CHAPTER II
REVIEW OF RELATED LITERATURE

“A familiarity with literature in any problem area helps the students to discover what is already known what others have attempted to find out, what methods of attack have been promising and disappointing and what problems remain to be solved” (Best and Kahn).

The phrase ‘Review of Literature’ consists of two words, viz., Review and Literature. The term ‘Review’ means to “Look Again” or to organize the knowledge of specific area of research, to involve an edifice of knowledge to show that study would be an addition to this field. The term “Literature” in research methodology refers to the knowledge of a particular area of investigation of a discipline which includes theoretical, practical and its research studies or literature as the mirror that reflects the past view and presents the future perspective.

Review of related literature means to locate, to read and to evaluate the past as well as current literature of the research concerned with the planned investigation. Such literature provides the researcher with the footprints of earlier travelers gone ahead on the same route. The time spent in survey of related literature is invariably a wise investment. It is a crucial step which minimizes the risk of dead ends, wasted efforts, rejected topics and even more important errorless findings based on a faulty research design.

Review of literature also makes a researcher aware of the nature, kind and magnitude of the work done in the field and indicates the direction of further studies on the subject. Sometime, from such reviews of the relevant literature, the probable and possible topics of research may also emerge. To conceptualize the research problem explicitly and meaningfully, there lies the significance of review of related literature done by the researcher.

Keeping in mind the stated arguments, the researcher has reviewed the relevant literature, followed by a systematic analysis of studies, ideas, concepts and views of different researcher, as presented here in two parts:

Studies done abroad; and
Studies in India
The use of information and communication technology (ICT) such as Internet applications, CD-ROMs, video technology and various computer attachments and software programs have caused many changes in society. Today, ICT in education encompasses a great range of rapidly evolving technologies such as desktop, notebook, and handheld computers; digital cameras; local area networking; the Internet and the World Wide Web; CD-ROMs and DVDs; and applications such as word processors, spreadsheets, tutorials, simulations, electronic mail (email), digital libraries, computer mediated conferencing, videoconferencing, and virtual reality. The analysis has accordingly been subdivided wider different topical sub-heads also.

2.1 STUDIES DONE ABROAD

- Integrating ICT in School

An impact Study (Cox, 1993) including a large scale investigation into the effects of ICT on children’s achievements, found that effective use of IT required substantial demands in terms of [teachers’] knowledge and understanding of, and familiarization with a variety of software in order to integrate the activity, in philosophical and pedagogical terms, with a larger scheme of work. The research methods related to three components: an assessment of pupils’ achievements of specific learning tasks and skills; in-depth longitudinal case studies in a few high IT classes focusing on classroom processes; and IT resourcing and use monitored throughout the two years of the field work.

BECTA (2000) investigated the relationship between ICT resources and pupil attainment in primary and secondary school and found a consistent trend for pupils in schools with better ICT resources to achieve better grades for English, Mathematics and Science. More than half of the schools with very good ICT resources were achieving above the national standards in science, compared with less than a third of schools with ‘poor’ ICT resources. There were similar results for English and Mathematics. Schools with very good ICT resources were found in a similar range of social contexts as schools with poor ICT resources. It concluded that any difference in standards and attainment levels between the two groups of schools is not due to socio-economic factors. This
report is based on an analysis of ofsted inspection results for the 2,500 primary school inspected in the year 1998-99.)

Goodison, T.A. (2002). investigated the UK primary school children’s awareness of the linkage between ICT and the way they learn within the context of a school that has been particularly successful in integrating ICT into the curriculum. Pupils were interviewed by their teacher and extracts from the dialogue, identified examples of good practices. Results of the study illustrate that ICT can make contributions to the promotion of independent learning.

McFarlane, A. and Sakellarion, S. (2002), considered two perspectives on the relationship between the science curriculum and the potential of ICT in science education: the first perspective related to the current English secondary science curriculum, while the second looked at how the role of ICT might be developed if the curriculum were to emphasize scientific reasoning rather than the practice of empirical science. It focused on the use of ICT to support or replace practical work and the use of multimedia or the internet as a tool for scientific reasoning. The authors argued that using ICT either as a tool in a practical investigation or as a substitute for the laboratory-based elements of an investigation can aid theoretical understanding. They also commented on the role of the internet and electronic communications in developing scientific literacy and an understanding of authentic science. In conclusion, they proposed a curriculum model which has a balance of empirical science and critical science, each supported by an appropriate use of ICT.

Allan, H.K. et al. (2003), reporting the findings of an analysis on models of change in 18 schools striving to integrate the use of ICT in teaching and learning across the school curriculum, showed that the strategy adopted by a school in instituting such a change and resulting variation of pedagogical practices using ICT is strongly dependent on the school leaders’ vision and understanding of the role and impact of ICT in the curriculum, their goals and objectives for ICT integration, as well as the history, culture and background of the school and its general vision and mission.

Osborne, J., Hennessy, S. (2003), reviewing the current state of science education, the impact of ICT use on the curriculum, pedagogy and learning and the implications for future practice, considered how ICT can be employed flexibly to support different
curricular goals and forms of pedagogy. They revealed that there are diverse ways of linking ICT use to existing classroom teaching, including supporting or replacing it, suggesting further that transformative use of ICT in science is found only in isolated pockets as technology is not yet embedded in the culture and practice of many science teachers. They hinted that the content oriented National Science Curriculum hindered the development of classroom use of ICT, but as the science curriculum moves towards a greater emphasis on scientific reasoning and analytical skills, there would be more opportunities for ICT to play a key role in Science Education.

Hennessy et al. (2003) investigated teachers’ and students’ changing roles and strategies in the context of using various forms of computer-based information and communication technology to support subject teaching and learning at secondary level. One hundred and fifteen teacher researchers participated in a collaborative programme of small-scale, classroom-based projects involving development, evaluation and refinement of new pedagogic approaches, strategies and activities in six curriculum areas. An analysis was conducted across the case study data derived from lesson observations; follow up teacher interviews and teachers’ written research reports. While interactions with individual students and small groups were increased and reportedly successful, mediating interactions between students and technology through whole-class interactive teaching, modeling and discussion appeared to be under-developed.

Baurer and Kenton (2005), in their qualitative study about technology integration in the schools to examine the classroom practice of 30 “Tech-Savvy” teachers who used computer technology in their instruction, found that though the teachers were highly educated and skilled with technology, were innovative and adept at over-coming obstacles, yet they did not integrate technology on a consistent basis both as a teaching and learning tool, perhaps for two major reasons, that is, the students did not have enough time at computers and teachers needed extra-planning time for technology lessons, besides concerns like outdated hardware, lack of appropriate software, technical difficulties and students’ skill levels.

Chong, et al. (2005), in a survey to study the barriers preventing the integration and adoption of information and communication technology (ICT) in teaching mathematics, identified six major barriers, that is lack of time in the school schedule for
projects involving ICT; insufficient teacher training opportunities for ICT projects; inadequate technical support for these projects, lack of knowledge about ways to integrate ICT to enhance the curriculum; difficulty in integrating and using different ICT tools in a single lesson; and unavailability of resources at home for the students to access the necessary educational materials. To overcome some of these barriers, it proposed an e-portal for teaching mathematics. The e-portal consists of two modules: a resource repository and a lesson planner. The resource repository is a collection of mathematical tools, a question bank and other resources in digital form that can be used for teaching and learning mathematics. The lesson planner is a user-friendly tool that can integrate resources from the repository for lesson plan.

Ngah, Nor Azilah and Masood, Mona (2006), in their pilot research to identify the ICT-skills needed by teachers with the ultimate aim of creating learning objects to be made available online in Malaysia, found that although access to ICT is not a problem, teachers felt that they lacked the necessary skills to integrate ICT into their classroom teaching. Survey questionnaire was developed and used as a data gathering tool which comprised of several components: (a) demography; (b) experience in using ICT as a teaching and learning tool; (c) attitude toward computers; (d) usage of school resource centre; (e) areas that need further training; (g) issues in innovation and diffusion; and (h) reflections on use of technology with respect to their career, teaching and learning and personal life.

Ololube (2006), set out to identify and evaluate how the relevant strategies, professional and non-professional ICT instructional material utilization competencies play in stimulating students’ academic achievement during and after instruction, revealed that there are significant differences in effectiveness between professionally trained teachers and untrained teachers in their ICT instructional material utilization competencies. To achieve the purpose of this study, several sets of statistical analysis were conducted using SPSS version 11.5 of a computer programme: Mean and Standard Deviation, ANOVA, t-test of significance and cross tabulation (N=300).

Higgins, S. & Moseley, D. (2001) In a study of teachers’ attitude towards ICT and an investigation into the correlation with pupil attainment constructs relating to teaching and learning elicited from 75 primary school teachers, revealed that professional
development needs to take into account teachers’ thinking about teaching and learning generally, and also the year group taught. Self-ratings on constructs related to ICT and learning were compared with pupil outcome data, questionnaire information about classroom practice, and teachers’ self reported levels of ICT skill. Consistent patterns of thinking emerged, as did clear differences in how these predicted pupil progress by the year-group taught. There were also links between the way teachers reported that they used computers and the relative pupil progress data from the performance indicators in Primary School Project (PIPs) at Durham University, but only when examined by year-group: amongst reception teachers, scepticism as to the value of ICT was a positive indicator of pupil’s progress, whereas for year 2 and 4 teachers, favouring the use of ICT was associated with pupils’ progress.

Experimental results regarding access to computers without additional instruction, provided by Gardner et al. (1993), who supplied 235 students with a personal Laptop for an entire school year and matched them to a control group that did not receive computers, found no significant differences between the two groups, suggesting that mere access to computer technologies without concurrent changes to instruction is not sufficient to effect achievement. Instruction was same for both the groups, and their, performance in English, mathematics, and science was measured after the year.

ICT is more the less quite powerful in presenting or representing information in different ways and through different forms (text and pictures or tables and graphs) or by enabling changes to be shown dynamically such as in mathematical modeling or by helping visualization of complex processes in science.

Information can be manipulated easily on a computer so that a pupil can make changes and evaluate the effect of those changes. This can be where the information is of the same type such as text in word-processing (Snyder, 1993; Breese et al., 1996) or number of spread sheets (Mann and Tall, 1992). It may be important, however, not to teach skills in isolation. Multimedia presentation in the form of talking books has been shown to improve beginning readers’ phonological awareness but without improving their word recognition (Chera and Wood, 2003). An interpretation of this might be that children get better at playing the computer ‘game’ (as they set it) but that the improved skills are not readily used away from the computer.
• **Use of Calculators**

Historically, research results on the use of *calculators* in mathematics have been mixed. However, after the graphing calculator was introduced in the 1980s, results were increasingly more positive. In the United States, the National Council for Teachers of Mathematics credited the graphing calculator for “the emergence of a new classroom dynamics in which teachers and students become natural partners in developing mathematics ideas and solving mathematical problems,” especially in algebra and higher mathematics (Interactive Educational Systems Design (IESD), Inc. (2003). In general, literature suggests that the use of calculators improved learning in three areas: understanding of graphical concepts; the ability to make meaningful connections between functions and their graphs, and enhanced spatial skills (Penglase, M., and Arnold, S. (1996).

Pennington, R. (1998), investigating the value of providing access to calculators and of providing instruction on how to use calculators (in addition to access) for increasing middle school students’ mathematics test scores, found that seventh and eighth-grade students using calculators outperformed students without calculators on a test of basic mathematics skills, whether or not the students were instructed in how to use the calculators

Wetzel, D.R. (2001), investigating the factors that influenced five middle school science teachers as they implemented and integrated *calculator-based laboratory (CBL)* probe ware in the curriculum, found that 80 per cent of participating teachers successfully integrated CBL probe ware into their teaching. The study involved empirical research both with qualitative and quantitative data, through interviews, questionnaires, anecdotal records and observations of teachers, presenting a holistic view of the influences on the level of teachers’ technical proficiency with CBL probe ware, level of actual use during integration into the curriculum, changes in pedagogy, changes in organisational culture, and curriculum transformation related to CBL probe ware. The study also identified the contextual barriers of integration, including training in the use of technology and pedagogical support.

Bett’s S. (2003), assessing the extent to which ICT contributes to quality in learning in science at key stage 3, found that ICT can enhance the quality of learning
where its use is tailored to lesson objectives and the needs of pupils. Considering the meaning of quality in the context of science education, it also identified some of the indicators of quality and, drawing on data from tests, interviews and observations, examined how ICT affected pupils’ understanding, their motivation and use of learning strategies as well as their mental engagement and the context for their learning.

- **The Motivational Effect of ICT on Pupils**

  According to Means *et al.* (1997), student motivation is enhanced through online collaborative research that includes online communication with peers and experts in other states and countries, evaluation of evidence and sharing of information and the use of standards-based curricula that are integrated with scientific visualization tools. Project GLOBE engaged K-12 students from schools in 34 countries in gathering data about their local environments. Students in the GLOBE classrooms demonstrated higher knowledge and skill levels on assessment of environmental science methods and interpretation of data than did their peers who did not participate in the program.

  A systematic review by Goldberg, *et al.* (2003), found that “*on average, students who use computers when learning to write are not only more engaged and motivated in their writing, but they produce written work that is of greater length and higher quality.*” The effect sizes were however, found to be moderate (0.50 for quantity and 0.41 for quality) and that this kind of impact would move a class using word-processing, from 50th up to 36th in a league table of 100 classes in terms of the quality of their writing. It further suggested on the basis of a meta-analyses conducted by Boston College on Writing with *Word Processors* across the curriculum, that students using these electronic tools wrote significantly more, received earlier interventions by teachers, and wrote higher quality work than students in comparison group. In the area of reading, several studies have shown that students who use *word processors*, versus those who use *pen and paper*, are more engaged and *motivated* in their writing, they write more, they receive earlier scaffolding and intervention by teachers, and they produce higher-quality work.

  Pittard *et al.* (2003) noted that evidence from large scale studies, most notably *impACT2* (Harrison *et al.*, 2002), showed that the use of ICT can motivate pupils and result in a positive effect on attainment amongst those pupils who make relatively high use of ICT in their subject learning. Strand 1 of the *impACT2* investigation focused
specifically on pupil learning and attainment and found positive associations between ICT use and achievement on some key stage (KS) tests, although the strength of the associations observed varied with stage and subject area. Statistically significant positive associations were found between ICT use and higher levels of attainment in; National Tests in English (KS2), National Tests in Science (KS3), GCSE Science (KS4), and GCSE design and technology (KS4). Positive associations were found between ICT use and National Test results in Mathematics (KS2) and in relation to GCSE outcomes in GCSE modern foreign languages and geography (both KS4), although they did not reach statistical significance. However, it was also noted that no association between superior performance and low levels of ICT use was observed. Factors such as expertise of the teaching staff, access to subject specific resources at each key stage and quality of the materials were identified as influential.

Passey et al. (2003), in a study to establish systematically the impact of ICT use in school on pupil motivation, found that the perceptions of teachers and pupils towards using ICT in school had an overall positive motivational impact on the pupils studied, based on case studies carried out in 17 schools, including interviews with 121 head teachers, teachers and classroom learning assistants and with 126 pupils, 33 lessons observed and 1,206 pupil questionnaires administered, besides interview with 24 social workers, youth workers, health workers, careers officers and police officers concerned with school liaison and youth offenders.

The most significant research study on the motivational effect of ICT on pupils Passey et al. (2004), aiming to identify and, where possible, to quantify impact and to relate it to aspects such as learning outcomes, behaviour, school attendance, truancy, antisocial behaviour and uses of digital content, found that ICT helped to draw pupils into more positive models of motivation and could offer a means by which pupils could envisage success. All of the secondary school teachers involved felt that ICT had a positive impact on pupil interest in and attitudes to school work. Pupils took greater pride in their work and it was more likely that tasks were completed and on time. The study drew on a range of theoretical stances, problematising the concept of motivation and identifying a number of different dimensions. It defined eight measures that could be used to identify and quantify these – learning goals, academic efficacy, identified
regulation, intrinsic motivation, performance approach goal, performance avoidance goal, external regulation and motivation. Each of these is based on usually implicit reasons pupils might have for engaging with tasks in the context of school. For the first four, high levels of measurement produce a positive learning profile while for the last four, low levels are desirable. The measures formed the basis of pupil questionnaires and motivational profiles constructed from the responses. The study also found that, when working with ICT pupils, learning was characterized by high levels of motivation towards achieving personal learning goals – a desirable outcome – but also high levels of motivation towards gaining positive feedback on individual competence (performance approach goals) -which was less desirable.

Davies et al. (2005), in reviewing the research evidence on the impact of ICT in the 14 to 19 age range, found that motivational variables do not in themselves lead directly to improvement in achievement; rather the effects of increased motivation are mediated by other variables that are linked to the development of learner autonomy and higher order cognitive skills. The development of meta-cognitive skills and self-regulation, it is argued, leads to increasingly effective learning strategies amongst pupils, greater engagement with learning activities, and in turn attainment.

Valentine et al. (2005) found that parents and pupils believed that ICT improved motivation and confidence, made school work more enjoyable and improved achievement. They reported a statistically small improvement in attainment in Mathematics and English linked to the home use of ICT for educational purposes at particular key stages, and concluded that home use brings advantages in terms of new sources of information, enhanced presentation and raised self-esteem which, in turn, affects attainment.

Chem et al.(2006), investigating use of ICT in music classrooms, with focus in secondary school music curriculum in the UK, revealed significant improvement in reading music (staff) notation and rhythm skills. The study focused on two aspects highlighted in the National Curriculum for England for Music (1999) which suggested that basic music notation and keyboard skills form part of pupil’s musical learning experience, and that such practical skills support classroom musical activities like performing, listening and composing. The study was carried out in a British Secondary
School using a commercial CD entitled “Teach me Piano Deluxe”, designed to teach music practical skills.

- **Graphic Calculator**

  Much of the research into the effective use of graphic calculators in enhancing student achievement appears to show positive results.

  In a study by Alexander (1993), college algebra students who used software designed “to aid in the instruction of functions using concrete visualization” plus a graphing calculator significantly outperformed students receiving conventional instruction in their “understanding of the concept of functions…. and in mathematical modeling”. The results in this study suggest the power of the computer to provide concrete visual support for the learning of abstract concepts.

  McFarlane *et al.* (1995), introduced line graphs to eight-year old children, using data logging. Children, who had been exposed to data logging showed an increased ability to read, interpret and sketch line graphs when compared to children using traditional apparatus. The results suggested that the manual plotting of points as a first introduction to graphs appeared to interfere with understanding.

  Pengalese and Arnold (1996) urged researchers not to treat the graphic calculator in isolation from the context in which it is being used – the particular learning environment.

  Tharp, Fitz Simmons and Brown Ayres (1997), in a four month study of 261 mathematics and science teachers, found that while participants’ views changed significantly in favour of viewing the graphics calculator “as a ‘thinking tool’ to enhance conceptual understanding and expand exploration”, there was a difference between the teachers classified as holding a rule-based view of mathematics learning and non-rule-based teachers. In particular, rule-based teachers, quickly abandoned inquiry approaches, were more likely to feel that the calculators were a hindrance to learning and were more concerned about students’ emotional reactions than indications of conceptual understanding.

  Barton (1997) in a comparative study on 12-14 year old students to investigate if there are any advantages to pupils using computer generated graphs as opposed to plotting them manually, found that manual plotting was a problem for all, particularly the
weaker students; it not only caused a time penalty, but misunderstandings too about the relationships between the variables being plotted, reinforced by difficulties the students had in drawing the best-fit lines. On the other hand, the computer-assisted graphing approach was particularly effective for the younger, weaker students, the production of real-time graphs stimulated the students to provide explanations, make predictions and spontaneously make links to previously acquired knowledge.

Hennessy, S. et al. (2001) In their PIGMI (Portable Information Technologies for supporting Graphical Mathematics Investigations) Project investigating the role of portable technologies in facilitating development of student’s graphing skills and concepts, examined the impact of a recent shift towards calculating and computing tools as increasingly accessible, every day technologies on the nature of learning in a traditionally difficult curriculum area. It focused on the use of graphic calculators by undergraduates taking an innovative new mathematics course at the Open University. A questionnaire survey both of students and tutors was employed to investigate perceptions of the graphic calculator and the features which facilitated graphing and linking between representations. Key features included visualization of functions, immediate feedback and rapid graph plotting. A follow-up observational case study of a pair of students illustrated how the calculator can shape mathematical activity, serving as a catalytic to facilitating and checking roles. The features of technology-based activities which can structure and support collaborative problem solving were also examined. In sum, the graphic calculator technology acted as a critical mediator both in the students’ collaboration and in their problem solving. The pedagogic implications of using portables are considered, including the tension between using and over-using portables to support mathematical activity.

- **Type of software**

Zollman et al. (1989), in a study of reading and mathematics achievement of Grades 2-6 students, experimental groups using Education Systems Corporation (ESC) software in computer laboratories twice per week during a period of one school year, and with access to the computer laboratories, demonstrated significant increases in achievement both in reading and mathematics.
Wood (1991), exploring the effects on mathematics achievement of two different types of software: a tutorial program and a tool program on high school students studying algebra and using the tutorial, demonstrated higher achievement in computational skills. The students using the tool program evidenced higher achievement in their understanding of algebra concepts. The study suggested that the best choice of software type may depend on the instructional goal. Since success in mathematics requires both computational and conceptual skills, students are likely to benefit from both types of software.

Gardner, Simmons and Simpson (1992) found evidence of the benefits of hands-on meteorology activities combined with content-specific tool software. Three groups of third graders were compared: one group receiving hands-on activities with software; one receiving hands-on activities without software; and one receiving traditional classroom instruction. The hands-on activities with software group significantly outperformed the hands-on activities only group on a test of meteorology knowledge. Both of these groups scored significantly higher than the students receiving traditional instruction did.

Lazarowitz and Huppert (1993) had similar results with high school biology students. One group received classroom–laboratory instruction that included use of a software program that combined simulated experiments and laboratory analysis tools. The other group received classroom–laboratory instruction only. The group using the software demonstrated significantly higher achievement in content knowledge and science process, skills of graph communication, data interpretation and controlling variables.

A study by Carter (1994) suggested that supplementing classroom instruction with tutorial and practice software had a positive impact on mathematics and reading achievement for low performing ninth graders. A group of students receiving computer-based instruction for one 50-minute period per week both in their mathematics and English classes for most part of one school year and for the remaining time, took part in regular classroom instruction, demonstrated significantly greater gains both in mathematics and reading skills than another group of low-performing students who received traditional instruction without access to computers. Both groups had the same amount of total instructional time.
Researchers from Leicester University (Underwood, Cavendish, Dowling, Fogelman and Lawson, 1996) found that 8-13 age group students using mathematics software in an Integrated Learning System (ILS) at schools throughout the United Kingdom showed significant learning gains, compared to students not using the software. Those in primary schools performed significantly better in the areas of addition, subtraction, multiplication and extensions while those at the secondary level showed significant gains in the areas of operations and diagrams.

Stone (1996), comparing second grade students who had used several mathematics and reading software programs since kindergarten with students in a nearby school who did not use the software demonstrated that the students who had used the software scored significantly higher in mathematics problem-solving on a standardized test than those who did not use this software. Both schools followed the same Board of Education approved course of study.

Elliott and Hall (1997) found that the use of computer-based mathematics activities enhanced mathematical achievement among at risk four year old children placed into one of the three groups, two of which used computer-based mathematics software. Children in the third group participated in a range of typical discovery-oriented preschool mathematics activities off-computer, together with computer activities in other areas. Students in both groups that used computer-based math activities had significantly higher post-test scores on the Test of Early Mathematics Ability (TEMA-2).

Two unpublished studies by researchers at the Stevens Institute of Technology (Jurkat, Skov, Friedman, Pinkham and McGinley) demonstrated positive effects of commercially available high school mathematics software on retention (i.e., performance on a delayed post-test). In one study, each student received instruction for two geometry topics, one with supplemental software and one without. One group used software for the first topic and the other group used software for the second topic. For retention, student performance was significantly better when instruction included software. In the other study, two groups of students were compared. One received instruction that included supplemental software and the other group did not use software. Once again, the group using software demonstrated significantly better retention (70 per cent better) than the group that did not use the software.
Wheeler et al. (1999), exposed ninth graders enrolled in algebra classes with traditional instruction to one of three conditions: (1) a control group; (2) a Placebo condition, where students were given a computerized word problem environment without active tutoring; and (3) an experimental group that received a computerized word problem environment with native tutoring, found that students who received computerized tutoring system performed better both on abstract and concrete reasoning word problem tasks than their age-mates in the other two conditions. However, they did not do better than students given human tutoring as a supplement to traditional instruction. In addition, although the tutoring system was designed to increase the ability to solve problems of a more abstract and theoretical nature, the students actually showed more improvement on concrete test questions than on abstract ones. Because the students were not assigned to conditions randomly, may be the results are attributable to the pre-existing differences between the control and experimental groups; as the experimental group scored significantly higher on test problems even before the manipulation. Notwithstanding its limitations, the study provides limited support for the argument that the use of computer tutorial programs has the potential to help students with problem solving skills.

Rogers and Newton (2001), exploring the potentials of software for supporting investigative work in practical science with 13-14year old students, suggested that the software proved successful in promoting students’ abilities to collect and manipulate data.

Huppert et al. (2002) evaluated a software programme in Israel for its potential to enhance tenth-grade biology students’ understanding of the life processes of micro-organisms. Control students studied the same learning material in the classroom and the laboratory. It found that the Growth Curve of Micro-Organisms simulation programme makes its possible to perform ‘experiments’ in short time and to check the Influence of various factors such as the initial number of organisms in a Population, the temperature range and the nutrient concentration on the Growth Curve. It also gave opportunities to evolution of facial expressions and was used to teach the concepts of artificial selection, genotypes and mutations.
• **General Tools for Mathematics**

General tools for mathematics education include, for example, *dynamic geometry software, computer algebra systems, spreadsheets, and dynamic mathematics software*. Fuglestad (2005) defines such tools: [... as open and flexible software, not made for specific topic or limited to teach specific tasks [This kind of] computer software [...] makes it possible for the user to plan and decide what to do. Such tools can be used for a wide variety of problems and can provide learning situations to explore and experiment with mathematical connections, and provide new ways of approaching the task.

Although “[g]eneral tools allow students and teachers much more freedom to shape and modify how to use them” (Barzel, 2007, p.80), the introduction of a general tool for mathematics education requires more time and effort both from teachers and students than simply using the virtual manipulative.

*Computer algebra systems, dynamic geometry software, and spreadsheets* are the main types of educational software currently used for mathematics teaching and learning {Drijvers and Trouche, 2007; Fulestad, 2005).

- **Computer algebra systems (CAS)**

Since the late 1980s, researchers worldwide have consistently reported positive learning gains from classrooms that integrated CAS appropriately.

Keller and Russell (1997), in a large study involving hundreds of college students, showed that when teachers used CAS technology with an appropriate instructional emphasis (i.e., on making sense of mathematics in group discussions), students learned to reason about symbolic expressions. The students taught with CAS were more successful than students without CAS at three levels: *basic computation, more advanced computation and complex symbolic problems*. Similar findings were reported for upper secondary school students (aged 16-19) in Finland who were taught the *concept of derivative* with and without CAS (Repo, 1994). Research has also examined student motivation. When used effectively, CAS can make mathematics more interesting and meaningful to students.

Velchos and Kehagias (2000) In a study with Greek business students showed that students using CAS were more interested, participated actively and spent more time preparing for class than their non- using CAS counterparts.
Schmidt and Moldenhauer (2002), In a 3-year study of CAS with grade 11-12 students in Germany found a moderate enthusiasm for mathematics and overall positive attitude of CAS.

Kramarski, B. and C. Hirsch (2003), investigating the differential effects of Computer Algebra Systems (CAS) and self-regulated learning (SRL) on algebraic thinking and self-regulated skills, comparing CAS Learning with SRL (CAS + SRL), and CAS Learning without SRL, found that (CAS+SRL) students used more easily and correctly generalized letters (variables) and algebraic manipulations. Empirical results from the experimental and caste study designs revealed that (CAS+SRL) students outperformed (CAS) students on algebraic thinking and that (CAS+SRL) students regulated their learning more effectively.

-Dynamic Geometry Software (DGS)

“Dynamic Geometry Software (DGS)” [.....] is used as a generic term to describe a certain type of software which is predominantly used for the construction and analysis of tasks and problems in elementary geometry (StraBer, 2002). Pure DGS is operated mainly with the mouse by activating different geometric tools and applying them to the drawing paid or already existing objects. An examples of DGS is Cabri Geometry (Cabrilog SAS, 2007). In general, DGS provides three main features that usually cannot be found in CAS or spreadsheets: drag mode, customizable tools, and trace or locus of objects (Graumann et al., 1996, p.197). DGS usually provides the following basic mathematical objects: points, segments, lines, circles, vectors and conic sections.

-Dynamic Mathematics Software

Dixon (1996), found that students who used the GSP (dynamic instructional environment) had higher significant achievement scores on a test containing the concepts of reflection and rotation.

Groman (1996), studying the use of GSP in a Geometry Course for Secondary Education Mathematics Majors and offering three examples of how sketchpad is used, showed that students wanted to get their own copies of the GSP software. The use of GSP showed more positive reaction both from the students and the instructors in testing conjectures and constructions.
Lester (1996), investigating the effects of the GSP software on achievement of geometric knowledge of high school geometry students, indicated that the mean of post-test scores for the dependent variable (geometric conjectures) of the experimental group was significantly higher than that of the control group and also that the GSP provided intelligent capabilities for improving learning and teaching.

White and Norwich (1997), presenting nine exercises on using different technological tools – GSP one of them – in explaining Calculus Concepts, found that the GSP can be used in teaching some of Calculus Concepts such as: vertices of a triangle, midpoint, equation of a line, slope of a line, and the trigonometric identities of sine, cosine, and tangent functions.

Yousef (1997), investigating the effect of using the GSP on high school students’ attitudes towards geometry, indicated that the scores of the pre-test and post-test of the students in the experimental group were significantly different and that there were significant differences also between the control and experimental groups’ gain scores from the pre-test to the post-test.

Gerretson (1998), comparing the geometry performance of two groups of preservice elementary teachers enrolled in a mathematics methods course, both groups completed hands-on, experiential activities designed to help them develop a deeper understanding of the concept of similar geometric figures. The control group used manipulative and traditional tools such as a protractor and ruler, together with a mechanical device for drawing similar figures. The experimental group used Geometer’s sketchpad software, showed that students using the Software performed significantly better on a posttest measuring understanding of the concept of similarity and that the use of the GSP in teaching and learning mathematics is a useful and attractive program that can create a healthy atmosphere in the educational process.

-Problem Solving Software

Funkhouser in a longitudinal study (1990) on the effects of integrating the so called “Problem-solving software” into mathematics instruction on 2nd and 3rd year high school students, showed that not only did the students develop more positive attitudes about themselves as learners of mathematics and mathematics as a discipline but they
also demonstrated significant gains in problem-solving ability and mathematical content on standardized tests of mathematics.

In a similar study, of the influence of problem-solving computer software on the attitude of 40 high school mathematics students toward mathematics, enrolled either in geometry or second year algebra course in a public high school, Funkhouser (1993) showed that “Students who use problem solving software tend to develop a more positive view of their own mathematical abilities and a more positive disposition toward mathematics as a subject”

A rigorous schedule of computer-based and non-computer-based student’s activities was developed and the students were given the National Assessment of Education Progress (NAEP), and skills-based test of problem-solving ability developed by Mayer and Weinstein (1986).

-Hypermedia

Liu (1993) found that hypermedia software designed to permit exploration of the semantic networks can help international college and graduate students (non-native English speakers) in English Vocabulary development. A semantic network is the web of interrelated concepts that represents one’s depth of understanding of any given concept. For example, a semantic network for the concept, Lawyer could include trial, judge, defendant, jury, etc. Students who used the software demonstrated significant gains in vocabulary knowledge.

Brantmayer (1994), comparing the effectiveness of hypermedia to traditional lecture for graduate students studying safety and industrial hygiene, in retention to the topic of instruction noise and hearing conservation, found that the students who used the hypermedia program demonstrated significantly superior achievement on a test of hearing conservation concepts and principles. Dede (1994) too found that hypermedia tools offer new methods for structured discovery, address varied learning styles, motivate and empower students and allow educators to present information as a web of interconnections rather than a stream of facts.

Montazemi and Wang (1995), studying the impact of a hypermedia tutoring program that had been implemented to help students in a management information systems course preparing for weekly lab tests through questions and feedback, showed
that students who spent more time with the program generally did better on the lab tests and in the final examination. Comparison of final examination scores with scores for the previous year showed a significant gain from the 71.43 per cent previous year to 81.81 per cent using the tutoring system.

Liao, (1999), in a meta-analysis of 46 studies performed to synthesize existing research comparing the effects of hypermedia verse non-hypermedia instruction (e.g., CAI, text, traditional, videotape instruction) on students’ achievement, found that the effects of using hypermedia in instruction are positive over non-hypermedia instruction as a whole and that they also provide to classroom teachers an accumulated research-based evidence for using technology in instruction. Forty-six studies located from three sources, their quantitative data transformed into Effect Size (ES), and their overall grand mean of the study-weighted ES for all 46 studies 0.41 too suggested that hypermedia instruction is more effective when there is no instruction for the comparison group or when the comparison group uses videotape instruction. However, CAI and text instructions were found to be slightly more effective than hypermedia instruction. As a whole, the results of this analysis suggest that the effects of hypermedia instruction on students’ achievement are mixed, depending on what type of instruction it compares to. In addition, four of the seventeen variables selected for this study (i.e., instrumentation, type of research design, type of delivery system, and comparison group) had a statistically significant impact on the mean ES.

- **Computer Assisted Instruction (CAI)**

In general, CAI in the content areas offers small yet significant advantages to learning with computers over learning in more traditional ways.

Chang (2003), building on previous studies, compared the achievement of tenth-grade Taiwanese students who experienced teacher-directed CAI (TDCAI) with those who undertook student-directed CAI (SCCAI). Both groups used the multimedia CAI software, which was designed to allow users to navigate the various learning sections in a non-linear fashion. The TDCAI approach emphasized direct guidance from the teacher, while the SCCAI stressed student self-paced learning.
BECTA (2004), comparing the academic achievement of elementary students who received CAI as a supplement to the traditional program versus students who received traditional instruction only, showed better achievement among the CAI students.

Cepni, S., Tos, E., Kose, S. (2006) investigating the effects of a computer-assisted Instruction material (CAIM) related to “Photosynthesis” topic on students’ cognitive development, misconceptions and attitudes, found that using AIM and CAIM in teaching photosynthesis topic was very effective for students to reach comprehension and application levels to cognitive domains. The study conducted in 2002-2003 academic year was carried out in two different classes taught by the same teacher, in which there were fiftytwo 11th grade high school students in Central City of Trabzon in Turkey. An experimental research design including the photosynthesis achievement test (PAT), the photosynthesis concept test (PCT) and Science Attitude Scale (SAS) was applied at the beginning and at the end of the research as pre-test and post-test. After the treatment, general achievement in PAT increased by 10% in favour of the experimental group at (P<0.05) significant level. Although the treatment, general achievement in PAT increased in cognitive development at Knowledge Level was 14.8% in the EG and 18.2% in the control group (CG), the development at comprehension and application levels were 19.8-18.5 in the Experimental Group and 1.75-0.86 in the control group, respectively.

- Educational gaming

In general, the use of computer games in educational settings seems to have a positive effect on academic achievement (reading comprehension, algebra and decoding); on attitudes toward learning; and on self-concept in comparison to traditional instruction. Games offer immediate feedback, increase active learner participation, reinforce knowledge, and influence attitudinal changes.

Marty (1985) investigating the effect of games in the students’ attitude towards and achievement in mathematics, revealed the following findings: (1) a significant difference at the .08 level, in change of class means on mathematical achievement favoring use of the computer game, (2) very little difference (p = 0.38) in the change of class means on attitudes towards mathematics, and (3) a significant difference at the .005 level, in change of class means on graphing ability favoring the use of computer game.
The computer games Algebra Arcade was used with experimental class in lieu of the in-class assignment during the 15-20 minutes at the end of mathematics classes.

Kafai (1996) found that learning about technology and programming supports other type of learning. When students find the games meaningful to their lives, learning and learning about learning takes place. The idea of children making software for fun and learning is definitely not limited to school activities, it has a place at home and in the virtual playground. This activity leads children into thinking and learning in mathematical terms. Children also learn to express themselves in the technological domain by engaging in programming activities, like designing games for younger students to learn mathematics, Programming games are a medium for personal and creative expression.

Educational gaming favours the development of complex thinking skills and problem-solving, planning and self-regulated learning (Rosas et.al.2003). The power behind games is in the concentration of attention of the user to an environment that continuously reinforces knowledge, scaffolds learning, provides leveled, appropriate challenges, and provides content to the learning of content.

Bull et al. (2003) describe the innovative use of blogs for students’ journals, which can be shared with and commented on by other students, linked to outside sites and include photos and texts which can deepen or illustrate the ideas presented. Green and Hannon (2007) indicate that “with the advent of blogging and tools such as wikipedia, young people are just as likely to seek feedback from their peers and strangers as they are from teachers and parents. Schrum & Solomon (2007) describe ways in which blogs, Podcasts, Wikis and Photo-sharing can be used in K-12 classrooms, with the objective of providing difficult and challenging activities to entice and engage students.

- **Visualization**

During the last thirty years, mathematics as an activity has become more experimental and more visual. In line with this development, the computer is a unique tool that has the potential of enhancing both visual and experimental features. The visual medium is widely used as instructional resource as children can learn from viewing and interacting with video and television, viewing video once thought to be a passive process.
Video can add rich context to students’ learning experience without increasing load on working memory, translating into increase in complex and higher-order thinking.

A study by Ziegler (1990), examining the effectiveness of three different methods of introducing university students to the academic library: interactive video with learner control; linear video; and traditional guided tours, found that students who had used the learner-controlled interactive video scored significantly higher than other students on measures of recall learning and self-perceived effectiveness at using the library.

Woodruff and Heeler (1990), working on a unique application of interactive videodisc technology to administer aural tests to university students taking a music appreciation course, found that the students who took the aural tests received significantly higher grades on unit tests than other students. Two groups were given study guides that identified aural objectives and specified the location of the musical examples for study … (One group) was required to take aural tests over each unit in a supervised computer laboratory… The (other) group did not take (the tests). The testing followed a competency-based method developed by Keller (1968), which has proved successful in science education (Kulik, Kulik, and Carmichael, 1974).

Vitale and Romance (1992), examining the effectiveness of videodisc Instruction plus supplementary activities focusing on core science concepts with female elementary education majors found that the students who used the videodisc and participated in the supplementary activities demonstrated significantly higher achievement on a test of application of science concepts. One group of students received conventional science methods instruction. The other group followed the same syllabus but also received videodisc-based lessons, completed corresponding workbook activities and prepared and presented model science lessons.

Kitz and Thorpe (1992), comparing the effectiveness of videodisc-based algebra instruction to conventional instruction using a textbook with learning disabled adults preparing for college revealed that students using the videodisc significantly outscored the students using the textbook on two different tests of algebra achievement.

Johnson (1993) comparing the effects of three instructional approaches for teaching college-level lessons in human resource development; that is, conventional
lecture-demonstration; *interactive video with students handling the computer controls;* and *interactive video with the instructor handling the computer controls* found no significant achievement differences between students who directly controlled the computer and those who did not, though both videodisc approaches resulted in *significantly higher* levels of student achievement than conventional instruction in a test of initial learning and a delayed test to measure retention.

Bitter and Hatfield (1993), comparing the effects of two methods for teaching about the use of geoboards to elementary education majors, as part of mathematics methods courses revealed that while both groups showed achievement gains in knowledge of geoboards as an educational tool, students receiving *videodisc-based* instruction demonstrated *significantly higher* gains. Both approaches began with instructor-led lessons. For one group of students, this was followed by *videodisc-based instruction* and for the other group, the follow-up consisted of cooperative, hands-on experiences with geoboards and discussion of the application of geoboards to classroom teaching.

Viesulas (1994), comparing the impact of demonstrations of standard chemistry experiments via video and via live lecture presentation, showed that students who watched the *video demonstrations* received *significantly higher* grades on their lab reports as well as on the mid-term and final examination and that they also completed experiments in less time, with fewer equipment breakages. Video offers the advantages of allowing each student a closer view of the presentation, permitting replay of any segment as needed.

Cavanaugh (2001), in his synthesis of 19 experimental and quasi-experimental studies of the effectiveness of interactive distance education using video conferencing and telecommunications for K-12 academic achievement, found a small positive effect in favour of distance education and more positive effect sizes for interactive distance education programs that combine an individualized approach the traditional classroom instruction.

Boster, Meyer, Roberto & Inge (2002), examining the integration of standards-based *video clips* into lessons developed by classroom teachers found increase in student achievement in a study of more than 1,400 elementary and middle school students in three Virginia school districts, showing an average increase in learning by students
exposed to the video clip application compared to students who received traditional instruction alone.

Lehrer (1993), in a study of eighth graders using a hypertext/multimedia tool to design their own lessons about the American civil war, revealed that the scores of students using the multimedia tool did not differ from the scores of the control group on a test given at the completion of the lesson. However, when tested one year later by an independent interviewer, the multimedia group displayed elaborate concepts and ideas that they had extended to other areas of history. In contrast, the control group of students remembered almost nothing about the historical content of the civil war lesson. The results reveal that multimedia tends to have long term effects on understanding and retention.

A study of the use of multimedia in the mathematics classroom, conducted by Phillips and Pead (1993) found no such evidence and concluded that learning through the use of multimedia appeared to be a natural continuation of the evolution of ideas for teaching with computers that took place in the 1980's. While the study extended over 2 years and a free choice of software titles was used by teachers in 7 schools spread throughout England, only a small sample of teachers (14) was used, the researchers admitting that while the software materials used were diverse, they could not be said to represent all multimedia materials used in mathematics teaching. Therefore, they felt that some caution is needed in drawing the conclusions.

Bell and Bell (2003) identified over 200 published texts dealing with the use of ICT in science education from 1994 to 2002. From their search they concluded that teacher educators are unfamiliar with the literature that has been published because it is situated in journals that are not familiar to most science educators. If science teacher educators are unaware of the findings of research into ICT in science education and hence of the affordances of various types of ICT for learning science, there is little hope that many science teachers will be adequately knowledgeable about the value of ICT in their teaching.

Keys, Phillip and Watters, James. J (2006) in a study to determine if the beliefs of elementary pre-service teachers had been influenced by the provision of an interactive CD ROM of modeled case studies of teaching science through a grounded theory
approach using constant comparative analysis, revealed that the modeled practices by themselves made little impact on the pre-service teachers’ beliefs and practices. The twenty-four pre-service teachers in the study continued to use traditional teaching approaches in their lessons, at the same time, they espoused the concepts of constructivism. Therefore, as an outcome of this study, it provides a transformative learning model that uses multimedia and ICT as a strategy in bringing about conceptual change in pre-service teachers’ beliefs which has application and implications for professional development for in-service teachers, as well as.

- **Word-processor**

  Text-to-speech feedback in a *word-processor* or interactive story book can improve early reading (Olson and Wise, 1992; Lewin, 2000). Voice input and text feedback (Miles *et al*., 1998) can also improve pupils’ reading and writing. These studies also indicate the importance of matching the tasks on a computer to pupils’ current attainment.

  Moseley, D. *et al*. (1999) in their collaborative research project working with teachers to help them make more effective choices about when, when not and how to use ICT in their teaching of literacy and numeracy, found that software enabled teachers to show ideas dynamically – for example, when showing suffixes joining with root words. Pupils were *motivated* to read more and in doing so, extending their vocabulary using ICT texts such as word processors with speech facilities. While the project demonstrated that ICT can be part of raising attainment dramatically, the researchers stressed that these gains cannot be attributed to the use of ICT alone and must be taken in the wider context of learning and teaching. However, students writing development was accelerated and enhanced by *access to word processing* and there was an average improvement in literacy of 5.1, month by month. (U.K.).

  Bresse, C. *et al*. (1996), investigating the effects of unlimited *access to word processors* on students writing over a period of 20 months, found that students using word processors showed significant improvement over those using pen and paper. Each of the seven 22 year students was given a laptop to use for all their writings in English Lessons and the samples of their narrative writings were compared with the samples from a parallel class who only used hand writing methods.
Animated Graphics

Several studies found evidence for the benefits of animated graphics. Calvert, Watson, Brinkley and Penny (1990) experimented with different versions of a graphic "micro world" designed for young children's language development.

...a computer screen depicted a park scene that had a green grassy area, a blue lake, able sky, a black train track and a brown road. Twenty-four...objects...could appear by...typing...the word for the...object.

Szabo and Pochkay (1996) found that university students in a mathematics education class learned better from animated illustrations than from static graphics or text only description. On the post-test, which included a hands-on triangle construction problem and multiple choice questions, students who read text and viewed animated graphics showing how to construct a triangle using a compass performed better than students who read a text explanation only or students who read a text explanation accompanied by static graphic illustrations.

Smith (1996) reported that developmental mathematics students at a community college learned significantly more from an-hour animated software tutorial on matrix Algebra than from a static one. Animation was used mostly to highlight symbols, objects, and “Morphing of addition elements and multiplication factors into sums and products.” Students could stop or repeat animation or alter the variables from a menu. A third (control) group read for an hour from a commercial algebra text. Smith found that both the static-CAI and the animated-CAI students performed significantly better than the text group on the immediate post-test. Animation seems to have had a positive impact on content retention for students in this study.

The three Chang studies, using multimedia computer facilities, including guided inquiry, animated weather-satellite images, virtual field trips and internet usage sought to evaluate different pedagogical approaches. Chang (2000), the author investigated the comparative efficiency of computer-assisted instruction (CAI) and traditional teaching methods in Earth Science classes in Taiwan. The focus of learning was on knowledge (the recall or recognition of ideas or concepts), comprehension, and the students’ ability to apply acquired knowledge to a new situation. Guided inquiry provided by a computer
programme allowed tenth-grade students to work individually with a range of provided resources, video, animated weather maps, books, and so on in a virtual research office to prepare a research report on debris flow hazards following a typhoon.

Chang (2001a) formalized a problem-solving computer-assisted tutorial, involving *lecture-internet-discussion* teaching, with a focus of learning on the recall or recognition of ideas or concepts, comprehension and the students’ ability to apply acquired knowledge to a new situation. The software, included relevant data, a virtual field trip and animated weather maps provided guidance for interactive investigation. Students in the comparison group were given clear and detailed instruction and explanations by the teacher on the same topic and used the internet to control for ‘Computer-novelty effects’.

Othman, et.al. (2005) conducting a study to examine the effects of computer-animated instruction (CAnI) on a group of students’ conceptual change progress by teaching complex, *abstract and dynamic (CAD)* concepts of *electro-chemistry* at a matriculation centre in Malaysia showed that the CAnI approach was found to have a positive effect on their overall performance in electro-chemistry. and also on the students’ conceptual change progress and an effective alternative instructional method in the understanding of CAD concepts. This study used an experimental pre-test and post-test control group design and open-ended questionnaires to collect data and responses from the CAnI and the CLI groups respectively. 120 subjects, comprising 60 high and 60 low achiever students were randomly chosen from the total research populations of 250 students and subjects were randomly assigned to a CAnI or a CLI group. Data collected from the post-test were analysed to examine the statistical significance of differences amongst the CAnI and the CLI groups.

- **PowerPoint presentations**

  In recent years, the use of PowerPoint in the classroom has significantly increased globally (Connor & Wong, 2004; Bartsch & Cobern, 2003). Since, in a PowerPoint presentation, topics are presented in a hierarchical fashion with graphics, color and animation, students could “use a mental image of that outline to study, to retrieve the information on a test, to organize their answer for an essay question, and
to perform other educational tasks (Clark and Paivio, 1991, p. 176).” Rose (2001) also noted that presentation of learning materials in graphical form is beneficial for students. Hanna and Remington (1996) found that color, as a stimulus, is a part of memory representation or as imaginary.

Evan’s (1998), in a pilot study of 161 students taking a General Psychology Course, found that students performed better (roughly 4 percentage points) with PowerPoint presentations as opposed to lectures with overhead transparencies, and the liked PowerPoint better than transparencies. Lowry (1999), in a study of 390 students enrolled in three sections of an Environmental Science course, found an 8% point increase in the students in the PowerPoint cohorts. Lowry did not give the same test to all three sections, only in the same format of the test, The students preferred PowerPoint over transparencies.

The study of Bartsch and Cobern (2003) noted that students preferred PowerPoint over the use of TOHP, but that in some instances the content of the PowerPoint presentation distracted students and they performed less well on tests compared with a control group. Szabo and Hastings (2000) carried out an extensive study comparing PowerPoint and OHP and observed no difference in student performance in tests. The most important factor was lecture subject difficulty in determining the students’ performance in these tests. They concluded that the efficacy of using PowerPoint was case specific rather than universal.

More recently, Blokzijl and Naeff’s (2004) surveyed 69 Dutch students’ reactions to PowerPoint as a tool and to lectures using PowerPoint instead of overhead transparencies. These students preferred PowerPoint over transparencies and liked the slides with large font sizes, unity in layout, and easy-to-view color contrasts. Not surprisingly, these are the same features that teachers and authors emphasize when teaching effective PowerPoint presentations.

Nouri, H. and A. Shahid. 2005) conducted a study to test whether using PowerPoint in an accounting course enhanced student short-term memory, long-term memory, and attitudes toward class presentation and the instructor. An experiment was conducted which includes a treatment-control design, in a classroom setting throughout a semester. In one section of an accounting principles II (Managerial Accounting) course,
PowerPoint was used as the delivery system, while the second section was taught using the traditional delivery system. The results showed that Power-Point presentation may improve student attitudes towards the Instructor and class presentation. The results did not provide conclusive evidence that PowerPoint presentations improved short-term or long-term memory. The latter results are consistent with other media comparison studies that show the medium alone does not influence learning.

Apperson, Laws, and Scepansky (2006) showed that college students enrolled in classes in which the professors used PowerPoint with lectures reported more interest in the class, an easier time paying attention, and greater learning when compared to the same classes in which the same professors used only chalkboards.

Nouri, H. and A. Shahid (2008), conducted a study to explored whether providing lecture notes when PowerPoint is used for class presentation affected student performance and attitudes toward instructor. This study was conducted in a classroom setting throughout the semester. The experiment involved two sections of an Accounting Principles I course.

The results showed that students who did not receive PowerPoint lecture notes indicated that the instructor was more effective and efficient than students who received PowerPoint lecture notes. No differences were found between the two groups in evaluating the instructor on such attributes as preparedness, caring about students and feedback. The results further indicated that providing lecture notes did not appear to affect.

Nicole Amare, analyzed the performance and attitudes of technical writing students in PowerPoint-enhanced and in non-PowerPoint Lectures. Four classes of upper-level undergraduates (n = 84) at a mid-sized, Southern University taking a one-semester technical writing course were surveyed at the beginning and end of the course about their perceptions of PowerPoint. Of the four sections, two classes were instructed using traditional lecture materials (teacher at podium, chalkboard, handouts); the other two sections were instructed with PowerPoint presentations. All four classes were given the same pre- and post-test to measure performance over the course of the semester. Traditional lecture or PowerPoint presentations consisted of at
least 50% of the course, with the remaining time spent on exercises and small group work. Results revealed that while most students preferred PowerPoint, performance scores were higher in the sections with the traditional lecture format.

2.2 STUDIES IN INDIA

Mohanty et al. (1976) studied the Multimedia Package prepared for the in-service training of rural primary teachers in the teaching of science. Their findings regarding video programmes were positive for message communication, but dubbing of programmes was not appreciated. Radio broadcasts were generally appreciated.

Bhat, V.D (1982) developed software material to study the effectiveness of simulation as an experimental instructional input and its interaction with the basic mode of presentation, a matched groups 2 x 2 factorial design was chosen. The presence or absence of simulation and self-instruction or teacher based instruction formed the two factors at two levels. One hundred and eighty-six trainees at B.Ed. level of the M.S. University of Baroda were divided into four groups. Instructional materials were developed for three units of educational psychology. The components of the strategies were simulation, programmed learning material (PLM), structured lecture, library reading, discussion, and assignment. The experiment was conducted for the duration of one semester. The tools used for study of effectiveness of the programme were criterion achievement test, an attitude scale on the role of the teachers in solving the problems of the children, and a risk-taking behaviour scale prepared by the investigator. Further, Govind's (1975) Reading Comprehension Scale and Bale's (1970) Interaction Process Analysis Scale were used. The F-test and t-test were used for arriving at conclusions. The findings revealed that Simulation combined with PLM led to a significantly superior performance by the trainees as compared to those who were taught through simulation combined with structured lecture.

Mahajan (1994) studied the effectiveness of computer instruction for teaching singular and plural at grade 2, and found that CAI more effective than the traditional method.

Joshi and Mahapatra (1995), in a study relating to effectiveness of computer software found that students taught through software package significantly did better than those taught through conventional method.
Bhangoo and Sidhu (1997), studied the impact of selected audio-visual aids on food hygiene knowledge of secondary school students. They found that students of experimental group taught through visual materials performed better than those of the controlled group.

Enigo (1997), comparing the effectiveness of instructor controlled video with conventional non-interactive video and lecture method in modifying the cognitive behaviour among farmers found that instructor controlled interactive video, irrespective of the difficulty level of the content area contained in instructor controlled interactive video.

Rangaraj (1997), in a study on the effectiveness of computer assisted instruction in teaching Physics found that CAI as Support System (CATSS) was much better than CAI as individualized instruction. Retention also was higher when taught through CATSS.

Anshuman Das (1998) conducted a research 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 LSRWability. 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. The investigator used two tools for the study, namely, the treatment tool and the 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. ANCOVA was used considering English Language class achievement test scores as covariate. The findings of the Study revealed that composite modes of presentation may not ensure higher cognitive Language learning.

Neera (1998) comparing effectiveness of Video Teaching Learning Material (VTLM), Video Aided Instruction (VAI) and Conventional Teaching (CT) found students most favourably disposed towards VTLM. Retention with VTLM and VAI was more effective than CT. Students exposed to VAT retained more than that through conventional approach. Students exposed to VTLM and VAI were significantly different in their achievement.
Anjali Khirwadkar (1999) investigated the effectiveness of the developed software in terms of instructional time and achievement of students. One of the English medium schools of Baroda City was taken for implementing the developed software. One section of Standard XI Science was taken and thirty students were selected randomly as sample for the experimental group and rest of the student’s of the section constituted the control group. The software developed by the investigator was used as treatment tool. Achievement test constructed by the investigator was used as a testing tool. The developed software package was found to be effective in terms of academic achievement of the students. The students and teachers were found to have favourable opinion towards the software package. An interaction effect of IQ, motivation and opinion of students on their academic achievement was also found to exist there.

Meera, S. (2000), in a study to find out whether there is any significant difference between the Conventional Lecture Method and the Computer Assisted Instruction (CAI) as an individualized Instructional strategy in terms of their effectiveness in realizing the instructional objectives in Biology at Class XI. On a sample of four groups each having 35 students selected through probability sampling method and using tools technique such as Cattell’s 16 P.F inventory for students, CRT developed by Raymond B and Achievement test revealed that the use of different modes of Computer based Instruction viz. Drill, Practice and Simulation was more effective than conventional lecture method in realising the instructional objectives in Biology at Class XI as well as in enhancing the retention of cognition of what have already learnt as revealed by the learner’s performance in the retention test.

Natesan, N. (2001), compared the effectiveness of teaching concepts in mathematics through video-cassette with that of traditional method Experimental method (equivalent group design) was adopted for the study. The sample taken was 45 boys and 45 girls, using probability sampling for the study. Findings of the study revealed that the increased level of academic achievement of experimental group was due to the teaching of Mathematical concept through video-cassette.

Beena Y. Desai (2004), developed a multimedia package for teaching the subject of nutrition (Protein) to the undergraduate level students of Home Science to find out the effectiveness of the multimedia package in terms of achievement of the students. The
sample of the study comprised of 98 students of B.A. first year home science (2001-2002) of Smt. J.P. Shroff Arts College, Valsad. The mean achievement of the experimental group was found significantly higher than that of the control group. The study found relative efficacy of teaching through the traditional method and the multimedia approach in the subject of Home Science, particularly, Proteins.

Irfan Shah (2005) conducted a research to study the ICT awareness of secondary and higher secondary teachers, to study the ICT use of secondary and higher secondary teachers, to study the ICT need of secondary and higher secondary teachers, and to study the variables related with the ICT awareness, use and need of secondary and higher secondary teachers. A scale was constructed to collect the data regarding ICT awareness, use and need of a teacher with respect to different components of ICT, like, computer, Internet, OHP, LCD Projector, Radio, TV. 12 secondary and 10 higher secondary schools were selected using stratified random sampling technique. Further 60 secondary and 50 higher secondary teachers were selected @ 5 teachers from each selected school. Data were analyzed using frequency, percentage, mean, SD, SE of mean, ‘t’ value and ANOVA wherever necessary. There was found a low degree of ICT awareness, use and need of secondary and higher secondary teachers. The variables related to ICT awareness of teachers were teaching experience, age and total salary. The variables related with the ICT use of teachers were total salary and computer training. The variable related with the ICT need of teachers was the Degree Program which they attended at the University level.

Subbaiah, S. (2005) investigated the application of information and Communication technology in teacher education with reference to certain selected variables and to identify the information and communication technology needs, knowledge and skills among the teacher educators The sample was taken 29 District Institutes of Education and Training from Tamil Nadu, 71 English teacher educators and 200 teacher trainees, using probability sampling method for the study. Questionnaire, Attitude scale, Interviews, Diary analysis were used as data collection tools. It revealed that the focus of computer equipment problem had both quantity problem (not enough computers) as well as quality problem.
Shankar, S. P. and J. Subasri (2006), analyzed accessibility of PowerPoint presentations among the high and higher secondary school teachers in classroom teaching in selected schools of Pondicherry state. The total sample size of the study was 80 teachers, with different age groups, gender, educational qualifications, specializations, computer knowledge and viability area and school. The study was done at random in selected government and private schools in Pondicherry state. For data collection, a questionnaire was provided to all respondents. Findings of the study revealed high significant relationship between the fundamental knowledge of computers among the teachers and PowerPoint accessibility in classroom teaching. The level of adaptability towards PowerPoint utility in classroom teaching was found to be more with the science teachers when compared to that of the teachers teaching Arts subjects. There was no significant difference between the high school and higher secondary school teachers in using the PowerPoint presentations in classroom teaching.

Kumar Rajender, (2007) attempting to find out the best instructional method out of three, i.e., Conventional Instructional System (CIS), Audio-Video Instructional System (AVIS) and Multimedia Instructional System (MIS) for teaching Information Technology at the secondary level, on a sample of 120 students randomly selected from three CBSE affiliated schools, and were assigned to three groups on the basis of their scores in Intelligence test and taught through three different methods. found that MIS is the best method, AVIS the second best and CIS the third best method for teaching Information Technology at secondary level.

Mehra Vandana (2007) in a study to determine the attitudes of school teachers towards use of computer technology for instructional purposes on a sample of 200 government senior secondary school teachers of Chandigarh revealed that teachers possessed fairly positive attitude towards computers uses but majority of teachers needs to be provided training for using computers in instructional settings.

Anjali Khirwadkar (2008) exploring the relevancy of ICT in education with a special focus on teachers’ training Multimedia Package for laboratory method in teaching of chemistry at pre-service level developed by the researcher and tried on sample of 18 B.Ed. students of the year 2005-06 batch offering teaching of chemistry as a method,
revealed effectiveness of the developed multimedia package in learning the concept of management of chemistry laboratory over the conventional approach.

Raja Roa, S.(2008) in a study to find out the access of media infrastructure at home of the distance learners and awareness of media support services and infrastructures at the study centers of Dr. B.R.Ambedkar Open University from two districts of Andhra Pradesh selected for collection of data and on a. The sample size of 343 learners selected from the study centers of two districts revealed that television, radio and tape recorder were widely available with majority of the respondents at their home; while computer-mail and video-cassette player were not widely available with the respondents. In response to awareness, half of them told that they were aware of television lessons; 37% felt that they were aware of radio lessons; and the rest said that teleconference, video lessons and audio lessons were part of the media support service.