analysis and interview.

Findings indicated that faculty was mainly using CMC technologies to support teaching practices and to improve teacher's productivity. It's were basically targeted to increase interactivity, open avenues for feedback and provide resources but less used for inquiry based and active learning. Faculty's primary intent to integrate CMC technologies was to create different avenues to communicate with students and to offer them a learning environment that would support students outside the classroom. CMC promoted the achievement of goals and objectives with different degree of success mainly in two different areas: content delivery and course management and less regarding tele collaborative activity structures.

(McLaughlin, 2004) conducted a study entitled "Towards a new paradigm for teaching and learning: A case study of the process of integrating instructional design and technology at Florida Community College at Jacksonville." The study examined the process by which administrators, faculty and instructional design staff at Florida Community College converted four traditionally formatted courses to online courses in order to integrate innovative instructional design and learning strategies with instructional technology. The study also examined the design and development of an electronic instructional design assistant that would enable the user to systematically design curriculum that incorporated learning and motivational theory. The investigator used case study design to describe the model and processes the college administration used to implement the project. The purpose of this study was to explore how one institution of higher education addressed the gap that exists between systematic and collaborative instructional design and the use of instructional technology in online course development. Data for the study was collected through semi-structure interview and a review of project related records, reports, guidelines and artefacts. Data was also obtained through field observations and investigator participation in training and professional development sessions with faculty and staff.

(Eteokleous, 2004) conducted a study on 'Computer technology integration in Cyprus elementary schools.' The purpose of this study is to evaluate the current situation in Cyprus elementary classrooms regarding computer technology integration. The study examined how Cypriot elementary teachers use computers and the factors that influence computer integration in their classroom practices. To address the research questions that guided the study, an evaluative case study design was applied. It employed mixed method approach through the usage do structures questionnaires and semi-structured, open-ended interviews as the major methods of data collection. The value of the proposed study lies in its potential to help policymakers, educators and stakeholders that have the power to take decisions and design policies, in gaining understanding on how computers are used in the classroom and the

factors that influence their use. The results of the qualitative analysis summarize the factors that influence teachers in applying computers in their classroom practices. A general uniformity across the three categories of teachers revealed, in terms of the factors that function as barriers in applying computer in the classrooms. The factors can be summarized as follow: lack of resources; tyranny of the curriculum; incomplete and inadequate professional development training.

(Hung, 2005) conducted a study on "The evaluation of a technology-aided lecture accompanied by a set of macroeconomics computer interactive exercises in macroeconomics for the undergraduate business major in Taiwan". The study examined the effects of a technology aided lecture accompanied by a set of macroeconomics computer interactive exercises and a traditional instruction supported by using transparencies on students' learning achievement. Since a significant difference in knowledge of macroeconomics existed between the experimental group and the control group, analysis of covariance (ANCOVA) of the post-tests, using pre-test as the covariate, was used to analyse the research data. As comparing the effectiveness of the two different instructional methods, it is concluded offering the courses for the unit on unemployment and inflation through the Technology-Aided Lecture (TAL), accompanied by a set of macroeconomics computer interactive exercises, or the standard instruction produced a non-significant difference, to the extent measured by the researcher developed test.

(Rosales, 2005) conducted a study entitled "The effect of computer-assisted instruction on the mathematics achievement of ninth-grade high school students in the lower Rio Grande Valley". This study was conducted to describe the effect a computer-assisted instruction program had on the mathematics achievement of ninth grade high school students in the lower Rio Grande Valley as measured by the state assessment. A quasi-experimental pre-test post-test control group design with matching was used. The subjects were first time, non-exempted ninth grade students from two schools paired by ethnicity and percentage of socio-economically disadvantaged. ANCOVA procedures were used to determine the statistical significance. The study tested the following research hypothesis: There was statistically significant difference between the mathematics achievement of ninth grade high school students in the lower Rio Grande Valley who participated in computer-assisted instruction and the mathematics achievement of ninth grade high school students in the lower Rio Grande Valley who did not participate in computer-assisted instruction. The resultant analysis indicated that there were no statistically significant differences between the mathematics achievements of the two groups.

(Gilbert, 2006) conducted a study entitled "Effectiveness of computer-assisted instruction blended with class-room teaching methods to acquire automotive psychomotor skills". Here two blended learning methodologies of web-based CAI and face-to-face classroom instruction were investigated in the Automotive Technology Department at Southern Illinois University Carbondale. Results were determined by a psychomotor electrical diagnostic skill evaluation of two matched groups exposed to different blending methods of teaching basic electrical concepts. Analysis revealed that the blended teaching methods experienced by the experimental group demonstrated a comparatively higher level of psychomotor electrical diagnostic skill capability.

(Beaird, 2007) conducted a study entitled "The effects of computer-assisted language learning on English language learners with and without disabilities in an elementary school setting". The purpose of the study was to investigate the effects of the English Language Learners Instructional System (ELLIS) on oral language, written language and reading achievement among students who are English language learners with and without disabilities. Additionally, levels of teacher satisfaction with computer-assisted language learning (CALL) and the use of ELLIS were assessed. Participant were 78 third, fourth and fifth grade students with and without disabilities enrolled in a public elementary school. They were randomly assigned to one of three groups. Treatment Group A included students with and without disabilities and received individual instruction on the ELLIS (English Language Learning Instructional System) program. Treatment Group B included students with and without disabilities and received ELLIS instruction in student pairs. The third group of students was a control group and did not receive instruction using the ELLIS program. Data were collected to answer eight research questions related to the effectiveness of the ELLIS program. Data were analysed quantitatively as well as qualitatively with ANOVA/ANCOVA and open-ended interview techniques respectively. In findings of the study, the ANOVA and ANCOVA analyses revealed that students with disabilities who received instruction using the ELLIS program performed similarly to students with disabilities who did not receive instruction using ELLIS program in oral language, written language and reading achievement. The students without disabilities who received instruction using the ELLIS program performed similarly to students without disabilities who did not receive instruction using the ELLIS program in oral language, written language and reading achievement. Paired instruction using the ELLIS software program had similar effects on student performance as individual instruction using the ELLIS software program. Results from the open-ended interview revealed high levels of teacher satisfaction with the ELLIS software program.

(Ford, 2007) conducted a study entitled "Effect of computer-aided instruction versus traditional modes on student PT's learning musculoskeletal special tests" with 3 group single-blind pre-test, immediate post-test, final post-test repeated measures with qualitative survey for the CAI group design. Subjects were randomly assigned to CAI, live demonstration or textbook learning groups. Three novel special tests were instructed. Analysis of performance on written and practical examinations was conducted across the 3 repeated measures. A qualitative survey was completed by the CAI group post intervention. Finding of the study revealed that CAI was equally as effective as live demonstration and textbook learning of musculoskeletal special tests in the cognitive domain, however, CAI was superior to live demonstration and textbook instruction at final post-testing.

(Galvis , 2007) conducted a study entitled "Computer Assisted Instruction (CAI) as a teaching tool for occupational therapy education: A guide to understand CAI design and effectiveness". The primary purpose of the study was to compare the effects of CAI versus traditional teaching methods with occupational therapy students. To explore the topic, three consecutive and inter-related studies were conducted. The result of this research can assist occupational therapy and other allied health educators to understand the advantages CAI materials can provide if they are properly designed and implemented in their classes. In its analysis researcher had founded that the CAI was an effective alternative to traditional classroom lecture to teach practical skills and theoretical knowledge. It was also found that CAI provides faster instruction while providing learner-centred training.

(Karnati, 2008) conducted a study entitled "Computer aided instruction for out-of-school children in India: An impact study in Andhra Pradesh". India has the largest number of out-of-school children, the majority of whom are girls. Against this backdrop, the Bridges to the Future Initiative (BFI), a computer-aided instruction (CAI) intervention was launched in Andhra Pradesh to bring children back to school. The BFI used multimedia software to teach basic literacy and numeric skills through interactive stories and activities, in the local language Telugu. The methodology employed in the study was a quasi-experimental design on a sample of around 140 children (age range 7-19 years). The research study included the Bridges to the Future Initiative (BFI) sites which offered two hours of CAI a day and comparison sites which provided five hours of teacher-based instruction (TBI) a day. This research was one of the first to explore the context of out-of-school children in poor communities and the use of CAI in Telugu (local language) to bring these learners back to school. The results support the use of ICT with marginalized sections of society in developing countries in order to improve literacy skills.

(Pilli, 2008) conducted a study on The Effects Of Computer-Assisted Instruction on The Achievement, Attitudes And Retention of Fourth Grade Mathematics Course. A PhD thesis submitted to Middle East technical University. The purpose of this study was to examine the impact of computer assisted instruction with the software *Frizbi Mathematics 4* on fourth grade students' achievement, attitudes and retention in mathematics lessons. In this study quasi-experimental research design was used in order to investigate the impacts of the *Frizbi Mathematics 4* educational software on the 4th grade student's mathematics achievement, mathematics attitude, and computer assisted learning attitude, and retention. Research Questions were 1: Is there a significant difference between the achievement post-tests scores of the students exposed to Computer Assisted Instruction with the *Frizbi Mathematics 4* and those who were exposed to traditional instruction with textbook? 2: Is there a significant difference between the mathematics attitude scale post scores of the students exposed to computer assisted instruction with *Frizbi Mathematics* 4 and those who were exposed to traditional instruction with textbook?3: Is there a significant difference between the computer attitude scale post scores of the students exposed to computer with *Frizbi Mathematics 4* and those who were exposed to traditional instruction with textbook? 4: Is there a significant difference between the retention test scores of the students exposed to computer assisted instruction with the *Frizbi Mathematics 4* and those who were exposed to traditional instruction with textbook? The sample consisted of 26 students in control group and 29 students in Experimental Group. Findings of the study 1. The results of pre-test and post-tests for unit 1: "Multiplication of Natural Numbers" revealed that the CAI with *Frizbi Mathematics 4* applied to the experimental group was demonstrated to be effective in increasing the115achievement scores of the students. 2. The results of pre-test and post-tests for unit 2: "Division of Natural Numbers" were significant differences between achievement tests' mean scores of students in the experimental and control group. 3. The results of pre-test and post-tests for unit 3: "Fractions" revealed there were significant differences between achievement tests' mean scores of students in the experimental and control group. 4. In unit 1 (Multiplication of Natural Numbers) retention test were lower than the post-test mean scores in both groups and the "rate of retention decay" was not significantly different between the experimental and the control group, the results of independent *t*-test indicated that the experimental group's retention test mean score was significantly higher than the control group.

(Jackson & Dave , 2011) conducted a study on "The Effect of Computer-Assisted Instruction on Student's Attitudes and Achievement in Matrices and Transformations in

Secondary Schools in Uasin Gishu District, Kenya, Moi University, Kenya." The purpose of the study was to investigate the effects of CAI on students' attitude and achievement in matrices and transformations between form four students who received instruction using CAI module or conventional instruction methods. The study addressed the following questions:1. What are the effects of the CAI module on students' achievement in matrices andtransformations?2. Is there any significant difference in the achievement on matrices and transformations between subjects exposed to CAI module and those not? 3. What are the effects of the CAI module on students' attitudes towards Mathematics course? 4. Is there any significant difference in attitudes towards lessons on matrices and transformations between subjects exposed to CAI module and those not? The pre-test – post-test control group experimental research design was used. Six classes selected at random with 205 students participated in the study. Results of this study indicated higher achievement and positive attitudes with CAI treatment groups. Making connections between the goals of Mathematics education and CAI offers a valuable means for improving mathematical knowledge and skills and hence performance in Mathematics.

(Bayturan & Kesan, 2012) conducted an study on "The Effect of Computer Assisted Instruction on the Achievement and Attitudes Towards Mathematics of Students in Mathematics Education" The objective of this study was to investigate the impact of Computer Assisted Instruction method on students achievement and attitudes towards mathematics in secondary mathematics education. The research was designed based on an experimental pre-test post-test model. The research was conducted in 60 ninth grade students from a Anatolian high-school during 2009-2010 academic year. The experiment group consists of 30 students and the control group consists of 30 students. The research is implemented by using Computer Assisted teaching material that is developed by Flash MX program related with the unit of "Relation, Function and Operation" of the area of learning algebra and took 10 weeks. Computer Assisted Instruction and traditional instruction methods were used in the experiment group and the control group respectively. The data were collected by using the Mathematics Test, Mathematics Attitudes Scale. Data analysis was done using t test. The results demonstrated that teaching mathematics with a computer assisted instruction method increased student success significantly in mathematics lesson. However, the experimental and control groups did not differ between students' attitudes towards mathematics.

2.08 Related literature in Education act

Investigator has reviewed the following authentic sources to conform the inclusion of class VIII in primary level. The (Gujarat Government Gazette, 2012) in the Right of Children to Free and Compulsory Education Rules, 2012 has stated that the Elementary Education Schools in the State of Gujarat shall be either from class I-V or VI-VIII or I-VIII and State Government shall modify the existing schools to conform to this structure. (Gujarat Government Gazette, 2012)The Gujarat Elementary Education Rules, 2010 Opening of new Elementary Schools or take over a private school. Areas or limits: The areas or limits of neighbourhood within which a school has to be established by the State Government shall be as under (a) In respect of children in classes I - VIII, a school shall be established within a walking distance of one km of the neighbourhood.

2.09 Analytical Review of Related Literature

Table 2.1 Analytical Review of Studies Related to Programmed Learning Material Conducted in India

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
1	Kulkarni and Yadav -1966	Comparative study of teaching by different methods of programming of different levels of pupils	Math	The study attempted to know which method of programming could have better impact on instruction for the development of an ability for a given group of students, i.e Branching, linear and simple programmes. Different types of programmes on the development of knowledge, comprehension and application objectives for "solving simple equations".	Three matched groups on the basis of marks were formed. ANOVA F Values	VI students of an English Medium school in Delhi	Solving Simple Equations	Findings showed that the treatment effects did not seem to be significantly different; to arrive at certain conclusions replications with better control were needed.
2	Sharma -1966 PhD Thesis	A comparative study of outcomes of teaching of Algebra by	Math	To find the effectiveness of the developed programmed instruction	The sample consists of 80 students of class IX. Besides usual pre-test and post-test a delayed	IX 80 students	Algebra	The findings of the study showed that the mean achievement of the experimental group taught

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
		conventional classroom and method of programmed instruction			posttest was also administered to study the effectiveness of the two methods in terms of retention.			through PLM was 2.5 point higher than that of the control group taught by the teacher through the lecture method. Also the delayed posttest showed better retention by the experimental group
3	Shah -1969 PhD Thesis	Auto instructional programmes in Algebra for standard VIII and to find out their effectiveness in relation to different variables	Math	The purpose of the study was To examine the potentialities of the auto instructional programmes as a practical solution.	-	VIII	Algebra	Findings (i) the total mean score achieved by the experimental group was higher than the total mean score achieved by the control group (ii) the average time taken by the experimental group was less than the average time allotted to the control group.
4	Patel -1975 PhD Thesis	Development of Auto Instructional Programmes in	Math	To developed Auto Instructional Programmes in Geometry for Std. IX	The tools used in the study were (i) The Desai's Intelligence Test	IX Fourteen	Geometry	The findings of the study were: (i) the PLM proved to be more effective than

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
		Geometry for Std. IX and to find out their Effectiveness in relation to different variables		and to find out their Effectiveness in relation to different variables	etc.,	class of Rural and Fourteen class of Urban high Schools		conventional method (ii) high and low IQ groups of students performed better with PLM than with conventional teaching (iii) the average time taken by the group learning through PLM was less than that of the group taught by the traditional method (iv) students from different strata of the society performed better with PLM than with conventional teaching.
5	Patel -1977 PhD Thesis	Development and try out Auto Instructional Programmes in Some Units of Geometry for Class VIII and to study its	Math	(i) to develop PLM in some units of Geometry for class VIII (ii) to compare the achievement in mathematics of students having different reading abilities, and learning through PLM	The sample consisted of 810 students of class VIII studying in fourteen schools of Kaira District. The sample was selected in view the following criteria, strength of the	VIII 810 students	Geometry	It was found that the auto instructional material does not work well with pupils having low n Ach.; (ii) in case of highly motivated students the material was found to be working well; (iii) learning through PLM

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
		Effectiveness in the Context of different Variables		and traditional way of teaching.	school etc.			in case of students having poor reading ability was not more effective than the conventional method but it was superior in case of students who had good reading ability: (iv) more anxious students could learn better through PLM than their counterparts.
6	Seshadri -1980 PhD Thesis MSU Baroda	An Experiment in the Use of Programmed Instruction in Secondary Schools	Math	(i) to identify different components of the instructional strategy. (ii) to develop software material to be utilized under different components, (iii) to study the effectiveness of each component in terms of students and parents' reactions and teachers observation. (iv) to study the effectiveness of	The tools of data collection were the criterion tests, Headmasters' Association examinations, semester and comprehensive examinations, questionnaire to know learners', parents' and school authorities' reaction. Other tools used were the Raven's	IX	Whole syllabus	She found that the strategy having PLM as its major component worked better.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				instructional strategy as a whole.	Standard Progressive Matrices, Junior of Motivation (JIM Scale) and Palsane's Study Habit Inventory. The statistical techniques used were t-test, product moment coefficient of correlation and partial correlation.			
7	Pandey -1980 PhD Thesis Pat. University	Use of programmed Instruction on Teaching Mathematics at Primary Level	Math	The aim of the study was to see the relative effectiveness of the traditional method without home assignment and grading, a programmed text and the traditional method with regular home assignment and grading in teaching mathematics at primary level.	Not available	IV 60 students	Whole syllabus	He found that the PLM was superior to other methods and that the high and the low-income group students following the PLM were distinctively superior to those who had traditional teaching with home assignment and grading.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
8	Trivedi-1980 PhD Thesis	Developed branching style PLM in mathematics for class V, VI and VII	Math	(i) to develop Programmed Learning Material of the branching type in mathematic for classes V, VI and VII (ii) to compare the achievement of the students by the traditional methods of teaching with that of the students studying through programmed materials (iii) to diagnose students weakness in mathematics and (iv) to use programmed materials as remedial measures.	Two way analysis of variance	V, VI and VII	-	For class VI the PLM was more effective than the corrective teaching and for class V and VII both the methods were equally effective. The class VI girls learnt better than the boys whereas in the other two class there was no difference between the sexes.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
9	Inamdar -1981 PhD Thesis SPU	Effectiveness of the Programmed Learning Strategy in the Subject of Mathematics for standard VII in relation to some Psychological Correlates	Math	(i) To develop PLM (ii) To study the effectiveness of the developed PLM	The performance of the group was studied in relation to some psychological correlates such gas general ability reasoning ability and motivation towards school. Analysis interpretation of the data were done to find out the relation between general ability and performance in achievement test in the PLM.	VII 108 boys and 100 girls	Simple Interest	He found that the programme fares better than the conventional method.
10	Shah -1981 PhD Thesis Gujarat Univ	To Develop and try Programmed Material in Mathematics for students of Class V	Math	(i)to develop programmed materials on various units of the mathematics syllabus of class V and (ii) to try the same on children of class V from a few selected schools.	For every unit criteria test was used. Questionnaire was used for students and teachers to know their reactions towards the programmed materials	V Seven Primary Schools 250 students for PLM and 200 for control Group	All	Findings (i) the total mean score achieved by the experimental group was higher than the total mean score achieved by the control group (ii) the average time taken by the experimental group was less than the average time allotted to the control group. The reactions of the students and the teachers were favourable.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
11	Suthar -1981 PhD Thesis SPU	Developed algebra programme for class VIII covering	Math	The major objectives of the study were (i) to develop PLM in algebra of students with different study habits, learning through PLM and traditional way of learning.(iii) to compare the achievement of algebra of students with different reasoning abilities. (iv) to compare the achievement of students having positive and negative attitudes.	Study habits, attitude towards mathematics, learning abilities, motivation towards school, learning and entering behaviour were also analysed	VIII	set theory, rational numbers, real numbers powers and indices, equations and problems, and graphs	The PLM emerged superior irrespective of different variables.
12	Davies -1982 PhD Thesis Madras Univ	Effects of Different Modes of paring in programmed Learning of Mathematics on the Performance of Underachievers	Math	To test the differential effects of the three pairing modes in PLM, on the achievement of underachievers in mathematics	Ten randomly selected schools The statistics used were t test, F- ratio, chi square test, ANOVA, multiple regression and factor analysis were used for data analysis.	IX 1092 students	Statistics	The main findings of the study were, the underachievers had 78% individual gains, underachievers in teachers choice and mixed pairs gained significantly in the post test and had significant residual gains

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								over the predicted level of performance in mathematics.
13	Rao -1983 PhD Thesis Osmania University	A comparative study of PLM and conventional learning methods in the instruction of mathematics, a psychological approach	Math	Objective of the study (i) to find out the efficiency of the PLM over the conventional learning method in the instruction of mathematics in school education. (ii) to determine the variation in learning gains in the pupils in the rural urban dimension.	The design was an experimental cum field investigation: Two matched groups of students were exposed to PLM and conventional classroom teaching.	Grade V and Grade X 300 students from grade V and 296 students from grade X	General	The findings of the study were (1) the mean performance scores of all the PLM groups were higher than those of the corresponding conventional learning groups. (2) The performance of urban subjects was superior to the performance of the rural subjects under the PLM, irrespective of grade.
14	Bhatia-1992 PhD Thesis	remedy of difficulties in learning fractions with Programmed instructional material	Math	Objectives (1) to develop programmed instructional material on fractions for students of class V. (2) to use programmed instructional material a remedial tool. (3) to test	A sample of 50 students was selected from two M.C.D primary schools of Karol Bagh New Delhi twenty five students from each school; four criterion	V	Fractions	Major findings : (1) Teaching and learning through PLM could definitely help both students and teachers. (2) Students receiving the PLM did better in post test

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				the effectiveness of programmed instructional material in class room teaching for students of class V and (4) to test the significance of difference between the traditional method of teaching and teaching through PLM.	tests were administered as tools to collect data. The collected data were treated by using mean, SD and t-test.			as compared to the other group. (3)The PLM worked effectively as a remedial tool. (4) PLM not only helped the students to learn better but also helped the teacher to know how the students learn better.
15	Thatte-1998	An Experimental Study of the Relative Effectiveness of Programmed Learning and Learning Through Audio Visual Aids with reference to certain selected topics from the syllabus of Science for Std. V to VII in Greater Bombay	Science	1. To compare the mean achievement scores of the students of Std. V, VI, and VII studying through AV Aids method, Programmed Learning Method and Traditional method.2. To study the effect of treatment, sex, and their interaction on achievement.	Tools of the study were the question papers set by the investigator based on the topic were used as tools for data collection. Data were Analysed using Central tendencies, percentile and percentile ranks, SD, ANCOVA and t test.	Std. V to VII Sample of the study was eight Schools of Greater Mumbai were selected in all. Twenty four different classes were considered and the total	-	Findings of the study were 1. AV aids method was found to be significantly more effective than the Programmed Learning Method and the Traditional method in terms of achievement at Std. V, VI, and VII. 2. Programmed Instruction Method was found to be significantly more effective than the Traditional Method in terms of achievement at Std. V, VI, and VII.3.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
						number of students was 1381.		Programmed Learning Method and Audio Visual Method are more successful when the classes are small, at the same time they are more effective for average students. 4. Male students and female students, both, equally benefited through the AV method as well as Programmed Learning Method. No significant effect of interaction between treatment and sex was found on the achievement of student.
16	Tare -2001 Rani Durgavati Univ, Jabalpure	A Study of the Effectiveness of Branching Variety of Programmed Instructional Material as	Chemistry	1. To compare the achievements of the students of urban and rural areas of Jabalpur Division by the traditional method of	Research Design used Experimental and Control Group Design was used for the purpose of this study. Tools and Techniques: A branching	Secondary Classes Sample 280 students were selected	-	Findings 1.The achievement of the experimental group was found significantly greater than the achievement of the control group. 2. The

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
		Diagnostic and Remedial Tool in Chemistry for Secondary Classes in Jabalpur Division		teaching with that of studying through branching frames of programmed learning in Chemistry Subject.2. To diagnose the weakness of the students of urban and rural areas with the help of PLM.	programme was developed on Atomic Structure and Chemical Bonding and pre-test and post-test were constructed by the investigator. Data Analysis: ANOVA and t-test were used for data analysis.	from different Government Higher Secondary Schools of urban and rural areas of Jabalpur Division		achievement of the urban girls through PLM was found significantly higher than that of the urban boys. 3. No significant difference was found in the achievement of boys and girls of rural areas in the post-test on atomic structure and chemical bonding. 4. 135 boys out of 180 and 64 girls out of 99 wanted to continue the study with the PLM on both the topics. 5. The weakness of individual students were diagnosed and removed when branched frames on both the topics were administered.
17	Ramani and Patadia-2012 Journal of	Development and Try-out of the Programmed	Math	1. To develop programmed learning material in mathematics	Post test only control group design was used.Tools of the study	XI 14 Students	Probability	PLM was found to be effective in teaching PROBABILITY to XI

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	Teacher Education in Developing Nations.	Learning Material in Mathematics for class XI students studying in schools affiliated to Gujarat Secondary and Higher Secondary Education Board (GSHSEB)		for XI standard students. 2. To implement the developed programmed learning material in mathematics to the XI Std. students studying in one of the English Medium Schools following the syllabus of GSHSEB. 3. To study the effectiveness of the developed programmed learning material.	were teacher made achievement tests. Data were analysed using correlated t test.			standard science stream s students as the achievement test score of experimental group students was found significantly higher than the achievement test score of the control group students.

Table 2.2 Analytical Review of Studies Related to Computer Assisted Instruction conducted in India

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
1	Nagar-1988 M.Phil., Education University of Delhi Fifth Survey	Effectiveness of computers in teaching mathematics in school	Math	(1) to examine the usefulness of the computer in teaching mathematics. (2) to examine areas/aspects of mathematics which can be more effectively taught with the help of computers and (3) to examine the trends regarding the use of computer-aided teaching of mathematics.	This study is based on survey of studies, which include; mainly, three projects and ten research studies conducted independently.	survey	General	The major findings are (1) Computer Assisted teaching (CAT) of mathematics benefited both the teacher and the learner. (2) CAT encouraged individualisation and practice without burdening the teacher with repetitive and monotonous activity. (3) CAT helped the learners to use their creativity by exploring new areas not covered by the syllabus. (4) computer

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								awareness was not sufficient in schools for CAT. level of education.
2	Jeyamani -1991 M Phil Thesis Avinashilingam Institute of Home Science, Coimbatore Fifth Survey	Development of Computer Aided Instruction in Physics for class IX	Physics	1.To develop CAI using BASICA. 2. To find the effectiveness of the developed software in terms of sex. 3. To find the effectiveness of the developed software in terms of medium of instruction.	Pre-test Post-test Control Group Design SD, mean and t test	XI	-	The experimental group received CAI and after the experiment it was found that experimental group performed better on the post-test. The difference was significant in terms of sex and medium of instruction. Significant: Yes
3	Singh, Ahluwalia, and Verma -1991	Effectiveness of Computer Assisted Instruction (CAI) and Conventional method of instruction	Math	Objectives: (i) To study the difference in mathematics achievement which occurs as a result of the	Stratified Random Sampling Pre-testpost-test control Group Design	The sample of the study consisted of 220 students from four selected higher secondary schools, covering the good, average	-	(i) The students who used the computer scored significantly higher than those taught mathematics

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				difference in instructional strategy among boys and girls separately and as a group. (ii) To study the direction of change in attitudes of male and female students separately and as a group towards mathematics as a result of two different instructional strategies.		and poor schools		through the conventional method. (ii) The students who used the computer showed significantly highly favorable attitude towards mathematics than those who did not use the computer (iii) Achievement in mathematics and change in attitude towards mathematics were found to be independent of the sex factor.
4	Rose Antony Stella V -1992 PhD Education Bharathidasan University	Effectiveness of Computer Assisted Instruction with special reference	Math	(1) To develop CAI software. (2) To find out the effectiveness of CAI with TSS and	The randomised block design was followed in the selection of the samples, with IQ	IX	Language of Sets	Major findings (1) Both the CAI strategies were superior to the traditional method

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	PhD Thesis	to underachievers.		CAI without TSS with references to the learners variables viz sex, IQ and achievement level and (3) To find out the interaction of the learner variables and the treatment on the achievement score.	as the blocking variables. t-test, Chi-square, one-way and two-way ANOVA. The tools used included CAI software on the language of sets, achievement test, and cultural fair, intelligent test by Cattell and cattell, study habitsinventory by patel, and Mathematics study attitude scale by Sundarrajan, Mean, S.D, t-test, Chi-square, one-way and two-way ANOVA were used to treat the collected data			of instruction, and CAI with TSS was more effective than CAI without TSS for underachiever (UA) (2) Except achievement level, all the other learner variables combined with the treatment had no interaction effect on the achievement score. (3) There was no relationship between the post-treatment scores and the variables 'sex','locali' and 'achievement level 'of the experimental group. In the case

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
					The samples consisted of three groups of size 32. composed of students of standard IX selected from Tamil Nadu State Board schools covering one rural and two Urban.			of the variables IQ, 'Study habits' and 'maths study attitude', the positive relationship between those variable and achievement at the pre-treatment level was found to be cancelled at the post-test. Similar results were obtained for UA. Significant: Yes
5	Singh -1992 PhD Education Guru Ghasidas University	Effectiveness of teaching mathematics through computer assisted instruction and conventional method of instruction on	Math	(1) To compare the results of the two groups in mathematical achievement. (2) To compare the results of the two groups in mathematical	The tools used in the study include rating scale by the researcher, general intelligent test of Mohsin, the attitude scale towards mathematics of	IX	simultaneous equations in algebra, statistical representation in statistics, and triangles and their congruency in geometry	(1) The groups taught through CAI in all the schools showed a substantial progress. (2) The gains in achievement of the pupils of good

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
		cognitive and non-cognitive variables		achievement sex wise and (3) To compare the attitudes towards mathematics of the two groups as whole and also sex wise.	Suydam, and the educational software prepared by the practising teachers. The statistical techniques used include mean, S.D and t-test. mean, S.D and t-test. Attitude Scale			schools are higher than those of pupils of average and poor schools. (3) the CAI method of teaching mathematics had proved to be more effective (4) both boys and girls gained more from the computer treatment.(5) a significant favourable change in the attitude of the pupils of the experimental groups over the control groups was observed.(6) The change in attitude towards mathematics was independent of

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								gender. Significant: Yes
6	Adhikari -1992 Journal Educational Media in India	Development of computer aided instructional material on cell and cell reproduction for class 9	Biology	(1) To develop computer aided instructional material on sell reproduction and study its effectiveness it terms of (a) achievement of students, (b) reaction of students studying through computer aided instructional material. (2) To compare mean achievement scores of the students towards the computer aided instructional material and traditional method by taking	Pre-testpost-test control Group Design t test	IX 40 Students	-	The findings of study were (1) the computer aided instructional material was found to be effective in terms of achievement of students. (2) students showed positive reaction towards computer aided instructional material (3) computer aided instructional material is effective in achievement when both the groups were matched on intelligence. Significant: Yes

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				intelligence as the co-variate.				
7	Das -1998 PhD work The M.S. University Baroda	Exploring effectiveness of computer assisted learning materials on rhymes in different modes	English	1. to develop computer software on rhymes in text, graphics-text, text-music, graphics text music, and graphics-text-music- recital modes. 2. to study the effectiveness of CALM prepared in different modes for learning the Rhymes in terms of Word meaning (lexicon), Analytical understanding, Comprehensive understanding, Writing ability, Recitation ability	Systematic RANDOM Sampling was used. The treatment tool was the Computer Assisted Learning Material (CALM) on rhymes developed by the researcher in different modes. Testing tool was an achievement test developed by the investigator. The design of the study was developmental cum experimental in nature. ANCOVA was used for data analysis	Class II 169 students	-	The findings of the study revealed that computer as a potential medium significantly contributed the realization of the objectives of the study and CAIM ensure higher learning in all area of language development. Significant: Yes

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				and LSRW ability.				
8	Khirwadkar -1998 PhD work The M.S University Baroda	Development of Computer Software for learning Chemistry at standard XI	Chemistry	(1) To develop CAL package in subject of chemistry for standard XI science students, studying GSTB syllabus. (2) To study effectiveness of the software package in terms of instructional time and achievement of students. (3) To study the effectiveness of software package of students' achievement in relation to students' intelligence level, motivational level	Randomization method ,t test, interview, Researcher had collected data of achievement through structured post-test and pre-test and data about attitude towards package through structured and unstructured interview schedule. Time duration one month for both the groups Data analysis was done by ANOVA, ANCOVA and Content Analysis	XI GSHSEB 60 students	-	The findings of the study revealed that the CAI package was effective in terms of academic achievement of students and instructional time, the teacher and students have positive attitude about developed CAI. IQ, academic motivation and attitude affected achievement of students. Significant: Yes

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				and attitude towards the package. (4) To study attitude of the students and teacher regarding the effectiveness of CAL.				
9	Zyoud -1999 PhD Work The M.S. University Baroda	Development of Computer assisted English language teaching of VIII standard students	English	(1) To develop a Computer assisted English Language Teaching VII standard Gujarati medium students. (2) To study the effectiveness of the Computer assisted English language teaching program on students' achievement in terms of vocabulary, grammar, and comprehension	Raven's progressive matrices. The researcher had randomly taken the sample of students for control and experiment group from the Gujarati Medium School. For the purpose of the study, tools had been constructed and used were achievement test, JIM scale and	VIII Gujarati Medium School GSHSEB Exp Gp 66 students and Control group 46 students	-	The finding of the study revealed that developed package helped the students in vocabulary and grammar; no effect in comprehension. Also, IQ had an impact on students' achievement, while motivation had not found impact on student's achievement.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				with respect to their intelligence motivation and attitude. (3) To study the attitude of the students towards the usefulness of the Computer assisted English language teaching program.	Raven's progressive matrices. ANCOVA was used for Data Analysis			Students were found to have positive attitude towards the packages. Significant: Yes
10	Yadav -2000 M.Ed Dissertation The M.S. University Baroda	A study of the effectiveness of the Computer Software for students of standard I	English		Researcher had selected the purposive sampling method for school and taken the Baroda High School, Bagikhana, as sample ,t test. For the purpose of study tool have been constructed and used were pre-test, semi-structure interview	I	-	The findings of the study revealed that developed package helped the students in vocabulary and grammar. Whereas, no effect in comprehension. Also, IQ had an impact on students' achievement, while motivation had not found

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
					for teacher and informal interview and observation for students.			impact on it. Students were found to have positive attitude towards the package. There was a significant gain in terms of mean achievement through CAL. Also CAL has evoked positive perceptions amongst teachers and students regarding computers. Significant: Yes
11	Dalwadi -2001 M.Ed The M.S. University of Baroda	Development of computer assisted instruction in science for the students of standard IX	Science	(1) To develop Computer Assisted Instruction (CAI) in science for standard IX. (2) To study the	T test	IX	-	The researcher had found the significant gain in terms of the achievement of students through CAI on "Light".

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				effectiveness of CAI in terms of achievement of standard IX students and (3) To study opinion of the science teachers and students regarding the effectiveness of the developed CAI.				CAI had evoked positive perception among the students. Though there were the students who did not take interest in CAI due to coloured graphics, but they like the more of presentation of text with graphics. Majority of students had enjoyed learning with CAI and suggested to prepare CAI on other topics too. The students were of opinion that coloured animated graphics, sound effect in CAI would enhance

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								learning. The teacher has also suggested to develop CAI in other area of science. Both the teacher and student encouraged the computerized self-learning instead of stereotype classroom session. Significant: Yes
12	Patel-2001 M.Ed The M.S. University of Baroda	Learning through Computer Assisted Learning Material in relation to selected production variables and contiguity	Science	(i) To analyse CALM in relation to production variables and contiguity. (ii) To study the effectiveness of CALM in terms of mean achievement of students. (ii) To study the learning through various	The research is an experimental type. In order to study the effectiveness of the developed CALM pre-testpost-test single group design was used. Correlated t test was used for Data Analysis	VIII 30 students single group	-	There has been found significant gain through interaction with the Computer Assisted Learning Material on Solar system and Magnet –Standard VIII through the computed correlated t

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				message items in relation to production variable and contiguity.				values. The status of the CALM in terms of production variable and contiguity vis-à-vis achievement has been found quite higher, except on a few teaching points where there was need to improve upon graphics, mode of presentation, spatial contiguity of text and animation and temporal contiguity of animation and narration. Significant: Yes
13	Sharma -2003 M.Ed Dissertation	A study of the effectiveness of	Chemistry	(1) To develop CAL in chemistry	T test	XI	-	The researcher had found that

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	The M.S. University Baroda	Computer Assisted Learning (CAL) in chemistry for the students of standard XI		in terms of achievement of standard XI students. (2) To study the effectiveness of the CAL in chemistry in terms of achievement of standard XI students. (3) To study the opinion of the chemistry students regarding the effectiveness of the developed CAL				CAL developed was effective for teaching Chemistry at standard XI. It helped the students to learn the topic of organic compound and clarified the concepts. Students were found to have a positive reaction towards the CAL. It was found to be favourable as far as the statements related to the interest, mode of presentation, content clarity and the question asked in the CAL. A chemistry teacher was found to have

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								positive reaction towards developed CAL. Also, the data analysed were revealed that teacher has given favorable statements regarding content, language clarity, mode of presentation, and clarity in graphics and evaluation procedure in developed CAL. Significant: Yes
14	Vasanthi and Hema -2003	Effectiveness of teaching Chemistry for 1 year B.E. students through Computer Assisted Instruction	Chemistry	. Objectives: (i) To study the effectiveness of teaching chemistry through Computer Assisted Instruction over the traditional	A pre-test and post-test parallel group experimental design was used. The experimental group was given the CAI software. Statistical	B.E. 60 students	-	Findings: (i) There is significant difference between the mean gain score of the control group taught through TTM and the

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				teaching Method. (ii) To study the effectiveness of the Computer Assisted Instruction over the traditional teaching	technique like Mean, S.D and t-test computed to analyse the data collected.			experimental group administrated by the CAI in all units put together. (ii) There is no significant difference between the mean scores of pre test of control group taught through TTM and experimental group administrated by CAI in all units together (Electrochemical and bonding). (iii) There is no significant difference between the mean scores of post test of control group

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								taught through TTM and experimental group administrated by CAI in all units put together. Significant : Yes
15	Helaiya -2004 M.Ed Dissertation The M.S. University Baroda	Developing and implementation of CAI package for teaching statistics to B.Ed. students	Statistics	(1) To develop a CAI package for teaching statistics to B.Ed. students. (2) To study the effectiveness of CAI package in statistics in terms of B.Ed. students. (3) To study the reaction of the B.Ed. students regarding the effectiveness of the developed CAI package.	Pre-test treatment post-test was used. t test	B.Ed 16 students	-	Investigator had observed that CAI was effective in teaching statistics to B.Ed. students than traditional method. Students had enjoyed learning with CAI & suggested to prepare CAI in other topics too. Significant: Yes
16	Ruttanathummatee	Effectiveness of	Thai Language	1. To know the	Pre-test, Post-test	Prathom-3 and	-	The CAI Packages

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	-2004 South Gujarat Univ, Surat	Computer Assisted Instruction for Primary School Students: An Experimental Study	and English Language	effectiveness of Computer Assisted Instruction in the subject of Thai language developed by investigator for the students of Pratom-3. 2. To know the effectiveness of Computer Assisted Instruction in the subject of Thai language developed by investigator for the students of Pratom-6.	design with replication groups was used for conducting the experiment. SD and t test were used for data analysis	Prathom-6 150 students in Prathom-3 and 150 students in Prathom-6		developed by the investigator on Thai language have been found effective at both the levels, that is, Pratom-3 and Pratom-6 .The CAI Packages developed by the investigator on Thai language and by the ONPEC on English language received favourable opinions both by the teachers and students.
17	Barot -2005 M.Ed Dissertation The M.S. University Baroda	To study the effectiveness of CAI in Sanskrit for std. VIII students	Sanskrit	(1) To develop Computer Assisted Instruction (CAI) in Sanskrit for	single group pre-test and post-test design Researcher has prepared CAI	VIII 86 students	-	Findings of the study had proved that CAI can be used very well for remediation

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				standard VII students. (2) To study the effectiveness of CAI package in terms of mean achievement of students in Sanskrit. (3) To study the reaction of the students regarding the effectiveness of the developed CAI package.	using Flash software. t test			purpose. Prepared CAI in Sanskrit was found effective. The reaction of students towards the prepared CAI was also found effective. Significant: Yes
18	Pardeshi -2005 Phd Study MSU Baroda	A study of the relative effectiveness of CAI and CAIPI in learning Trigonometry by English medium students of Standard IX of Baroda City	Math	To develop the CAI and study its effectives in mono, diad and triad settings and its relative effectiveness in the three settings and through reactions of the students.	An achievement test was constructed for administering as pre-test and post-test. The data were analysed through mean, SD, uncorrelated 't' and ANOVA.	IX three section of students	Trigonometry	No significant difference has been found in the mean achievement scores of the experimental group in mono, diad , triad and control groups, respectively. Significant

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								difference has been found in the mean achievement scores of the experimental group in triad and control group. The students were found to have positive reactions towards the developed CAI. Significant: No
19	Parikh -2006 M.Ed Dissertation The M.S. University Baroda	Developing and implementing Computer Assisted Learning Material for 11th std commerce students on subject Introduction to book-keeping and Accountancy prescribed by GSEB	Commerce	(1) To develop CALM for "Rectification of Error" chapter selected from the 11th standard Introduction to Book Keeping and Accountancy text book of GSEB (2) To study the effectiveness of CALM package in	Pre-testpost-test control group design t test	XI	-	In findings CALM was effective for 2nd objective. Students had positive reactions towards the CALM and given favorable statements related to the interest, mode of presentation, content, clarity in

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				Accounts in terms of Achievement of 11th standard commerce students (3) To study the reaction of 11th standard commerce students regarding the effectiveness of the developed CALM.				graphics with content and the questions asked in it. Significant: Yes
20	Thakkar -2006 M.Ed Dissertation The M.S. University Baroda	To develop and implement CAI for 'Organization of commerce and management' subject in standard XI as prescribed by GSEB	Commerce	(1) To develop a CAI for the chapter of Foreign Trade selected from the subject 'Organization of Commerce and Management' textbook of standard XI (2) To study the effectiveness of the developed CAI.	pre-test, post-test experimental and control group research design T test	XI	-	The findings of the study revealed that CAI was found effective in teaching foreign trade leading to significant gain achievement in the scores of the post test from the pre test of experimental group. CAI was found effective in

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								teaching foreign trade leading to increase in the mean of gain achievement scores of the experimental group than the control group. The overall reaction of the students towards the prepared CAI in commerce was found positive. CAI was perceived by majority of students to be quite interesting and motivating in learning. Significant: Yes
21	Rathwa -2007 M.Ed Dissertation	Development and Implementation of	Gujarati	(1) To develop a multimedia	T test	VII	-	Study revealed that developed

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	The M.S. University Baroda	Multimedia Package for teaching Gujarati subject		package in Gujarati subject for std. VII students. (2) To study the effectiveness of the multimedia package in terms of achievement of students on whom it was implemented. (3) To study the effectiveness of multimedia package in terms of reflection of students (of experimental group) collected through opinionnaire. (4) To compare the achievement of VIII grade students in the				multimedia package was found to be an effective and had great impact to gain better achievement of experimental group in comparison to that of control group. It was observed through opinionnaire that multimedia package was effective and students enjoyed learning. Significant: Yes

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				unit test conducted for experimental and control groups.				
22	Patel -2008	Computer Assisted Instruction in Physics for the students of standard XI	Physics	(i) To develop Computer Assisted Instruction package on two units of physics for XI Science student studying GSTB syllabus. (ii) To study the effectiveness of the CAI package in terms of achievement of students of experimental group. (iii) To study the relative effectiveness of teaching Physics in terms of two methods of	Multistage sampling technique was used by the researcher in the study. The pre-test post-test control group design was employed. The tool used was an opinionnaire for students of both groups. Statistical technique such as mean, S.D., t -test and chi square test was employed.	XI 60 Students	-	(i) The study has resulted in the development of a CAI program on 'motion in one dimension and two dimensions' and 'Laws of Motion' for teaching Physics to the students of Class XI. (ii) The package was found significantly effective for the students of class XI of both the groups. (iii) Comparative effectiveness of the CAI method

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				teaching Physics i.e. conventional method of instruction and CAI package for students of traditional group and experimental group. (iv) To study the relative effectiveness of CAI with reference to the sex of the students of the experimental group. (v) To know the opinions of the students of the experimental group regarding the effectiveness of used CAI in Physics. (vi) To know the opinions of the teachers of				and the traditional method was measured by the experiment and CAI method was found more effective in terms of achievement scores. (iv) In relative effectiveness of the package was equally effective in teaching boys and girls. (v) Students and teachers both revealed a favourable opinion towards CAI program.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				the experimental group regarding the effectiveness of used CAI in physics.				
23	Patel- 2009	Development and Implementation of CAI to teach English grammar to standard VIII student in different modes	English	(i) To develop the CAI to teach English Grammar to Standard VIII Gujarat Secondary and Higher Secondary Board (GS&HSEB) students in different modes (only CAI, CAI with repetition, CAI with discussion) (ii) To study the effectiveness of the developed CAI in different modes in terms of students' achievement in	Pre-test post control group design Data was analysed through ANOVA	VIII 48 students	-	Findings: (i) The achievement of the students in English Grammar taught through CAI was found significantly higher than that of the students taught through traditional method. (ii) The achievement of the students taught through only CAI was found significantly higher in English Grammar than that of the students taught through traditional

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				English Grammar. (iii) To study the effectiveness of the developed CAI in terms of the reactions of students. (iv) To study the relative effectiveness of the developed CAI in different modes of presentation (only CAI, CAI with repetition, CAI with discussion) in terms of differences in the adjusted post-test mean achievement of the student in English Grammar.				method. (iii) The achievement of the students taught through CAI with repetition and CAI with Discussion was found significantly higher than the achievement of the students who were taught through traditional method. (iv) From the three modes of the presentation of this CAI, the mode i.e. teaching through CAI with discussion was found significantly superior in comparison to other two modes. (v) CAI was also

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								found to be effective in terms of the students.
24	Vansia -2011 Journal International Referred Research Journal, September, 2011	Effectiveness of Computer with Peer Interaction for Math's learning in urban area	Math	1. To develop Computer Assisted Instruction Programme in math's subject for standard IX students. 2. To compare the achievement scores of students learning through Computer Assisted Instruction with Peer Interaction (CAIPI) for boys and girls on post-test. 3. To compare the achievement score of students learning through Computer Assisted Instruction with Peer Interaction (CAIPI) for students of high IQ and low IQ on post-test. 4. To compare the	Data were analysed through the statistical techniques such as t-value and ANOVA. Multistage Sampling technique	IX Total sampling consisted of 104 students	Solid Matter	1. Math's learning through Computer Assisted Instruction with Peer Interaction (CAIPI) was equal effective for boys and girls.2. Math's learning through Computer Assisted Instruction with Peer Interaction (CAIPI) was more effective for high IQ student's then low IQ students.3. Effectiveness of sex was shown on mean achievement score of posttest.4. Effectiveness of

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				achievement scores of boys and girls group on post-test. 5. To compare the achievement scores of experimental and traditional group on post-test. 6. To compare the achievement scores for students of high IQ and low IQ group on post-test. 7. To study the interaction between sex and method of teaching on post-test. 8. To study the interaction between sex and IQ on post-test. 9. To study the interaction between method of teaching and IQ on post-test. 10. To study the interaction between sex, method of teaching and IQ on post-test.				teaching method was shown on mean achievement score of post-test. 5. Effectiveness of IQ was shown on mean achievement score of post-test. 6. Interaction effects of sex and teaching method was not shown on mean achievement score of post-test. 7. Interaction effects of sex and IQ was not shown on mean achievement score of posttest. 8. Interaction effects of teaching method and IQ was not shown on mean achievement score of posttest.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								9. Interaction effects of sex, teaching method and IQ was not shown on mean achievement score of posttest. Significant Difference: Yes

Table 2.3 Analytical Review of Studies Related to Computer Assisted Instruction Conducted in Abroad

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
1	Suwanma -1991 PhD	Construction of Computer Assisted Instruction in science on topic "Earth and Changing	Science	1. To develop computer Assisted instruction on topic "Earth and Changing". 2. To find its effectiveness.	The subjects took a pre-test and then they were given the post-test. Data were treated using item by objectives analysis .t test	II 20 Mathayom Suska 2 students	-	The result showed the efficiency of the CAI. The students mastered at 84.75 percent criterion of objectives of the study. They were satisfied and appreciated with this CAI program. **Significant: Yes**
2	Hsu – 1994 Dissertation Abstracts International	Computer assisted language learning (CALL) to see the effect of elementary language students (ELS) use of interactional modification on listening comprehension	Language	(1) Is second language student request modification of the input they hear while working on Computer based listening exercise, and (2) If this international computerized modifies help second language students listening comprehension and language acquisition.	Data were collected from 15 elementary second language students by using a single group pre-test research design.	Elementary Level 15 students	-	The findings revealed that second language students use the tools made available by the computer technology to make input comprehensible and computerized modification and language acquisition. **Significant: Yes**
3	Nimtrakul -1999 Chiang Mai University	Effects of computer-assisted instruction Atomic Structure in chemistry if Mathayon Suska 4	Chemistry	(1) To construct CAI on atomic structure in chemistry of Mathoyom Suska 4 students (2) To investigate the	Cluster Random sampling, paired t test	Mathoyom Suska 4 students	-	Research Finding were (1) The efficiency of the CAI on atomic structure in Chemistry of Mathoyom Suska 4 students was 93.26/92.06, which was higher

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
		students		achievements in chemistry on atomic structure of Mathoyom Suska 4 students who were taught through the CAI program and (3) To explore the learning attitude towards the chemistry of the students who were taught through the CAI program.				than the standard criterion 85/85. (2) The learning achievement in chemistry on atomic structure of Mathoyom Suska 4 students, after being taught through the CAI on atomic structure in Chemistry was higher than that before being taught through the CAI on atomic structure in Chemistry at the .01 level of significance. (3) The learning attitude in Chemistry with CAI on atomic structure of Mathoyom Suska 4 students was at the moderate to satisfactory. **Significant: Yes**
4	Robkob -1999	Achievement and Retention in science of Prathom Suska 5 students in science studying through CAI	Science	The purpose of this study was to compare achievement and retention of Prathom Suska 5 students from at Anubaab Chiang Main School, Muang District, and Chiang Mai Province, first semester in academic year 1999.	Data were analysed using item by objective analysis. The retention test was applied to both groups of the students, two weeks after the post test.	XI	-	The results showed that learning achievement and retention of students, which studied through CAI and studied by conventional method, were differing. **Significant: Yes**

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
5	Vaisopha -1999	Construction of Computer Assisted Instruction in the Mathematics on topic 'Adding fraction' for Prahom Suska 5 students	Math	1. To develop CAI. 2 .To find its effectiveness.	Data were analysed using item-by-objective analysis.	IV	fractions	The finding of the study revealed that significant gain in terms of mean achievement through CAI. CAI has evoked positive perceptions amongst teachers and students. **Significant: Yes**
6	Salsbury-2002 PhD Thesis Kansas State University	A study on comparing teacher-directed and computer-assisted instruction of elementary geographic place vocabulary	Geography	The purpose of this study was to compare computer-assisted instruction to teacher-directed instruction for teaching elementary geographic place name vocabulary.	The quasi-experimental research design of pre-test, treatment and post-test was employed in this study since the students were in pre-assigned classrooms. Two classrooms received instruction for learning to identify and label 50 world places, and third class was the control group.	Grade IV	-	Overall data analysis revealed significant difference between two methods of instruction when compared to each other, and to the control group. Gains in pretest to posttest scores were greater from computer-assisted instruction. This study has reported the highly significant academic success of fourth grade students learning geographic place name vocabulary through drill, whether a teacher or a computer provides the instruction.
7	Crews -2003	A case study that investigates the	Language	(1) To scientifically investigate if poor	The study was conducted at a Title 1 elementary school in a	Grade IV and V	-	Results of pre-post reading comprehensive tests and

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
		effectiveness of a CAI reading tutorial in helping poor readers improve their ability to read		readers using the CAI significantly improved their reading abilities, and assuming the CAI was effective (2) To identify the instructional methods and strategies implemented in the CAI design (3) To theoretically explain the effectiveness of the CAI and thereby provided information of effective methods of designing effective CAI for poor readers	large city in the southwest. Title 2 schools serve a high concentration of students living in poverty and as a result, receive funds to provide special educational services for low achieving and at-risk students. The 13 participating students were fourth and fifth grade students with poor reading abilities as determined by the independent assessments and observations of their homeroom teachers. The multimedia CAI program investigated supports the active cognitive participation of the learner, delivers multi-sensory instruction, and provides timely, directed feedback, teacher's phonics skills, and implements 100 per cent mastery learning. The instruction is individualized and self-paced.	13 students		interviews indicate that poor readers completing the CAI tutorial significantly improved their reading skills and the students and their teachers felt that using the CAI tutorial helped the students become better reader.
8	Casanova -2004	An analysis of	CMS	to determine the extent to	The data collection was done by	Higher	-	Findings indicated that faculty

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	West Virginia University Dissertation Abstract	computer-mediated communication technologies as tools to enhance learning	Computer Mediated communication	which CMS technologies promoted the achievement of stated goals and objectives for course taught in higher education. This study was directed by three research questions (1) in what ways are higher education faculties using CMS technologies to deliver their courses? (2) What is the faculty's primary instructional intent for the CMS technologies they selected for integration into the teaching process? (3) In what ways does the integration of selected CMS technologies promote achievement of stated goals and objectives in their courses?	survey, course analysis and interview. Interview, survey	education		was mainly using CMC technologies to support teaching practices and to improve teacher's productivity. It's were basically targeted to increase interactivity, open avenues for feedback and provide resources but less used for inquiry based and active learning. Faculty's primary intent to integrate CMC technologies was to create different avenues to communicate with students and to offer them a learning environment that would support students outside the classroom. CMC promoted the achievement of goals and objectives with different degree of success mainly in two different areas: content delivery and course management and less regarding tele collaborative activity structures. **Significant: Yes**
9	McLaughlin Daniel -	Towards a new	IT	The purpose of this	The investigator used case	College	-	Data for the study was collected

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	2004 Florida Community College	paradigm for teaching and learning: A case study of the process of integrating instructional design and technology at Florida Community College at Jacksonville		study was to explore how one institution of higher education addressed the gap that exists between systematic and collaborative instructional design and the use of instructional technology in online course development.	study design to describe the model and processes the college administration used to implement the project.	students		through semi-structure interview and a review of project related records, reports, guidelines and artifacts. Data was also obtained through field observations and investigator participation in training and professional development sessions with faculty and staff. **Significant: Yes**
10	Eteokleous, Nikelia -2004 Dissertation Abstract International	Computer technology integration in Cyprus elementary schools	Computer technology integration in elementary classrooms	1.To evaluate the current situation in Cyprus elementary classrooms regarding computer technology integration. 2. To study how Cypriot elementary teachers use computers and the factors that influence computer integration in their classroom practices. 3. To address the research questions that guided the study, an evaluative case study	Qualitative analysis, semi structured interview	Elementary school	-	The results of the qualitative analysis summarize the factors that influence teachers in applying computers in their classroom practices. A general uniformity across the three categories of teachers revealed, in terms of the factors that function as barriers in applying computer in the classrooms. The factors can be summarized as follow: lack of resources; tyranny of the curriculum; incomplete and inadequate professional development

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				design was applied.				training. **Significant: Yes**
11	Hung -2005 Idaho State University Dissertation Abstract International	The evaluation of a technology-aided lecture accompanied by a set of macroeconomics computer interactive exercises in macroeconomics for the undergraduate business major in Taiwan	Micro Economics	The study examined the effects of a technology aided lecture accompanied by a set of macroeconomics computer interactive exercises and a traditional instruction supported by using transparencies on students' learning achievement.	ANCOVA	Under Graduate	-	As comparing the effectiveness of the two different instructional methods, it is concluded offering the courses for the unit on unemployment and inflation through the Technology-Aided Lecture (TAL), accompanied by a set of macroeconomics computer interactive exercises, or the standard instruction produced a non-significant difference, to the extent measured by the researcher developed test.
12	Rosales -2005 the lowere Rio Grande Valley.Ed.University of Houston Dissertation Abstract International	The effect of computer-assisted instruction on the mathematics achievement of ninth-grade high school students in the lower Rio Grande Valley	Mathematic s		ANCOVA	IX	-	There was statistically significant difference between the mathematics achievement of ninth grade high school students in the lower Rio Grande Valley who participated in computer-assisted instruction and the mathematics achievement of ninth grade high school students

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								in the lower Rio Grande Valley who did not participate in computer-assisted instruction. The resultant analysis indicated that there were no statistically significant differences between the mathematics achievements of the two groups.
13	Gilbert -2006 Southern Illinois University Carbondale	Effectiveness of computer-assisted instruction blended with class-room teaching methods to acquire automotive psychomotor skills	Automotive Technology	To study the relative effectiveness of two blended learning methodologies of web-based CAI and face-to-face classroom instruction were investigated in the Automotive Technology Department at Southern Illinois University Carbondale	t test	Results were determined by a psychomotor electrical diagnostic skill evaluation of two matched groups exposed to different blending methods of teaching basic electrical concepts.	Higher Education	Analysis revealed that the blended teaching methods experienced by the experimental group demonstrated a comparatively higher level of psychomotor electrical diagnostic skill capability.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
14	Beaird -2007 Ph.D. Thesis., University of Nevada, Las Vegas Dissertation Abstract International	The effects of computer-assisted language learning on English language learners with and without disabilities in an elementary school setting	English	The purpose of the study was to investigate the effects of the English Language Learners Instructional System (ELLIS) on oral language, written language and reading achievement among students who are English language learners with and without disabilities. Additionally, levels of teacher satisfaction with computer-assisted language learning (CALL) and the use of ELLIS were assessed	Data were analysed quantitatively as well as qualitatively with ANOVA/ANCOVA and open-ended interview techniques respectively.	Elementary school(IV and V)	III, IV and V grade	In findings of the study, the ANOVA and ANCOVA analyses revealed that students with disabilities who received instruction using the ELLIS program performed similarly to students with disabilities who did not receive instruction using ELLIS program in oral language, written language and reading achievement. The students without disabilities who received instruction using the ELLIS program performed similarly to students without disabilities who did not receive instruction using the ELLIS program in oral language, written language and reading achievement. Paired instruction using the ELLIS software program had similar effects on student performance as individual instruction using the ELLIS software program. Results from the open-ended interview revealed high levels of

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
								teacher satisfaction with the ELLIS software program.
15	Ford -2007 Dissertation Abstract International	Effect of computer-aided instruction versus traditional modes on student PT's learning musculoskeletal special tests	Biology	To find the relative effectiveness of computer-aided instruction verses traditional modes on student's PT's learning musculoskeletal special tests.	Analysis of performance on written and practical examinations was conducted across the 3 repeated measures. A qualitative survey was completed by the CAI group post intervention.	-	-	Finding of the study revealed that CAI was equally as effective as live demonstration and textbook learning of musculoskeletal special tests in the cognitive domain, however, CAI was superior to live demonstration and textbook instruction at final post-testing.
16	Galvis -2007 Ph.D. Thesis, Texas Women's University Dissertation Abstract International	Computer-assisted instruction (CAI) as a teaching tool for occupational therapy education: A guide to understand CAI design and effectiveness	occupationa l therapy education	The primary purpose of the study was to compare the effects of CAI versus traditional teaching methods with occupational therapy students. To explore the topic, three consecutive and inter-related studies were conducted.	t test	-	-	In its analysis researcher had founded that the CAI was an effective alternative to traditional classroom lecture to teach practical skills and theoretical knowledge. It was also found that CAI provides faster instruction while providing learner-centered training.
17	Karnati -2008 Ph.D. Thesis., University of	Computer aided instruction for out-of-school children in	Telugu Language	India has the largest number of out-of-school children, the majority of	The methodology employed in the study was a quasi-experimental design on a	Age range 7-19 140 children	-	The results support the use of ICT with marginalized sections of society in developing

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
	Pennsylvania Dissertation Abstract International	India: An impact study in Andhra Pradesh		whom are girls. Against this backdrop, the Bridges to the Future Initiative (BFI), a computer-aided instruction (CAI) intervention was launched in Andhra Pradesh to bring children back to school. The BFI used multimedia software to teach basic literacy and numeric skills through interactive stories and activities, in the local language Telugu.	sample of around 140 children (age range 7-19 years). The research study included the Bridges to the Future Initiative (BFI) sites which offered two hours of CAI a day and comparison sites which provided five hours of teacher-based instruction (TBI) a day. This research was one of the first to explore the context of out-of-school children in poor communities and the use of CAI in Telugu (local language) to bring these learners back to school.			countries in order to improve literacy skills.
18	Pilli -2008 PhD Thesis Middle East Technical University	The Effects Of Computer-Assisted Instruction On The Achievement, Attitudes And Retention Of Fourth Grade Mathematics Course	Math	Research Questions were 1: Is there a significant difference between the achievement posttest scores of the students exposed to Computer Assisted Instruction with the *Frizbi Mathematics 4* and those who were	In this study quasi-experimental research design was used in order to investigate the impacts of the *Frizbi Mathematics 4* educational software on the 4th grade students' mathematics achievement, mathematics attitude, computer assisted learning attitude, and retention.	Grade IV The sample consisted of 26 students in control group and 29 students in Experimental Group.	Multiplication, Division of Natural Numbers and Fractions	Findings of the study 1. The results of pretest and posttest for unit 1: "Multiplication of Natural Numbers" revealed that the CAI with *Frizbi Mathematics 4* applied to the experimental group was demonstrated to be effective in increasing the 115 achievement scores of the

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				exposed to traditional instruction with textbook? 2: Is there a significant difference between the mathematics attitude scale post scores of the students exposed to computer assisted instruction with *Frizbi Mathematics* 4 and those who were exposed to traditional instruction with textbook? 3: Is there a significant difference between the computer assisted learning attitude scale post scores of the students exposed to computer assisted instruction with *Frizbi Mathematics 4* and those who were exposed to traditional instruction with textbook? 4: Is there a significant difference between the retention test				students. 2. The results of pretest and posttest for unit 2: "Division of Natural Numbers" were significant differences between achievement tests' mean scores of students in the experimental and control group. 3. The results of pretest and posttest for unit 3: "Fractions" revealed there were significant differences between achievement tests' mean scores of students in the experimental and control group. 4. In unit 1 (Multiplication of Natural Numbers) retention test mean scores were lower than the post test mean scores in both groups and the "rate of retention decay" was not significantly different between the experimental and the control group, the results of independent *t*-test indicated that the experimental group's retention test mean score was significantly higher than the control group.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				scores of the students exposed to computer assisted instruction with the *Frizbi Mathematics 4* and those who were exposed to traditional instruction with textbook?				
19	Jackson and Dave - 2011 International Journal of Curriculum and Instruction	The Effect of Computer-Assisted Instruction on Student's Attitudes and Achievement in Matrices and Transformations in Secondary Schools in Uasin Gishu District, Kenya, Moi University, Kenya	Math	The purpose of the study was to investigate the effects of CAI on students' attitude and achievement in matrices and transformations between form four students who received instruction using CAI module or conventional instruction methods. The study addressed the following questions: 1. What are the effects of the CAI module on students' achievement in matrices and transformations? 2. Is	The pretest – posttest control group experimental research design was used. Six classes selected at random with 205 students participated in the study.	Secondary Schools 205 students	Matrices and transformation	Results of this study indicated higher achievement and positive attitudes with CAI treatment groups. Making connections between the goals of Mathematics education and CAI offers a valuable means for improving mathematical knowledge and skills and hence performance in Mathematics.

S.No	Investigator	Title of the Study	Subject	Major Objectives	Design & Tools of the Study	Level & Size of the Sample	Unit (Maths)	Major Findings
				there any significant difference in the achievement on matrices and transformations between subjects exposed to CAI module and those not? 3. What are the effects of the CAI module on students' attitudes towards Mathematics course? 4. Is there any significant difference in attitudes towards lessons on matrices and transformations between subjects exposed to CAI module and those not?				
20	Bayturan and Kesan(2012)	The Effect of Computer-Assisted Instruction on the Achievement and Attitudes Towards Mathematics of Students in Mathematics Education	Math	The objective of this study was to investigate the impact of computer-assisted instruction method on students achievement and attitudes towards mathematics in secondary mathematics education.	The research was designed based on an experimental pre-test post-test model. The research was conducted in 60 ninth grade students from a Anatolian high-school during 2009-2010 academic year. t test was used for Date analysis	IX 60 ninth grade students	Relation, Function and Operation	The results demonstrated that teaching mathematics with a computer assisted instruction method increased student success significantly in mathematics lesson. However, the experimental and control groups did not differ between students' attitudes towards mathematics.

2.10 Flow Chart of the Reviewed Studies

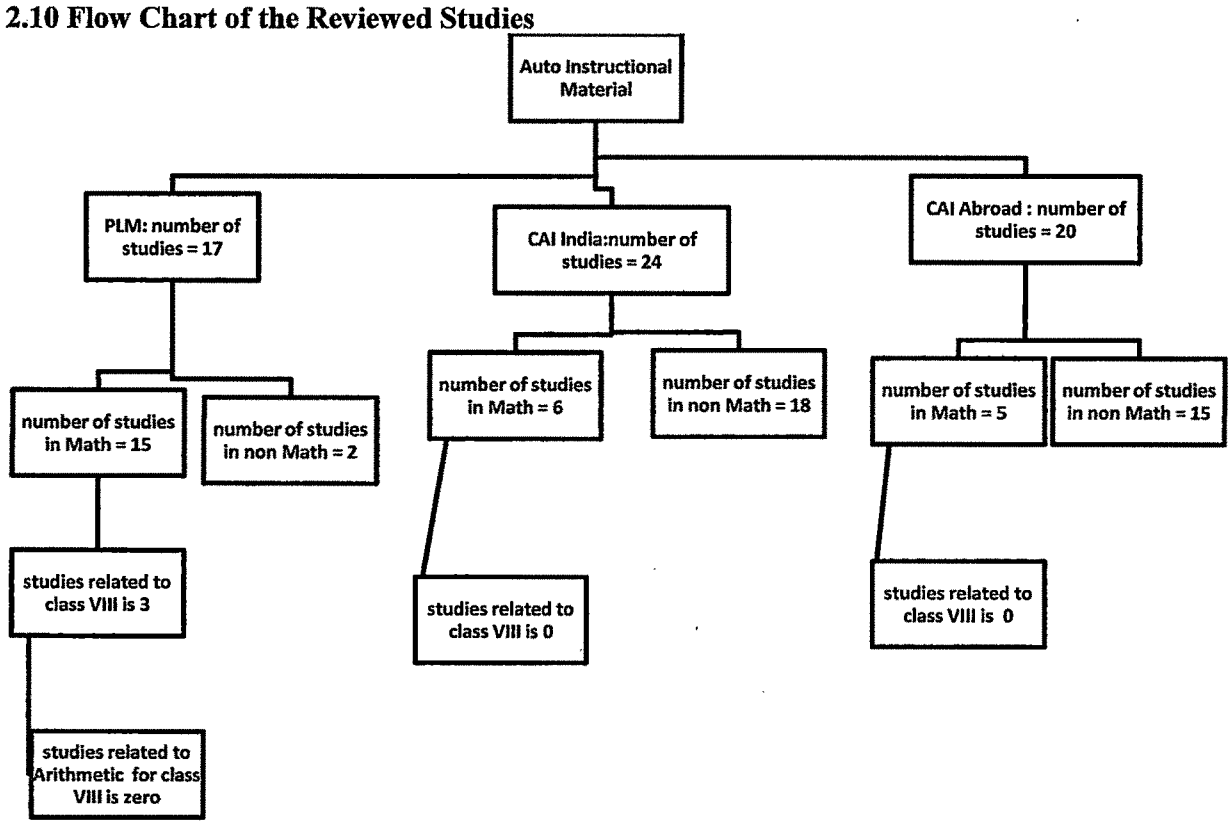

Figure 2.1 Flow Chart of the Reviewed Studies

2.11 Analysis of Reviewed Literature

2.11.1 Classification of Reviewed Studies Related to Mathematics

Table 2.4 Studies Conducted in India Related to PLM in Mathematics

S.No	Investigator	Class/ Level	Topic
1	Kulkarni and Yadav -1966	VI	Solving Simple Equations
2	Sharma- 1966	IX	Algebra
3	Shah-1969	VIII	Algebra
4	Patel-1975	IX	Geometry
5	Patel-1977	VIII	Geometry
6	Seshadri-1980	IX	Whole Syllabus
7	Pandey-1980	IV	Whole syllabus
8	Trivedi-1980	V, VI, VII	-
9	Inamadar-1981	VII	Simple Interest
10	Shah-1981	V	All
11	Suthar-1981	VIII	Set theory, Rational numbers, real numbers, powers and Indices, equations and problems and graph
12	Davies-1982	IX	Statistics
13	Rao-1983	V and X	-
14	Bhatia-1992	V	Fractions
15	Ramani and Patadia-2012	XI	Probability

Investigator has reviewed a total of seventeen studies (ref table 2.1) related to PLM. Out of seventeen studies fifteen (ref table 2.4) related to Mathematics. Out of fifteen there were three studies conducted for class VIII. Two studies were related to the topic Algebra and one was related to the topic geometry. There were no studies related to profit and loss, simple interest and compound interest ie arithmetic part of mathematics for class VIII mathematics.

Table 2.5 Studies Conducted in India Related to CAI in Mathematics

S.No	Investigator	Class/ Level	Topic
1	Nagar-1988	Survey	General
2	Singh, Ahluwalia, and Verma-1991	Higher Secondary	-
3	Rose Antony Stella V-1992	IX	Language of sets
4	Singh-1992	IX	Simultaneous equations in algebra, statistical representation in statistics, and triangles and their congruency in geometry
5	Pardeshi-2005	IX	Trigonometry
6	Vansia-2011	IX	Solid Matter

Investigator has reviewed a total of twenty four studies conducted in India related to CAI (ref table 2.2). Out of twenty four studies six were related to Mathematics (ref table 2.5). Five studies were conducted for class IX and one for Higher Secondary. There were no studies related to class VIII and especially for profit and loss, simple interest and compound interest i.e. arithmetic part of mathematics.

Table 2.6 Studies Conducted in Abroad Related to CAI in Mathematics

S.No	Investigator	Class/ Level	Topic
1	Vaisopha-1999	IV	Fraction
2	Rosales-2005	IX	Not available
3	Pilli-2008	IV	Multiplication, Division of Natural Numbers and Fractions
4	Jackson and Dave-2011	XI	Matrices and Transformation
5	Bayturan and Kesan (2012)	IX	Relation, function and Operation

Investigator has reviewed a total of twenty studies conducted Abroad related to CAI (ref table 2.3). Out of twenty studies five were related to Mathematics (ref table 2.6). Out of five studies two were related to class IV mathematics, and two for class IX and one for class IX. There were no studies related to class VIII and especially for profit and loss, simple interest and compound interest ie arithmetic part of mathematics.

2.11.2 Year Wise Classification of Reviewed Studies

Table 2.7 Year Wise Classification of Indian Studies in PLM Conducted During 1966-2012

S.No	Year	Number of Studies Conducted	Percentage
1	1966	3	17.65%
2	1975	1	5.88%
3	1977	1	5.88%
4	1980	3	17.65%
5	1981	3	17.65%
6	1982	1	5.88%
7	1983	1	5.88%
8	1992	1	5.88%
9	1998	1	5.88%
10	2001	1	5.88%
11	2012	1	5.88%

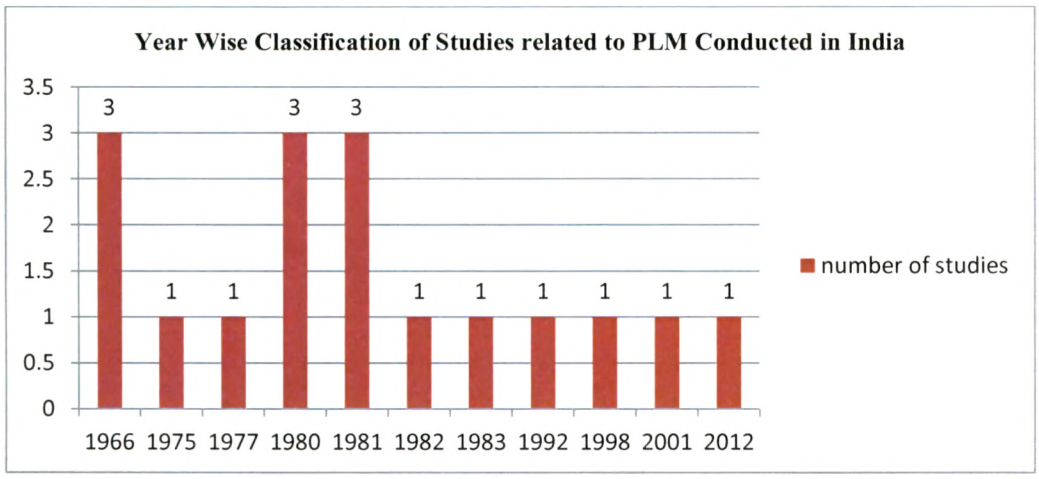

Figure 2.2 Year Wise Classification of Studies Related to PLM Conducted in India

In the year wise classification of the studies related to PLM conducted (ref table 2.7) in India. Three studies were conducted in the year 1966, 1980 and 1981. In the rest there was only one study each in the respective year 1975, 1977, 1982, 1983, 1992, 1998, 2001 and 2012. It can be clearly seen that there was a decreasing trend in the studies related to PLM.

Table 2.8 Year Wise Classification of Indian Studies in CAI Conducted During 1988-2011

S.No	Year	Number of Studies Conducted	Percentage
1	1988	1	4.17%
2	1991	2	8.33%
3	1992	3	12.5%
4	1998	2	8.33%
5	1999	1	4.17%
6	2000	1	4.17%
7	2001	2	8.33%
8	2003	2	8.33%
9	2004	2	8.33%
10	2005	2	8.33%
11	2006	2	8.33%
12	2007	1	4.17%
13	2008	1	4.17%
14	2009	1	4.17%
15	2011	1	4.17%

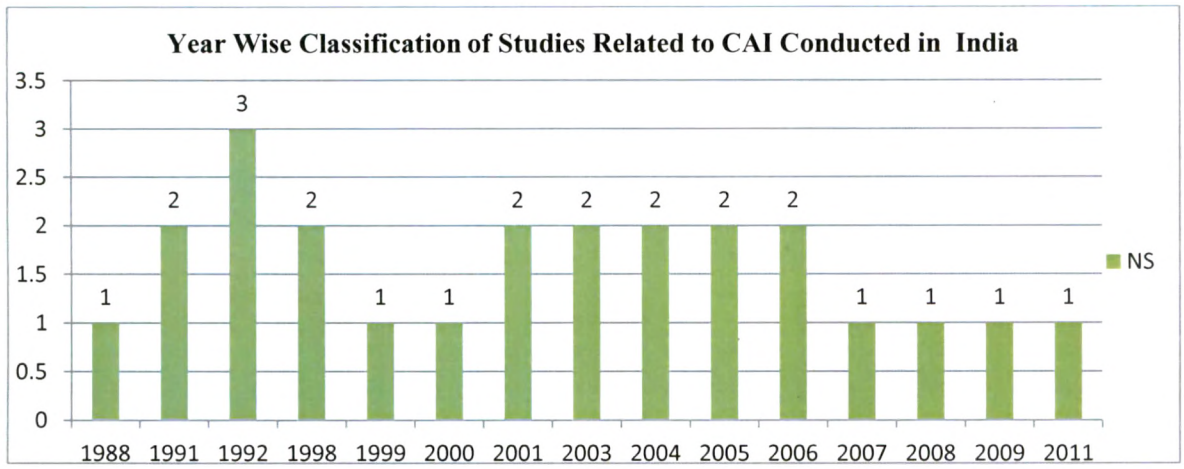

Figure 2.3 Year Wise Classification of Studies Related to CAI Conducted in India

NS=number of studies

In the year wise classification of the studies related to CAI conducted (ref table 2.8) in India one study was conducted during the year 1992, two were conducted in the year 1991, 1998, 2001, 2003, 2004, 2005 and 2006. There was one study each in the year 1988, 1990, 2000, 2007, 2008, 2009 and 2011 respectively.

Table 2.9 Five Year Interval Wise Classification of Indian Studies in CAI Conducted During 1988-2011

S.No	Year	Number of Studies Conducted	Percentage
1	1988-1992	6	25%
2	1993-1997	0	0%
3	1998-2002	6	25%
4	2003-2007	9	37.5%
5	2008-2012	3	12.5%

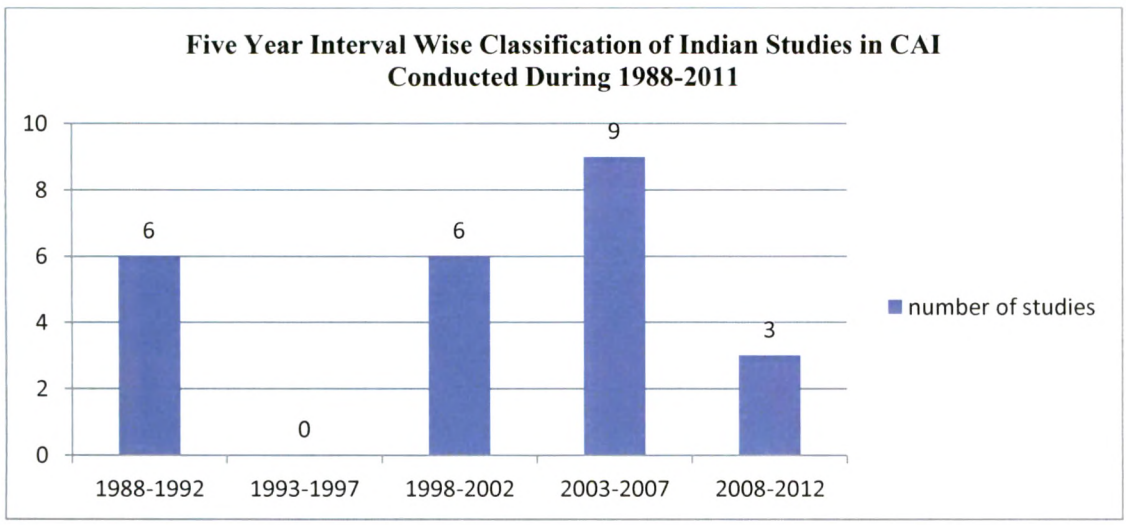

Figure 2.4 Five-year Interval wise classification of Studies Related to CAI conducted in India

In the five year classification of the studies(ref table 2.9) it can be seen that six studies were conducted during the period 1988-1992 and 1998-2002, nine studies during 2003-2007 and three studies during 2008-2012 and there were no studies during 1993-1997.

Table 2.10 Year Wise Classification of Studies Related to CAI Conducted abroad during 1991-2011

S.No	Year	Number of Studies Conducted	Percentage
1	1991	1	5%
2	1994	1	5%
3	1999	3	15%
4	2002	1	5%
5	2003	1	5%
6	2004	3	15%
7	2005	2	10%
8	2006	1	5%
9	2007	3	15%
10	2008	2	10%
11	2011	1	5%
12	2012	1	5%

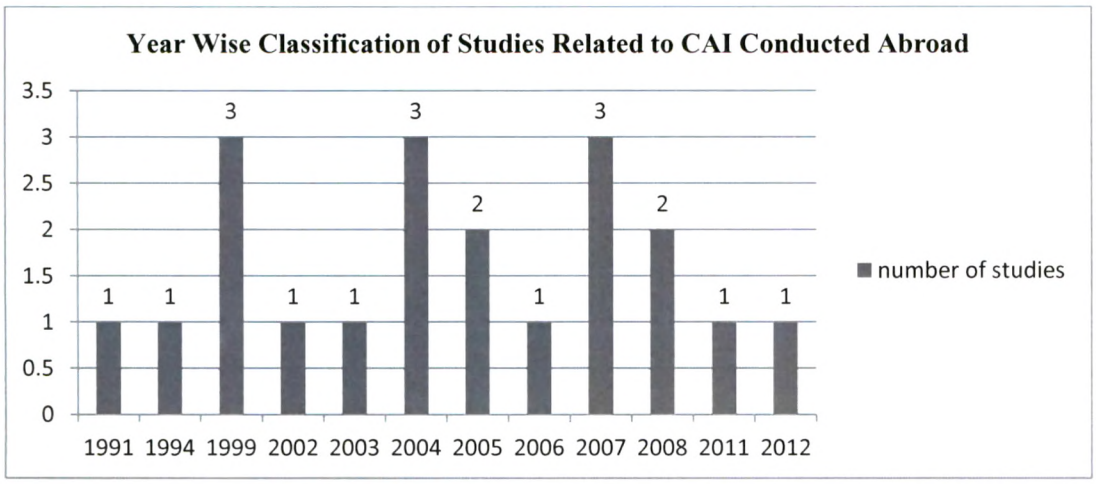

Figure 2.5 Year Wise Classification of the Studies Related to CAI Conducted Abroad

In the year wise classification of the studies conducted abroad (ref table 2.10) it can be seen that there were three studies conducted respectively in the year 1999, 2004 and 2007. Two studies were conducted respectively during the year 2005 and 2008. There was one study conducted respectively during the year 1991, 1994, 2002, 2003, 2006, 2011 and 2012.

2.11.3 Research Study Wise Classification of Reviewed Studies Related to PLM

Table 2.11 Research Study Wise Classification of the Indian Studies Related to PLM

S.No	Research study	Number of studies	Percentage
1	Experimental	17	100%
2	Survey	0	0%
3	CASE	0	0%

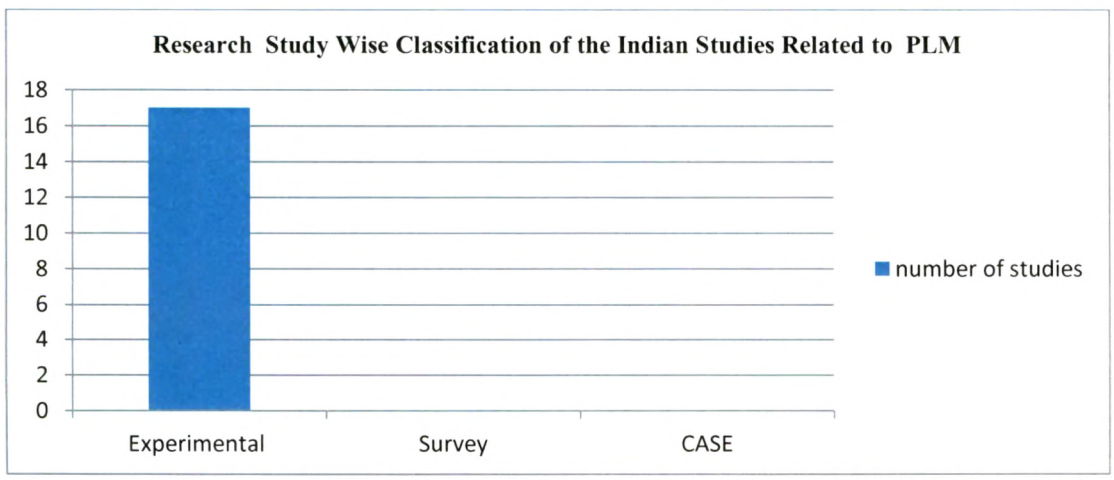

Figure 2.6 Research Study Wise Classification of Indian Studies Related to PLM

In research study wise classification of the reviewed studies conducted in PLM(ref table 2.11) it was found that all the seventeen studies were of Experimental study.

Table 2.12 Research Design Wise Classification of the Indian Studies Related to PLM

S.No	Research Design of the study	Number of studies	Percentage
1	Pretest-Posttest Control Group	5	29.41%
2	Post-test only Control Group	2	11.76%
3	Not known	10	58.82%

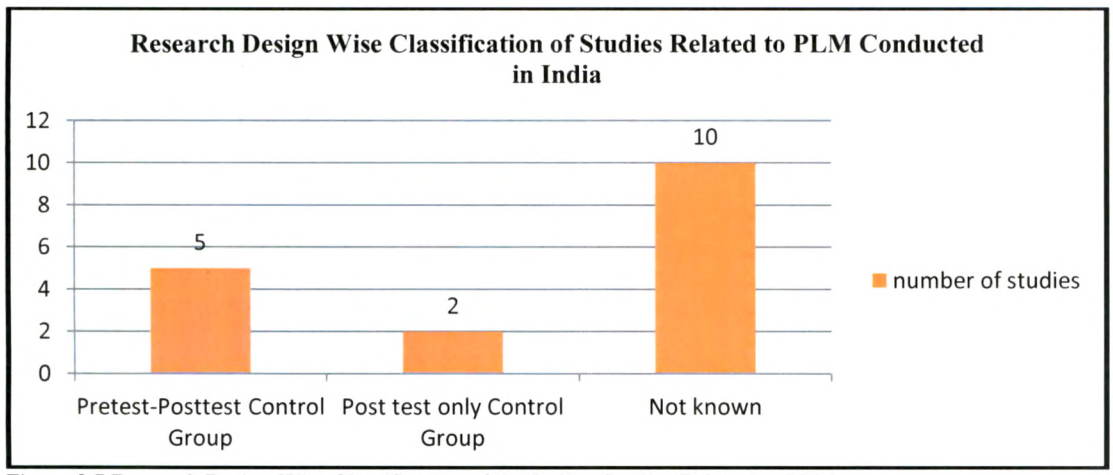

Figure 2.7 Research Design Wise Classification of the Indian Studies Related to PLM

In research design wise classification of the studies conducted in PLM(ref table 2.12) it was found that there were five studies related to Pretest-Posttest Control Group design, two studies related to Post-test Only Control Group design and in ten studies research design was not known.

Table 2.13 Data Analysis Wise Classification of the Indian Studies Related to PLM

S.No	Data Analysis wise classification	Number of studies	Percentage
1	t test	7	41.18%
2	Correlated t test	2	11.76%
3	ANOVA	1	5.88%
4	ANCOVA	1	5.88%
5	Not Known	6	35.29%

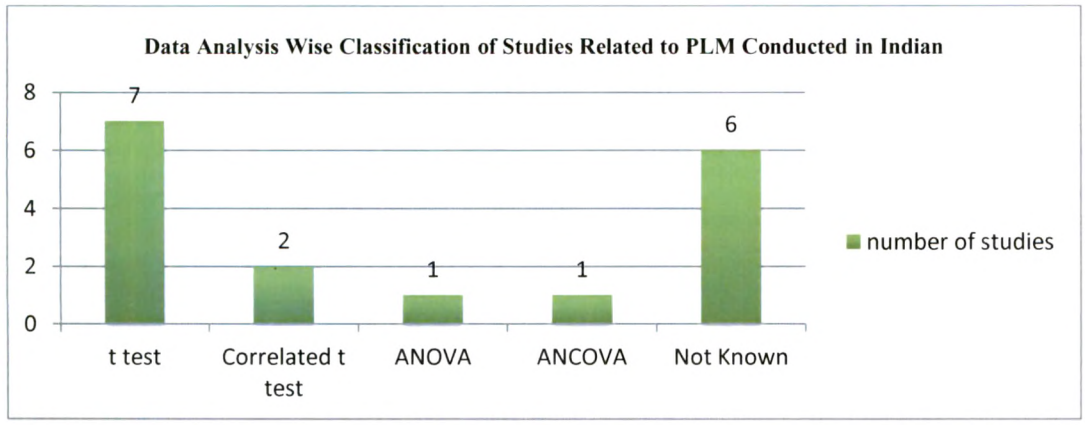

Figure 2.8 Data Analysis Wise Classification of the Indian Studies Related to PLM

In data analysis wise classification of the studies conducted in PLM (ref table 2.13) it was found that there were seven studies related to t test, two studies related to correlated t test, one study related to ANOVA, one study related to ANCOVA and six were unknown.

2.11.4 Research Study Wise Classification of Reviewed Studies Related to CAI Conducted in India

Table 2.14 Research Study Wise Classification of Studies Related to CAI Conducted in Indian

S.No	Research study	Number of studies	Percentage
1	Experimental	23	95.83%
2	Survey	1	4.17%
3	CASE	0	0%

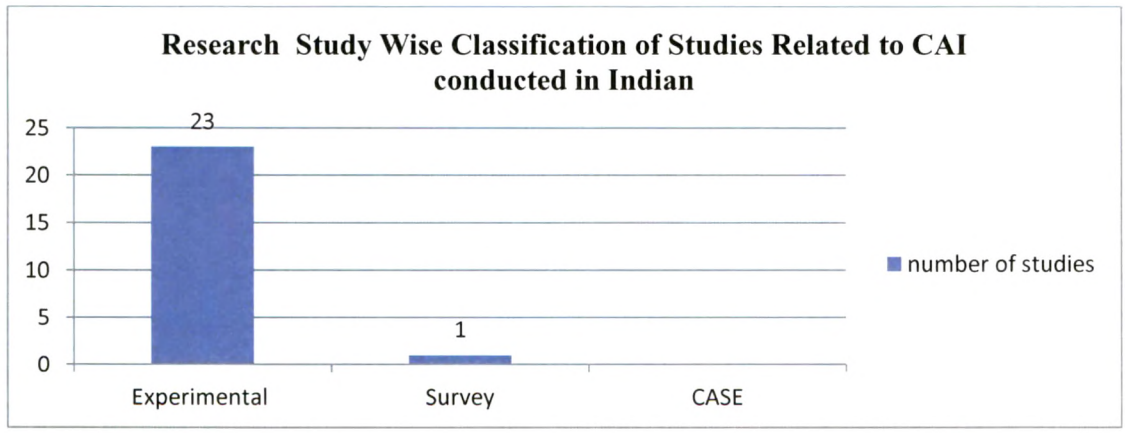

Figure 2.9 Research Study Wise Classification of the Indian Studies Related to CAI

In research study wise classification of the reviewed studies of CAI conducted in India (ref table 2.14) it was found that twenty-three were of Experimental study and one was of Survey Study and there was no study related to CASE study.

Table 2.15 Sampling Method Wise Classification of the Indian Studies Related to CAI

S.No	Sampling Method	Number of Studies	Percentage
1	Simple Random Sampling	4	16.67%
2	Stratified Sampling	4	16.67%
3	Randomised Block Sampling	3	12.5%
4	Multistage Sampling	2	8.33%
5	Purposive Sampling	5	20.83%
6	Not known	6	25%

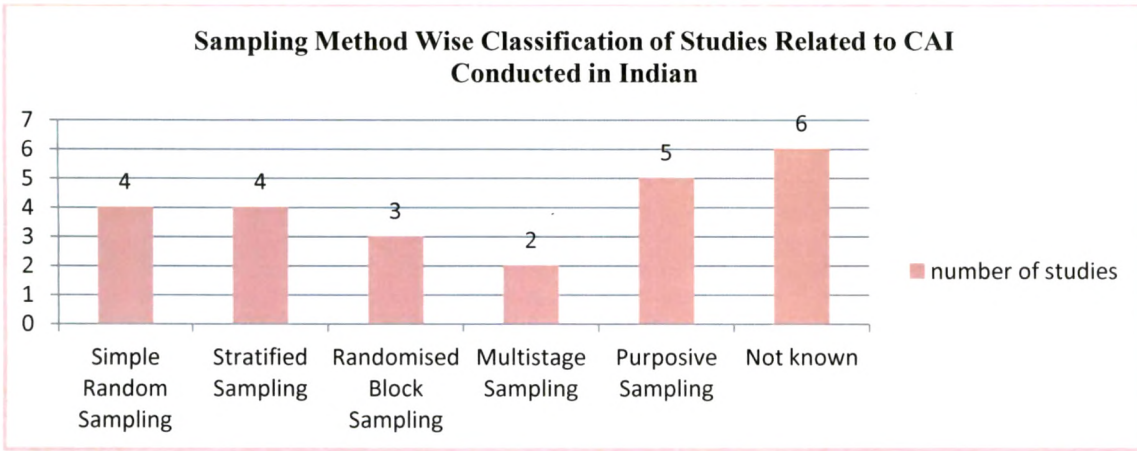

Figure 2.10 Sampling Method Wise Classification of the Indian Studies Related to CAI

In the Sampling Method Wise classification of CAI conducted in the India (ref table 2.15) it was found that there were four studies using Simple Random Sampling, four using Stratified Sampling, three using Randomised Block Sampling, two using multistage Sampling, five using Purposive Sampling and in six studies sampling method was not known.

Table 2.16 Research Design Wise Classification of the Indian Studies Related to CAI

S.No	Research Design of the study	Number of studies	Percentage
1	Pretest-Posttest Control Group	10	41.67%
2	Post-test only Control Group	4	16.67%
3	One group Pretest-Posttest Design	2	8.33%
4	Not known	8	33.33%

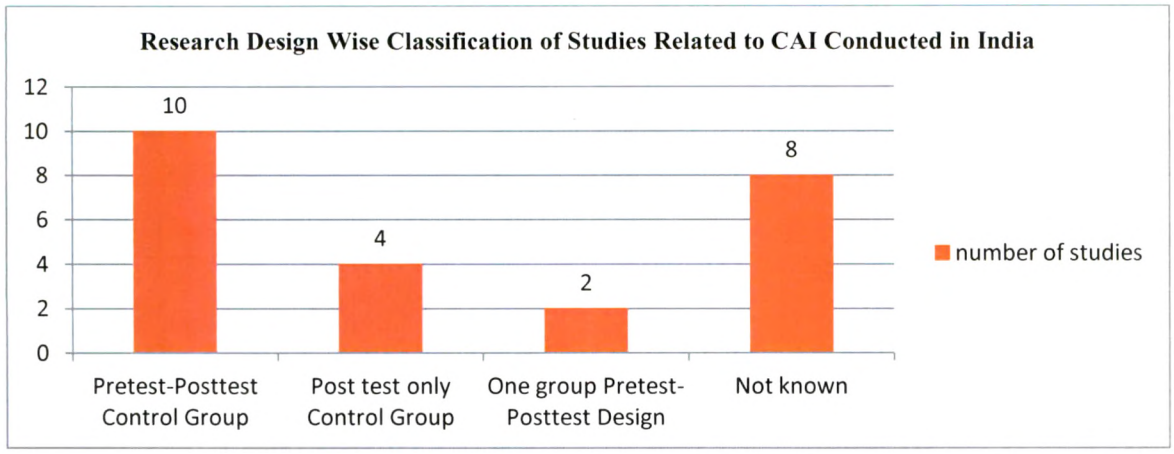

Figure 2.11 Research Design Wise Classification of the Indian Studies Related to CAI

In research design wise classification of the studies related to CAI conducted in India(ref 2.16) it was found that there were ten studies related to Pretest-Posttest Control Group design, four related to Post-test only Control group design, two related to one group Pretest-Posttest design and eight studies were not known.

Table 2.17 Data Analysis Wise Classification of the Indian Studies Related to CAI

S.No	Data Analysis wise classification	Number of studies	Percentage
1	t test	13	52%
2	Correlated t test	6	24%
3	ANOVA	4	16%
4	ANCOVA	2	8%

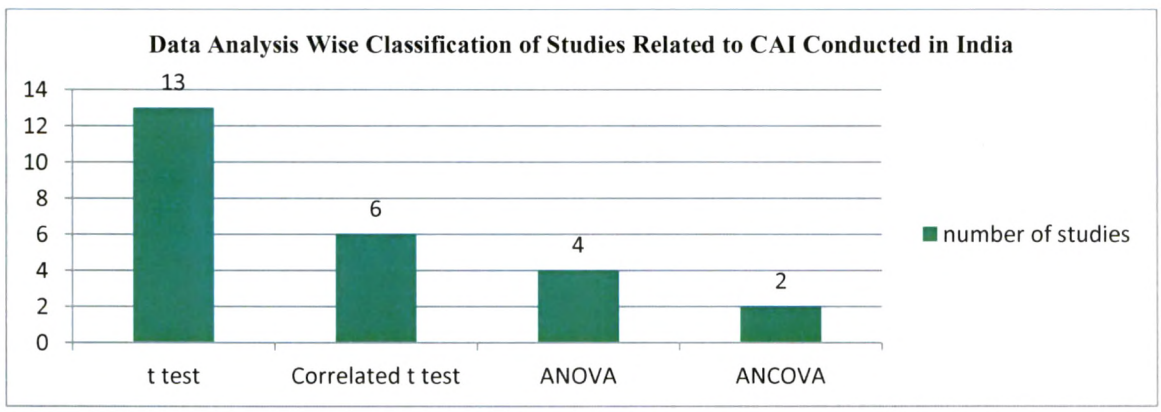

Figure 2.12 Data Analysis Wise Classification of the Indian Studies Related to CAI

In data analysis wise classification of the studies related to CAI conducted in India (ref table 2.17) it was found that there were thirteen studies related to t test, six studies related to correlated t test, four studies related to ANOVA and two studies were related to ANCOVA.

2.11.5 Research Study Wise Classification of Reviewed Studies Related to CAI Conducted Abroad

Table 2.18 Research Study Wise Classification of the Abroad Studies Related to CAI

S.No	Research study	Number of studies	Percentage
1	True Experimental	15	75%
2	Quasi Experimental	2	10%
2	Survey	2	10%
3	CASE	1	5%

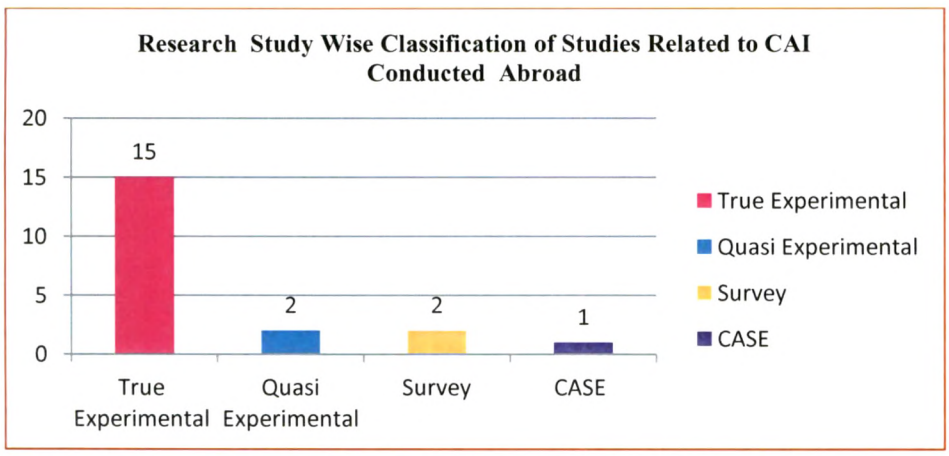

Figure 2.13 Research Study Wise Classification of the Abroad Studies Related to CAI

In research study wise classification of the studies related to CAI conducted Abroad (ref table 2.18) it was found that there were fifteen studies related to True Experimental, two studies related to Quasi Experimental, two studies related to Survey and one study related to CASE study.

Table 2.19 Sampling Method Wise Classification of the Studies Conducted Abroad Related to CAI

S.No	Sampling Method	Number of Studies	Percentage
1	Simple Random Sampling	3	12.5
2	Stratified Sampling	1	4.17
3	Cluster Sampling	0	0
4	Quota Sampling	1	4.17
5	Purposive Sampling	8	33.33
6	Not known	7	29.17

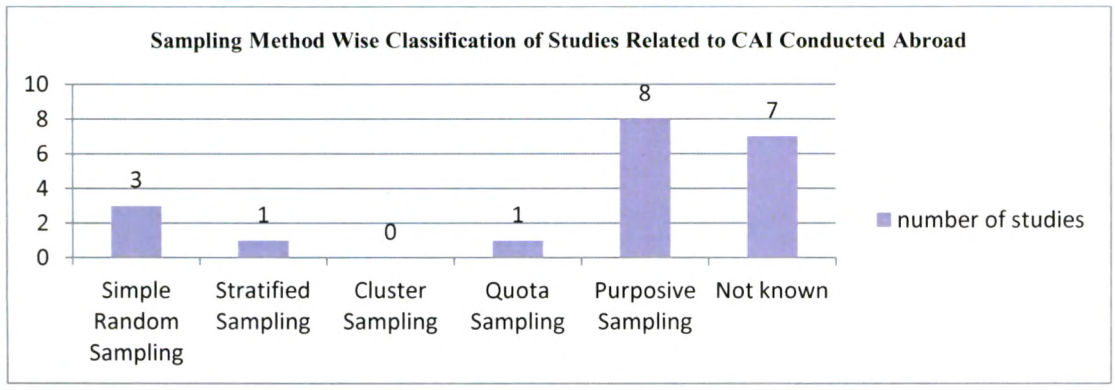

Figure 2.14 Sampling Method Wise Classification of the Abroad Studies Related to CAI

In the research method wise classification of the CAI studies conducted Abroad (ref table 2.19) it can be found that there were three studies related to simple random sampling, one related to stratified sampling, one relate to quota sampling, eight related to purposive sampling and seven were unknown.

Table 2.20 Research Design Wise Classification of the Abroad Studies Related to CAI

S.No	Research Design of the study	Number of studies	Percentage
1	Pretest-Posttest Control Group	8	33.33%
2	Post-test only Control Group	6	25%
3	One group Pretest-Posttest Design	1	4.17%
4	Qualitative	1	4.17%
5	Not known	4	16.67%

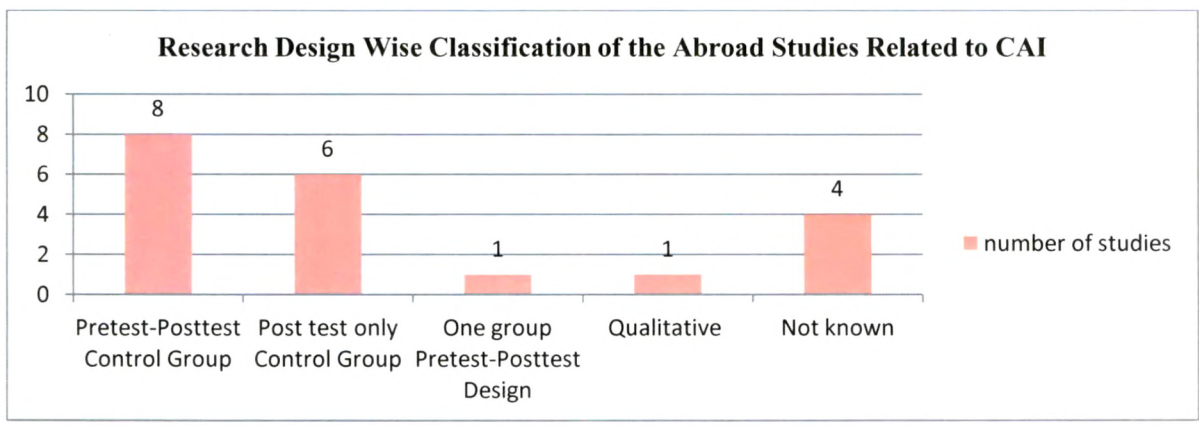

Figure 2.15 Research Design Wise Classification of the Abroad Studies Related to CAI

In research design wise classification of CAI conducted Abroad (ref table 2.20) it was found that there were seven studies related to Pretest-Posttest Control Group design, six studies related to Post-test Only Control Group design one related to qualitative and four were not known.

Table 2.21 Data Analysis Wise Classification of the Abroad Studies Related to CAI

S.No	Data Analysis wise classification	Number of studies	Percentage
1	t test	3	13.04%
2	Correlated t test	7	30.43%
3	ANOVA	1	4.35%
4	ANCOVA	3	13.04%
5	Item wise objective	2	8.70%
6	Content Analysis	1	4.35%
7	Semi structured Interview	3	13.04%
8	Not Known	3	13.04%

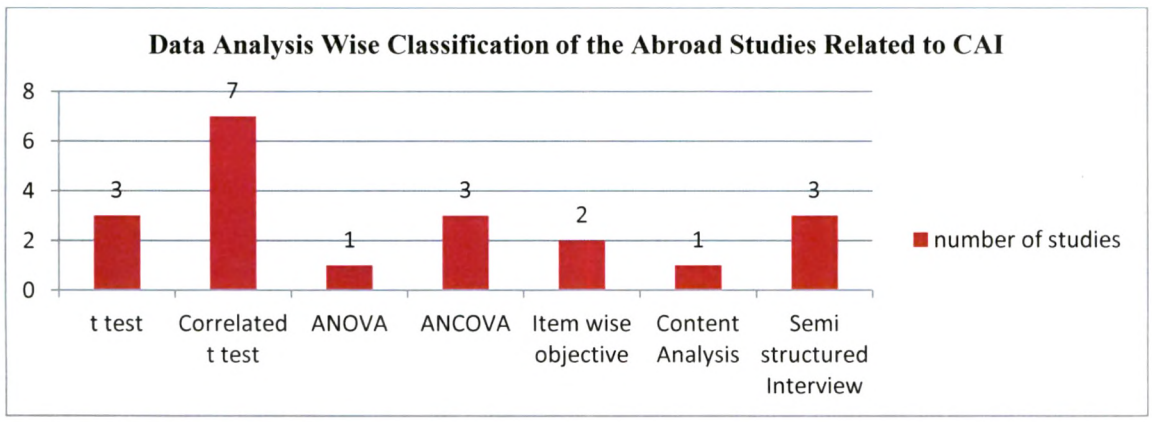

Figure 2.16 Data Analysis Wise Classification of the Abroad Studies Related to CAI

In data analysis wise classification of the CAI studies conducted abroad (ref table 2.21) it was found that there were three studies related to t test, seven studies related to correlated t test, one study related to ANOVA, three studies related to ANCOVA, two related to Item wise objective one related to content analysis, and three related to semi structured interview.

2.11.6 Research Level Wise Classification of Reviewed Studies

Table 2.22 Research Level Wise Classification of the Indian Studies Related to PLM

S.No	Level of the Study	Number of Studies Conducted	Percentage
1	Lower Primary	2	11.76%
2	Upper Primary	10	58.82%
3	Secondary	4	23.53%
4	Higher Secondary	1	5.88%
5	Higher Education	0	0%

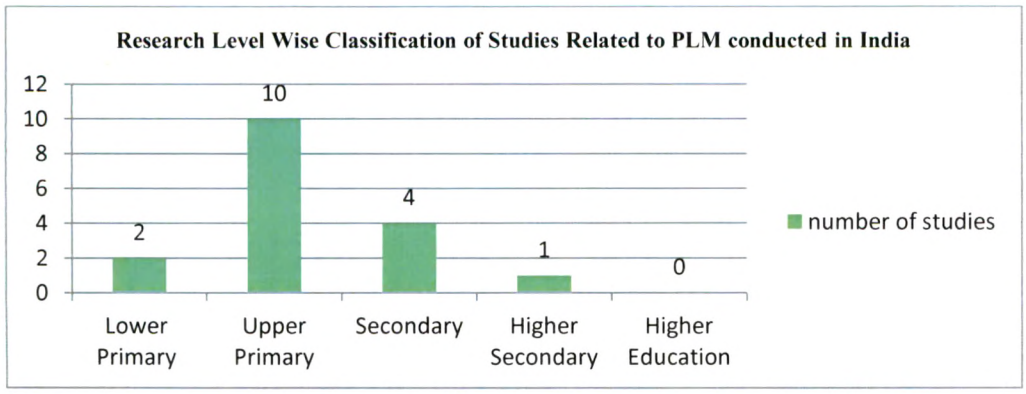

Figure 2.17 Research Level Wise Classification of Studies Related to PLM Conducted in India

In the research level wise classification of the studies conducted in the field of PLM (ref table 2.22) it can be seen that there were two studies related to lower primary level and ten related to upper primary level, four related to secondary level and one related to higher secondary. More studies were conducted in the upper primary level.

Table 2.23 Research Level Wise Classification of the Indian Studies Related to CAI

S.No	Level of the Study	Number of Studies Conducted	Percentage
1	Lower Primary	3	13.04%
2	Upper Primary	5	21.74%
3	Secondary	7	30.43%
4	Higher Secondary	6	26.09%
5	Higher Education	2	8.70%

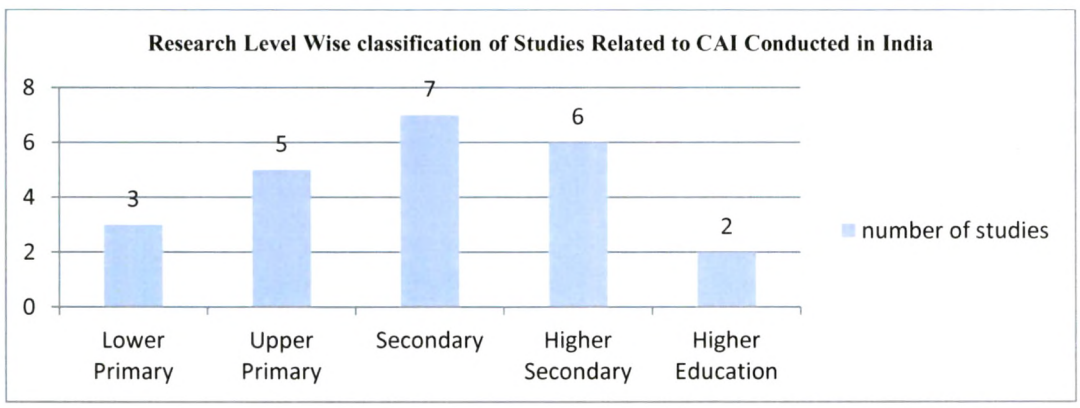

Figure 2.18 Research Level Wise Classification of India Studies Related to CAI

In the research level wise classification of the studies conducted in India in the field of CAI (ref table 2.23) it can be seen that there were three studies related to lower primary level, five related

upper primary level, seven related to secondary, six related to higher secondary and two related to higher education. It can be seen that more studies were conducted in secondary level.

Table 2.24 Research Level Wise Classification of the Abroad Studies Related to CAI

S.No	Level of the Study	Number of Studies Conducted	Percentage
1	Lower Primary	9	50%
2	Upper Primary	1	5.55%
3	Secondary	3	16.67%
4	Higher Secondary	1	5.55%
5	Higher Education	3	16.67%
6	Out of School-Age 7 to 19 years	1	5.55%

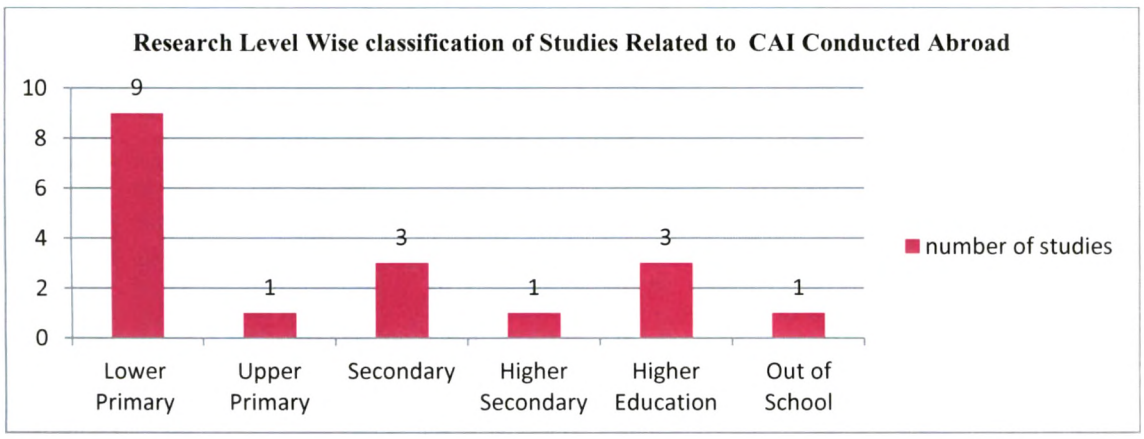

Figure 2.19 Research Level Wise Classification of Abroad Studies Related to CAI

In the research level wise classification of the studies conducted abroad in the field of CAI (ref table 2.24) it can be seen that there were nine studies related to lower primary level. One study related to Upper primary level, three related to secondary level, one related to higher secondary level, three related to higher education and one study related to out of school for the age group 7 to 19 years. We can see that more studies were conducted in lower primary level.

2.11.7 Research Finding Wise Classification of Reviewed Studies

Table 2.25 Classification of Indian studies related to PLM according to findings

S.No	Investigator	Class/subject	Findings
1	Kulkarni and Yadav - 1966	VI-Math	No Significant difference was observed
2	Sharma -1966	IX-Math	Significant difference was observed
3	Shah -1969	VIII-Math	Significant difference was observed
4	Patel-1975	IX-Math	Significant difference was observed
5	Patel-1977	VIII-Math	Significant difference was observed
6	Seshadri-1980	IX-Math	Significant difference was observed
7	Pandey-1980	IV-Math	Significant difference was observed
8	Trivedi-1980	V,VI and VII-Math	Significant difference was observed
9	Inamdar -1981	VII-Math	Significant difference was observed
10	Shah -1981	V-Math	Significant difference was observed
11	Suthar-1981	VIII-Math	Significant difference was observed
12	Davies-1982	IX-Math	Significant difference was observed
13	Rao-1983	V and X-Math	Significant difference was observed
14	Bhatia-1992	V-Math	Significant difference was observed
15	Thatte-1998	V and VII-science	Significant difference was observed
16	Tare-2001	Secondary-Chemistry	Significant difference was observed
17	Ramani and Patadia-2012	XI-Math	Significant difference was observed

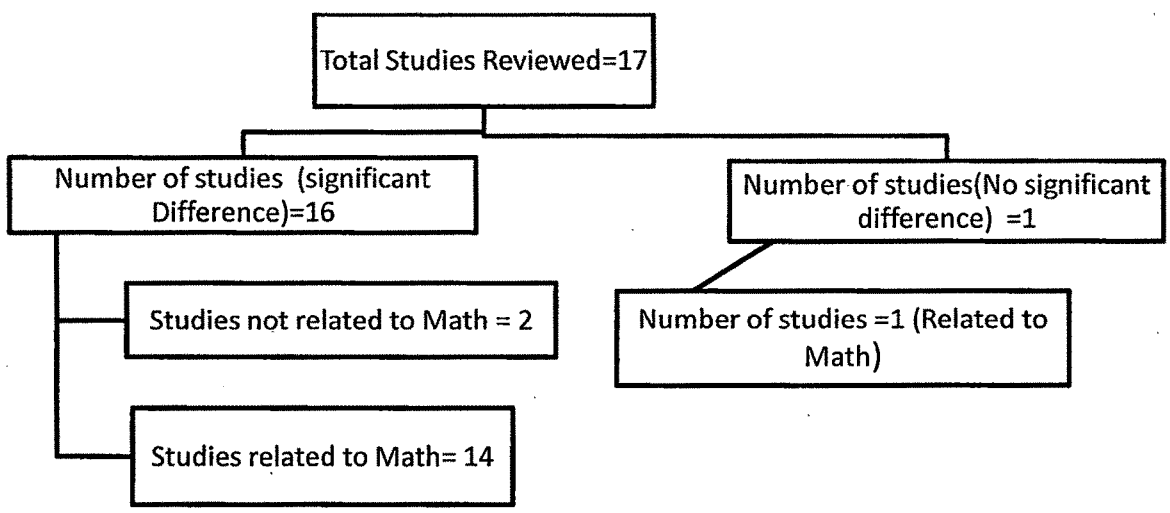

Figure 2.20 Classification of Studies Related to PLM Conducted in India according to Findings

Out of seventeen studies reviewed related to PLM, in sixteen studies there was significant difference between PLM and traditional method. Out of fifteen studies related to mathematics, in fourteen studies there was significant difference between PLM and traditional method. Therefore, it can be concluded that PLM is one of the best method to teach mathematics to students.

Table 2.26 Classification of studies related to CAI conducted in India according to findings

S.No	Investigator	Class/subject	Findings
1	Nagar(1988)	Survey	Significant difference was observed
2	Jeyamani (1991)	XI-Physics	Significant difference was observed
3	Singh, Ahluwalia, and Verma (1991)	IX-Math	Significant difference was observed
4	Rose Antony Stella, V. (1992)	IX-Math	Significant difference was observed
5	Singh (1992)	IX-Math	Significant difference was observed
6	Adhikari (1992)	IX-Biology	Significant difference was observed
7	Das (1998)	II- English	Significant difference was observed
8	Khirwadkar (1998)	XI- Chemistry	Significant difference was observed
9	Zyoud (1999)	VIII-English	Significant difference was observed
10	Yadav (2000)	I-English	Significant difference was observed
11	Dalwadi (2001)	IX-Science	Significant difference was observed
12	Patel (2001)	VIII-Science	Significant difference was observed
13	Sharma (2003)	XI-Chemistry	Significant difference was observed
14	Vasanthi and Hema (2003)	B.E. Chemistry	Significant difference was observed
15	Helaiya (2004)	B.Ed., Statistics	Significant difference was observed
16	Ruttanathummatee (2004)	Prathom-3and 6 Thai and English Language	Significant difference was observed
17	Barot (2005)	VIII- Sanskrit	Significant difference was observed
18	Pardeshi (2005)	IX- Math	No Significant difference was observed
19	Parikh (2006)	XI-Commerce	Significant difference was observed
20	Thakkar (2006)	XI-Commerce	Significant difference was observed
21	Rathwa (2007)	VII-Gujarati	Significant difference was observed
22	Patel (2008)	XI- Physics	Significant difference was observed
23	Patel (2009)	VIII-English	Significant difference was observed
24	Vansia (2011)	IX- Math	Significant difference was observed

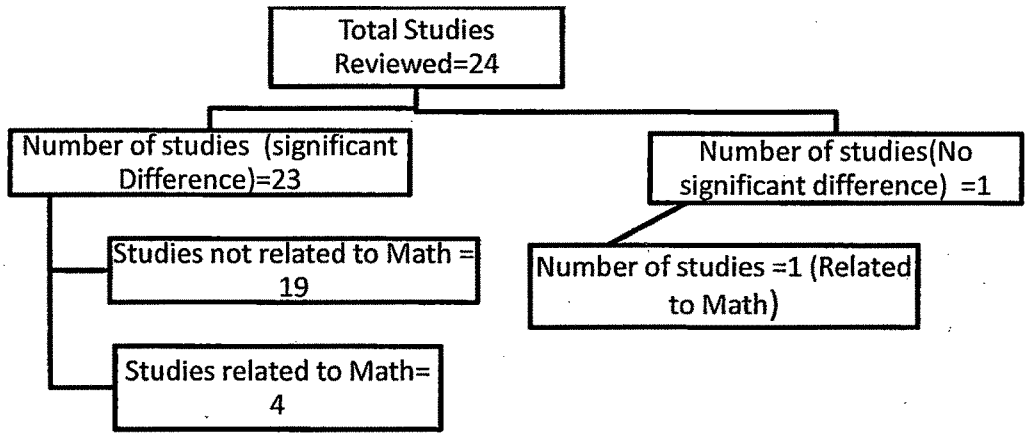

Figure 2.21 Classification of Studies Related to CAI conducted in India according to Findings

Out of twenty-four studies reviewed related to CAI conducted in India(ref table 2.26), in twenty three studies there was significant difference between CAI and traditional method. Out of five studies related to Mathematics in four studies there was significant difference between CAI and traditional method therefore it can be concluded that CAI is one of the best method to teach mathematics to students.

Table 2.27 Classification of studies related to CAI conducted Abroad according to findings

S.No	Investigator	Class/subject	Findings
1	Suwanma (1991)	II-Science	Significant difference was observed
2	Hsu (1994)	Elementary-Language	Significant difference was observed
3	Nimtrakul (1999)	IV- Chemistry	Significant difference was observed
4	Robkob (1999)	XI-Science	Significant difference was observed
5	Vaisopha (1999)	IV-Math	Significant difference was observed
6	Salsbury (2002)	IV- Geography	Significant difference was observed
7	Crews (2003)	IV and V-Language	Significant difference was observed
8	Casanova (2004)	Higher Education-CMS	Significant difference was observed
9	McLaughlin Daniel (2004)	College students-IT	Significant difference was observed
10	Eteokleous, Nikelia (2004)	Elementary	Significant difference was observed
11	Hung (2005)	Undergraduate-Microeconomics	No Significant difference was observed
12	Rosales (2005)	IX- Math	Significant difference was observed
13	Gilbert (2006)	Higher Education-Automatic Technology	Significant difference was observed
14	Beaird (2007)	IV and V- English	No Significant difference was observed
15	Ford (2007)	Secondary- Biology	Significant difference was observed

S.No	Investigator	Class/subject	Findings
16	Galvis (2007)	Higher Education-Biology	Significant difference was observed
17	Karnati (2008)	Out of school children-Basic literacy and Numerical Skills	Significant difference was observed
18	Pilli (2008)	IV- Math	Significant difference was observed
19	Jackson and Dave (2011)	Secondary- Math	Significant difference was observed
20	Bayturan and Kesan(2012)	Higher Education-Math Education	Significant difference was observed

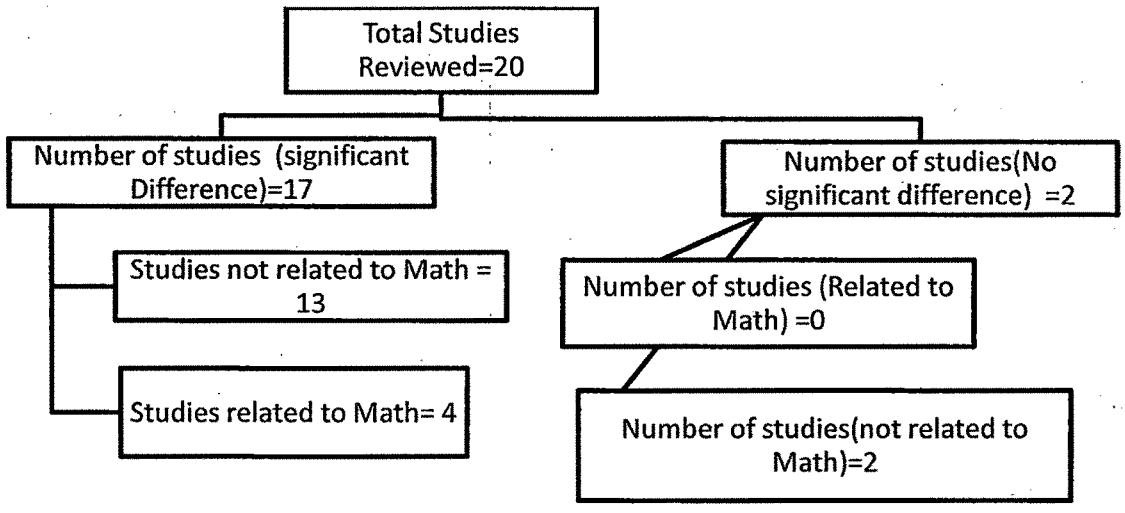

Figure 2.22 Classification of Studies Related to CAI conducted Abroad according to Findings

Out of twenty studies reviewed (ref table 2.27), in seventeen studies significant difference between CAI and traditional method was observed. Out of five studies related to Mathematics, in all studies there was significant difference between CAI and traditional method. Therefore, it can be concluded that CAI is one of the best method to learn mathematics.

2.12 Discussions Based on Reviewed Literature to Locate Research Gaps and its Implications for the Present Study

Class VIII was included in secondary level until academic year 2011 in Gujarat. However, from the academic year 2012, class VIII has been shifted to primary level. Elementary education consists of classes I–VIII, I–IV is primary and V–VIII is upper primary. Irrespective of whether a student continues his/her study after class VIII or dropouts, mathematics as a subject and its application is very important to him/her in day to day life as well as to face all kinds of challenges in life.

According to NCERT 2005, "...We want mathematics education that is affordable to every child, and at the same time, enjoyable. With many children exiting the system after Class VIII, mathematics education at the elementary stage should prepare for the challenges they face further in life." Studies like (Jain &Burad1988), (Kasat, 1991) found the causes responsible for low results in secondary mathematics and cause of failure in SSC mathematics respectively. They found that non-availability of mathematics teachers due to late appointments and frequent teacher transfers; lack of appropriate classrooms, blackboards and other physical facilities; irregular attendance of students; low standard in the lower classes; non-availability of textbooks; lack of timely correction of homework; overburdened and uninteresting curriculum; lack of child-centered teaching; insufficient periods for teaching mathematics; and lack of suitable teaching aids etc., are cause of low achievements. They have, however, not analysed why these causes affect mathematics learning more than any other subject. They have not suggested steps to enable such students to do better in the examinations. Wagh (1991) conducted a study on multimedia system for remedial purpose and Aguele et al (2012)have conducted a study on use of Educational Technology and effective teaching of mathematics. Yasoda (2009) conducted a study on problems in teaching and learning mathematics. The study reveals that 'commercial mathematics' and 'mensuration' are the most difficult chapters for the students of class VIII and that in addition to these two chapters 'triangles and polygons' and 'circles and concurrent lines of triangles' are most difficult chapters as per the teachers. Students face problems in understanding the mathematical language, symbols and relation between different concepts in mathematics.

Jayasree (1997) and Vasudevan (2003) found certain learning difficulties in mathematics class. Jayasree (1997) found that the level of attainment is poor in the case of classification of open and closed sentences in expanding algebraic expression. The study also revealed that there is no mastery of the rules of signs and many pupils do not seem to have a clear grasp of identities. Vasudevan (2003) found that majority of the students faced difficulty in carrying out the fundamental operations involving negative numbers due to the lack of clarity on rules of fundamental operations. Aguele (2010), Moila(2006) and Anthony and Walshaw(2009) have suggested that enough practice activities should be given to the students for better learning in mathematics. Chel(1990) conducted a study on diagnosis and remediation of underachievement in compulsory mathematics. Researcher diagnosed the learning difficulties in mathematics which are concept gaps, confusion in understanding mathematical language, *stereotype way of presenting*

contents and lack of openness in teaching. The major mistakes found in the performances of students and teacher trainees in the areas include mathematisation of verbal problems, interpretations of mathematical results and *learning new topics in mathematics*. He also found that underachievement was caused due to *lack of understanding* of the mathematical concepts of the *earlier stage*, and the abstract nature of mathematics. Errors are caused due to the versatility and variability of contents and *lack of time*. He also found that student's difficulty to learn mathematics was because of faculty's arrangement of content. The researcher's findings related to remediation's were that the teacher should use reinforces like *readiness*, *interest, active involvement*, use of *effective materials of instruction* and learning efficiency. This study clearly shows that students find difficult to understand mathematics because of mathematical language and teaching style of teacher. This study clearly shows that teaching is not enough for the students to learn mathematics and there should be some supplement material in addition to traditional teaching. As per Sashidharan (1992) the initial deficiencies of students in mathematics subject have a long-term damaging effect because the content of mathematics is organized in such a manner that learning in each class depends on previous class mathematics content. This study clearly states that higher learning in mathematics depends on students' content mastery in learning previous mathematics classes. If a student is weak in previous class it will be difficult for him to learn mathematics in next class. Therefore, in each class students should learn mathematics thoroughly to understand higher mathematics in the next class because the contents are linked. Class VIII mathematics is bridge between upper primary and secondary mathematics. During this transition from lower level mathematics to higher level mathematics students find it difficult to learn secondary mathematics if they did not learn class VIII mathematics thoroughly. Therefore, learning class VIII mathematics is crucial for students. Based on these studies the investigator found that there are many learning difficulties existing in mathematics class. These difficulties to some extent can be solved by giving enough practice activities to the students as indicated by studies Aguele (2010), Moila (2006) and Anthony and Walshaw (2009). Chel (1990) suggested the use of effective materials in addition to conventional classroom teaching. Learning mathematics should be enjoyable as suggested by NCERT (2005). Investigator has not come across enough studies that provide enough practice activities to the students inside and as well as outside the mathematics classroom. Hence investigator has attempted to develop some practice material to overcome learning difficulties faced by the students in mathematics. Based on these studies investigator could locate the gap in terms of researches

conducted related to material which will give enough practice. This lead the investigator to review sixty-one studies in the field of self-learning material viz. PLM and CAI.

Out of reviewed sixty-one studies fifty-six studies were effective in achieving the respective objectives of the studies for which they were designed. In the remaining five studies there was no significant difference between the experimental group and control group, that is, traditional method of teaching was found to be as effective as teaching through CAI/PLM. Investigator has reviewed a total of seventeen studies related to PLM. Out of seventeen studies fifteen studies related to Mathematics. Out of fifteen there were three studies conducted for class VIII viz one for the topic Algebra, another for the topic geometry and other for the topic set theory. In addition to that there were twelve studies related to classes other than class VIII. Investigator has reviewed a total of twenty-four studies conducted in India related to CAI. Out of twenty-four studies, six of them related to Mathematics and rest seventeen of them are not related to Mathematics. In the said six studies, five studies were conducted for class IX and one for higher secondary. There were no studies related to CAI for class VIII. Investigator has reviewed a total of twenty studies conducted abroad related to CAI. Out of twenty studies, five related to Mathematics. Out of said five studies, two related to class IV mathematics, two for class IX mathematics and one for class XI mathematics. There were no studies related to CAI for class VIII mathematics conducted abroad. In all the reviewed studies viz studies related to PLM, CAI conducted in India and CAI conducted abroad, there was no study related to topics of arithmetic especially at upper primary level, which is very crucial for students learning algebra in higher classes as well as for dropouts.

During 1960's (Kulkarni and Yadav (1966), Shah (1969) and Sharma (1966)) researches concentrated on comparative studies of PLM and conventional learning and found that PLM was effective. During 1970's (Patel (1975) and Patel (1977)) researches started taking different variables such as different learning abilities, rural and urban, high income and low income group. During 1980's (Seshadri (1980), Pandey (1980), Trivedi (1980), Inamdar (1981), Shah (1981), Suthar (1981), Davies (1982) and Rao (1983)) researches were related to Psychological Characteristics, Different modes of Paring, Sex Variation, Study Habits, and Entry Behaviour of the learner and 'comparison between linear and branching style' were studied by researchers. From1990's most of the studies were related to CAI. Some studies related to PLM (Bhatia (1992), Thatte (1998) and Tare (2001)) were conducted, these studies are related to PLM as a remedial teaching, relative effectiveness of PLM and Audio Visual Aids, 'Diagnostic and remedial tools' were studied by the

researchers. But most of these studies were conducted at M.Ed level. During 2000 (Barot (2005) and Pardeshi (2005)) the researchers used different programming languages like BASICA, Flash MX, and Corel Draw 11 for the construction of CAI.

In the year wise classification of the studies related to PLM conducted in India, reviewed by the investigator, it was found that there were three studies during 1960-1970, five studies during 1971-1980, five studies during 1981-1990, two studies during 1991-2000 and two studies during 2001-2010. Hence a decreasing trend in PLM related studies can be observed over the years. In the year wise classification of the studies related to CAI conducted in India, reviewed by the investigator. It was found that there was one study during 1981-1990, nine studies during 1991-2000, thirteen studies during 2001-2010 and one study during the year 2011. In the year wise classification of the studies related to CAI conducted abroad, reviewed by the investigator, it was found that there were five studies during 1991-2000, there were thirteen studies during 2001-2010 and there were two studies during the year 2011-12.

In the research study wise classification of the reviewed studies related to PLM it was found that all the seventeen studies were of 'Experimental' type. In the research design wise classification of the studies related to PLM it was found that there were five studies related to 'Pre-test Post-test Control Group design', two studies related to 'Post-test Only Control Group design' and in ten studies research design were unknown. In data analysis wise classification of the studies related to PLM it was found that there were seven studies related to 't test', two studies related to 'correlated t test', one study related to ANOVA, one study related to ANCOVA and in six studies data analysis was unknown. In research study wise classification of the reviewed studies of CAI conducted in India it was found that twenty-three were of 'Experimental' type, one was of 'Survey' type and there was no study related to 'CASE' study. In the Sampling Method Wise classification of studies related to CAI conducted in the India it was found that there were four studies using 'Simple Random Sampling', four using 'Stratified Sampling', three using 'Randomised Block Sampling', two using 'multistage Sampling', five using 'Purposive Sampling' and in six studies sampling method was not found. In research design wise classification of the studies related to CAI conducted in India it was found that there were ten studies related to 'Pretest-Posttest Control Group design', four related to 'Post-test only Control group design', two related to 'One group Pretest-Posttest design' and in eight studies research design were not known. In data analysis wise classification of the studies related to CAI conducted in India it was found that there were thirteen studies related to

't test', six studies related to 'correlated t test', four studies related to ANOVA and two studies were related to ANCOVA. In research study wise classification of the studies related to CAI conducted abroad it was found that there were fifteen studies related to 'True Experimental', two studies related to 'Quasi Experimental', two studies related to 'Survey' and one study was related to 'CASE study In the research method wise classification of the CAI studies conducted abroad it was found that there were three studies related to 'simple random sampling', one related to 'stratified sampling', one relate to 'quota sampling', eight related to 'purposive sampling' and in seven studies research method were unknown. In data analysis wise classification of the CAI studies conducted abroad it was found that there were three studies related to 't test', seven studies related to 'correlated t test', one study related to 'ANOVA', three studies related to 'ANCOVA', two related to 'Item wise objective', one related to 'content analysis', and three related to 'semi structured interview. In the research level wise classification of studies it was found that there were only ten studies related to PLM for upper primary level out of seventeen studies reviewed related to PLM, only five studies related to CAI conducted in India for upper primary level out of twenty three studies reviewed related to CAI conducted in India and only one study related to CAI conducted abroad for upper primary level out of eighteen studies reviewed related to CAI conducted abroad. Totally there were only sixteen studies related to upper primary level out of fifty-eight studies reviewed. The above analysis clearly shows that only few studies were conducted for upper primary level in comparison with other levels. There were only six studies related to post-test only control group design in a total of twenty studies reviewed by the investigator, only in three studies ANOVA was used for data analysis in a total of twenty-three studies and in only two studies Chi Square was used for data analysis in a total of twenty-three studies reviewed by the investigator. In t test and correlated t test only two groups were considered viz. experimental group and control group but in ANOVA more than two groups were considered. ANOVA is one of the most powerful statistical techniques for data analysis because it considers variance between the groups and within the groups.**(Eck)** A chi square (X^2) statistic is used to investigate whether distributions of categorical variables differ from one another. In pre-test post-test design it is difficult to eliminate carryover effect which affects internal validity of the experiment this effect is to a great extent is eliminated by using post-test only control group design. The research design used in present study was post-test only control group design, data analysis used was ANOVA and Chi Square.

Of the fifteen studies reviewed related to PLM in Mathematics, fourteen studies found significant difference between PLM and traditional method and in one study there was no significant difference between PLM and traditional method. The two studies reviewed related to PLM other than mathematics found significant difference between PLM and traditional method. Out of twenty-four studies (five related to mathematics) reviewed related to CAI conducted in India, in twenty-three (four related to mathematics) studies there was significant difference between CAI and traditional method and in one study (one related to mathematics) there was no significant difference between CAI and traditional method. Out of twenty studies (five studies related to mathematics)related to CAI conducted abroad in seventeen studies(four studies related to mathematics) there was significant difference between CAI and traditional method and in rest three studies (one study related to mathematics) there was no significant difference between CAI and traditional method. In the reviewed studies investigator found few studies related to upper primary level especially in mathematics as stated above, there was no study related to arithmetic part of mathematics at this level. Investigator found a research gap and there was dire need to conduct a study related to arithmetic part of mathematics at the upper primary level. Therefore investigator is interested in conducting a study related to upper primary level in arithmetic part. Investigator is also interested to know whether there is significant difference between the mean achievement score of experimental group and control group because in three studies it was found that there was no significant difference found between mean achievement score of experimental group and control group.

Investigator felt a need of research related to upper primary level which is the crucial stage of mathematics development and this is the stage we can see more dropouts (Sarva Shiksha Abhiyan, 2012)in India(dropout rate is 1.79 in 2010-primary census abstract 2001) and ultimately leads to the end of learning mathematics. There was no study to compare the achievement of students by CAI, CAI with simultaneous discussion and conventional method. Considering that arithmetic is one of the important topics in mathematics, investigator has proceeded as a step in that direction to study the effectiveness of CAI with different modes.