CHAPTER II

2.1 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 & Kahn).

The phrase ‘Review of Related Literature’ comprised of two different words, which are, Review and Literature. The term ‘Review’ means to “Re-Look” or to look again or to collect the knowledge of particular area of research in a systematic way, to involve a collection of knowledge to show that the study would be an addition of knowledge to the field. The term “Literature” refers to the knowledge of a particular field of study of a stream which includes theory, practical and its research 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 gone through by the investigator.

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.
2.2 Studies Done Abroad

**Taleb and Hassanzadeh (2015)** in their research paper titled, “Toward Smart School: A Comparison between Smart School and Traditional School for Mathematics Learning, found the quality of nation’s political, social and economic future will depend on the capabilities of their young generation. Smart schools have been proposed as a solution to increase the capabilities of the new generation in the era of ICT. Recently, many smart schools have been established in Iran and other developing countries. The aim of this study is to compare smart training method and traditional training method in learning-retention processes of Mathematics. Among 9724 grade 3 students in Yazd, 60 students were selected from a traditional school by using cluster random sampling method. They randomized into two equal classes. After getting a pre-exam, the multiplying section of grade 3 Mathematics was presented in six sessions every week by using the researcher-made multimedia software in smart class and traditionally in other class. The learning score was assessed at the end of every session, while the retention score was assessed two weeks after each session. Independent-samples T test was used to compare learning and retention scores between two groups and paired-samples T test to compare retention and learning scores in each group. The mean learning score is significantly higher in the smart training group (19.33+0.9 vs. 17.66+0.68; P<0.001) than traditional group. Also, the mean retention score is significantly higher in the smart training group (18.57+1.91 vs. 16.65+1.95; P<0.001) than traditional group. We propose that developing and using appropriate educational technology could enhance Mathematics learning and retention in primary schools”.

**Taleb et. al. (2015)** in their research paper titled, “the effect of m-learning on mathematics learning, found that mobile technology opens the door for next generation and let the learning occurs in anytime, anywhere and to be influence in a variety of learning contexts. The study was conducted in 329 teachers from 2352 secondary school teachers of Mathematics from 19 districts of Tehran using descriptive-field method during 2012-2013 academic years. A researcher-made Likhert-type questionnaire was developed to identify the teachers’ viewpoint of the effect of m-learning in different aspects of Mathematics learning. Twenty six questions measured the effect of different
functional capabilities of mobile technology on increased motivation of learning Mathematics. Thirty seven questions measured the effect of different aspects of mobile learning on diversity of training methods of learning Mathematics. Thirty one questions measured the effect of different functional capabilities of mobile learning on students’ participation in learning Mathematics. The reliability of the questionnaire using Chronbach’s Alpha was 92%. One sample T test was used to examine significance of difference among the variables supporting the effect of M-leaning on different aspects of Mathematics learning. ANOVA was used to examine the effect of teachers’ educational level and teaching experience on the effect of M-leaning on Mathematics learning. The results revealed that in teachers’ viewpoint, mobile learning has a positive effect on motivating the students towards Mathematics. Also there is a positive and significant relation between using mobile learning and students’ participation in Mathematics. Moreover, the relation between mobile learning and diversity of training methods of teachers is positive and significant. The findings of this survey show that teachers of Mathematics are interested in using the mobile technology in Mathematics learning. In their view this technology could increase students’ motivation and participation in Mathematics learning and provide the opportunity of diversity of training methods of Mathematics”.

**Khamis and Wafa (2014)** in their research paper titled, “The Effect of Using Smart Board on Mathematics Achievement and Retention of Seventh Grade Students investigated, the effect of using smart board on mathematics achievement and retention of seventh grade students. To achieve this purpose a study sample of (103) students was selected from the seventh grade. This sample was divided into two groups. One group was randomly chosen to be the experimental group that studied mathematics using smart board; the other was the control group that studied mathematics using traditional method and board. The instrument of the study was an achievement test which was used to measure mathematics achievement and retention of the students. Data analysis procedures using T-test for independent samples revealed a positive effect of using smart board on students’ achievement and retention in mathematics”.

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Ali et. al. (2013) in their research paper titled, “The Role of ICT to Make Teaching-Learning Effective in Higher Institutions of Learning in Uganda found that the use of ICT in teaching-learning process is a relatively new phenomenon and it has been the educational researchers' focus. The effective integration of this technology into classroom practices poses a challenge to teachers and administrators. This empirical study aimed at finding out the factors influencing use of ICT to make teaching learning effective in higher institutions of learning in Uganda and identifying the innovations that ICT has brought into teaching-learning process, particularly in higher institutions of learning in Uganda. A survey was employed and in order to empirically investigate the study. The findings of this study revealed that teaching staff and administrators had a strong desire to integrate ICT into teaching-learning processes. The innovations that ICT has brought in teaching learning process include: E-learning, e-communication, quick access to information, online student registration, online advertisement, reduced burden of keeping hardcopy, networking with resourceful persons, etc. However, the presence of all these factors increased the chance of excellent integration of ICT in teaching-learning process. Therefore, the training of teaching staff in the pedagogical issues and administrators in administration should be increased if teachers and administrators are to be convinced of the value of using ICT in their teaching-learning process and administration”.

Amare (2011) analysed, “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, and 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.”
Hui Ling Xu, Robyn Moloney (2011) in their paper reported, “A case study undertaken in the university’s undergraduate Chinese beginner course, which began to use IWB learning activities in 2009. Their study was undertaken to obtain students’ perceptions of the IWB pedagogy in Chinese language acquisition in general and in particular, of the effectiveness of IWB in the retention of Chinese characters. To many students whose first language was non-logographic, the recognition and retention of characters were the most difficult tasks in learning Chinese. Their findings indicated that the IWB’s affordance to create a variety of visual activities had impacted, most saliently, the retention of characters and syntactical elements. Students also reported that the IWB had enhanced the learning experience, reflected in increased motivation and engagement through interaction with this technology. The tertiary students revealed particular learning priorities, in appreciating interaction, intellectual demand and participation, as components of effective learning. The feedback process itself proved to be useful in facilitating critical awareness in both teacher and students, of teaching strategies and learning respectively.”

Akbas and Pectas (2011) studied, “The effects of using an interactive whiteboard on the academic achievement of university students The aim of this study was to identify the effects of the use of an interactive whiteboard on the academic achievement of university students on the topic of electricity in a science and technology laboratory class. The study was designed as a pretest/posttest control group experimental study. Mean, standard deviation and t- tests were used for data analysis. An independent group’s t-test was used to test for the differences between the pretest and posttest mean of experimental and control group. No significant difference was observed between the academic achievement of the students in the experimental group, who were taught with both interactive whiteboard and laboratory practices, and the control students, who experienced only laboratory practices. The posttest standard deviation values in the experimental group were relatively lower than those in the control group. The electric motor, electric bell, and generation of the induction current models were prepared on the computer by the researchers using Macromedia Flash 8, and its application was undertaken by the students
on the interactive whiteboard (smart board). It was seen that although interactive whiteboard use might not significantly alter students’ academic achievement, it encouraged them to participate more in the lesson, created an interesting and enthusiastic atmosphere, and led to more enjoyable lessons. At the same time, many students from the experimental group stated that the interactive simulations and virtual experiments were superior to real experiments and enabled them to better visualize the topic.”

Manny-Ikan et al. (2011) studied, “An educational organization that worked in 60 countries across the world, established a pilot project whereby smart classrooms were installed for use in six middle and senior high schools in Israel. In this project, each school received 10 Interactive White Boards (IWBs) (25% of the total number of classrooms in the school), 32 laptops, internet connection, communication software and teacher training. Formative evaluation accompanied the pilot project for two years in order to examine the effects of integrating technology into instruction on teachers, students, and the school community. The findings indicated the following: a) student motivation and engagement in the learning process increased when studying with the IWB; b) teachers reported on their professional development and enhanced technology skills. The findings also showed that the integration of technology into instruction posed some difficulties and challenges, such as a sense of over-burdening among teachers. The main conclusions were the following: a) there is a need to focus on the pedagogical training of the teachers, with an emphasis on the ways that technology can assist interactive teaching; b) in order to help relieve the over-burdening of teachers, a database of instructional tools should be established providing suggestions for lesson plans and instructional materials; c) accessibility to the technology should be extended to more teachers and students by adding smart classrooms to every school in the project.”

Sendil et al. (2010) conducted a research, “to determine the attitudes of the pre-service teachers from the department of elementary education towards the effects of use of teaching materials; overhead projector and projector; on learning. The study was carried out with 184 senior pre-service teachers, 32 of whom are from the department of science teaching, 70 are from the department of classroom teaching, 46 are from the department
of pre-school teaching and 36 are from the department of social studies teaching. The data obtained from the questionnaire used in the study were analyzed through SPSS program package. Independent t-test was used to test whether there is a significant correlation between the pre-service teachers’ responses and gender and their background. In addition, One-Way ANOVA was used to test whether there is a significant correlation between student teacher’ responses and their departments and some differences are detected with regards to the effects of using overhead projector and projector on learning. According to the findings of the study, the students were found to believe that the use of overhead projector and projector brought some kind of change and variety to the teaching, saved teaching from being monotonous, and contributed to establishing lively, colorful and smooth setting for teaching and learning.”

Emron & Dhindsa (2010) in their study described, “the findings of an experimental research project that deals with the integration of interactive whiteboard technology in science teaching to improve students’ learning outcomes, gender gap in learning outcomes and the implementation of the findings in Brunei schools. The first stage of the project was designed to investigate whether or not the integration of interactive whiteboard technology in the Brunei classroom would improve students’ learning outcomes and minimize gender gap in learning outcomes, given that teaching and learning is a cultural activity. During this impact study, the mean gain in achievement score of an experimental group taught secondary science content using interactive whiteboard technology in a constructivist learning environment was significantly higher compared to that of a control group taught using the traditional approach. The learning outcomes were compared in terms of students’ academic achievement. Moreover, non-significant and significant gender differences in mean scores for experimental and control groups respectively were observed. These results suggested that the integration of interactive whiteboard technology in Brunei schools can gainfully improve science students’ achievement and minimize gender gap in achievement to overcome the national problem experienced in Brunei. The implementation of these results on a large scale in schools required the training of teachers and making the interactive whiteboards available in classrooms. The perceptions of those teachers who have undergone training lend
further support towards the suitability of the interactive whiteboard technology for teaching science. The finding of the experimental research and teacher perception of training can guide decisions of teacher trainers and ministry of education uses this technology in teaching science.”

Peter and Karen (2010) studied, “the Effects of Interactive Whiteboards (IWBs) on Student Performance and Learning: A Literature Review. Many K-12 and higher-education schools in both the United States and the United Kingdom have made a substantial investment in interactive whiteboard technology. Interactive whiteboards (IWBs) are generally perceived by students and teachers as a positive addition to the classroom learning environment. While there is support for links between IWBs and increases in student motivation, questions remain about the relationship between IWBs, student learning, and achievement. In this study a literature review was conducted to better understand the research to date in this area. Several common themes surfaced including the effect of IWBs on pedagogy, motivation, interaction, perception, learning, and achievement. In addition, the research suggests that these effects are related to contextual factors such as teacher training, teacher confidence, school culture, technical support, and lesson preparation and practice time. An IWB framework is suggested and directions for future research are also discussed.”

Ong et al. (2010) in their paper reported, “The relative effect of Smart and Mainstream schooling on student’s attitudes towards science which was measured using ATSSA (M) -- the Malay version of the German’s (1988) Attitudes towards Science in School Assessment (ATSSA) instrument. The participants comprised 775 Form 3 (15-year-old) students from two Smart Schools and two Mainstream Schools. Using student’s Standardised National Examination (SNE) primary-school science achievement results as covariate, the attitudinal data collected were analysed using analysis of covariance (ANCOVA). The results indicated that the level of attitudes towards science of Form 3 students who had participated in the Smart Schools is statistically significantly higher than the level of attitudes towards science of Form 3 students who had participated in the Mainstream Schools. A ‘statistical triangulation’ was provided by performing two further
analyses, namely (i) ANCOVA by school and (ii) like-for-like comparison through independent t-tests for each entry grade of students, so as to make a convincing case that the main result from the ANCOVA by group was truly the outcome of differences between Smart and Mainstream schooling. The paper discusses the findings in terms of parallel impact comparison within the available literature and recommends that future studies should look into isolating specific elements of the Smart Schools Initiative that have direct impact on student’s attitudes towards science.”

Young (2008) conducted his study, “to determine the effect that computer technology use in the classroom had on students' grades, motivation, attitude and attendance. Teacher/student technology surveys were used to measure teacher use, student use, and overall use of technology in the classroom. The sample for this study consisted of teachers from the Kaiserslautern School District. Results of the study indicated that teachers' technology use, students' technology use, and overall technology use depended on how well the teacher used the technology in the classroom. For the most part, the use of technology was motivating for the students, but it had no significant positive effect on their grades and/or attendance, including at risk students. In addition, the study found that the continued use of technology was low among the teachers in the sample. These results suggest that for technology to be effective and make changes in students' grades, motivation, attitude, and attendance, schools must be prepared for technology use in the classroom. Leaders must develop a model of implementation that includes a shared vision among teachers and leaders and includes entire school community involvement. They must also offer consistent and specific training for staff, time during the school day for the training, a full-time technology director, and time for the staff to communicate and share with peers for technology to be an effective tool in the classroom curriculum. The case study teachers demonstrated contrasting approaches to designing and supporting activity in which pupils shared, evaluated and developed ideas using the IWB. Pupil manipulation of objects on the IWB was deemed desirable but along with pedagogical interactivity was constrained by systemic school and subject cultures,
curricular and assessment frameworks. Observed and potential opportunities for active cognitive and social participation are outlined.”

Slay (2008) in his article found, “extensive investment by governments and individual schools in interactive whiteboard technology in developed countries premised on the assumption that their use in education will impact positively on learners’ achievements. Developing countries, such as South Africa, keen to raise attainment among their learners are following suit. While at least one of the nine provinces in South Africa had undertaken pilot roll-outs of interactive whiteboards (IWBs) in schools, the Eastern Cape Department of Education commissioned a feasibility study to determine teachers and learners perceptions of the potential benefits and drawbacks of using interactive pen technology, specifically the e-Beam, in their teaching and learning environments, before embarking upon a large scale roll-out. This paper reports on a case study of three government schools and highlights the learners and teachers’ enthusiasm about the big screen and the multimedia options, but also raises concerns about the lack of ICT literacy displayed by teachers and learners and the cost of technology. As most of the benefits mentioned by the teachers and learners seemed to accrue to the use of the laptop and data projector combination and most of the drawbacks emanated from the use of the interactive pen technology itself, we suggest that it may not be expeditious to attempt to leap-frog the use of interactive technologies. Instead they suggested that an evolution of ICT related pedagogy is necessary to make optimal use of interactive pen technologies such as the e-Beam and that teachers should be offered technologies, not to have imposed upon them.”

Alodiedat and Eyadat (2008) conducted a study on “Effect of intranet use on Students’ Achievement and Self-Confidence. The major objectives of the study were (i) to study the effect of the intranet on students’ achievement and self-confidence. (ii) Are there any significant differences between the control group and experiment group in regard to achievement and self-confidence? The study found that experiment group used the
intranet and internet more often than the traditional group. Students in the control group and the experimental group had a positive, high level of confidence in all items. Also, the study found that there was no significant difference in achievement based on the number of hours spent using the intranet and internet; also, there is no significant difference in self-confidence or achievement between male and female students in the control group. In addition, the study found a weak correlation between self-confidence and achievement.”

Morgan (2008) in his study examined, “The impact of interactive whiteboard use on student engagement and appropriate at-task behaviors of junior high school students. Two hundred twenty-six students at two public schools in northeast Florida were observed during the second quarter of the school year. Data were collected using an at-task checklist, and students completed an attitude survey regarding their perception of their own engagement and enjoyment with interactive whiteboard use. Significant differences were noted in student behavior between instruction without interactive whiteboard use and instruction with interactive whiteboard use. No significant correlations were found between the variables gender and ethnicity and improved student behavior. Results indicate that use of the interactive whiteboard as an instructional tool has a beneficial effect on student engagement in classroom lessons and leads to improved student behavior. Suggestions for further research are incorporated as part of the study results.”

Nouri and Shahid (2008) conducted a study to explore, “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.”
Hennessy (2007) in his study aimed, “to extend the currently limited understanding of how pedagogy is developing in response to the influx of interactive whiteboards (IWBs) in schools in the UK and some other countries. A case study approach was employed to investigate how experienced classroom practitioners are beginning to harness the functionality of this technology to support learning in science. The methods included focus group interviews with four secondary science departments, plus lesson observations and interviews with two teachers and their pupils. He analysed the data from a socio-cultural perspective on learning, focusing on the strategies that teachers used to exploit the dynamic, manipulable objects of joint reference and annotative tools afforded by the technology to foster the cognitive, social and physical participation of learners in whole class activity.”

Tuncay Sevindik (2007) in his research titled, “Future’s learning environments in health education: The effects of smart classrooms on the academic achievements of the students at health college. The purpose of this research was to determine the effectiveness of smart classrooms on the academic achievement of the nursing students. The sample of the research included 66 Health College students in Elazığ. The sample was randomly chosen from second year students of Nursing and Midwife Education. The research was carried out using experimental method. The experimental group included nursing students and the control group, midwife students. Pre-test and post-test including questions regarding internal diseases course were applied to both groups. t-Test, percentage and frequency were used as statistical procedures for data analysis. The findings showed that lectures given through smart classroom significantly increases the academic achievements of the students. It is, therefore, reasonable to state that smart classroom applications are effective environments that can be used as an alternative and a supplement to face to face educational environments in the institutions where health education is given.”
**Glover et al. (2007)** in their study, “Considerable investment in the use of interactive whiteboard technology in schools in the UK. There was evidence that whilst teachers understand such technology, many do not understand the nature and implications of interactive learning. Observation and analysis of 50 video-recorded lessons taught by ‘successful’ teachers drawn from mathematics and modern foreign language departments in secondary schools led to the classification of three types of practice representing a spectrum of increasing interactivity. The nature of this good practice was analysed together with criteria for assessing the changes being wrought by technology in approaches to learning and teaching. The investigation concluded that the use of new technology alone cannot lead to enhanced learning. Teachers also need training to develop awareness of the relationship between approaches to interactive learning and conceptual and cognitive development in subject areas”.

**Higgins et al. (2007)** in their article reviewed, “the literature on interactive whiteboards. The aims of this article was to review the existing literature on the introduction and use of interactive whiteboards (IWBs) in schools and to summarise the key issues arising from this analysis in order to provide a context for the articles which follow in this special issue of Learning, Media and Technology. The article reviewed the evidence about the initial adoption of the technology in classrooms, the existing empirical evidence of its impact on teaching and learning in schools as well as presenting an analysis of some of the underlying theoretical and conceptual issues.”

**Cepni et. al. (2006)** in their research, “investigated 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 fifty two 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”.

Ololube (2006) in his research tried, “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)”.

Ngah, et al. (2006) in their identified, “the ICT-skills required by teachers with the final aim of creating learning objects to be made available online in Malaysia found, 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.”

Apperson et al. (2006) showed that, “the 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”. 
Chem et al. (2006) in their study investigated, “the 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”.

Nouri and 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”.

Armstrong (2005) in his research paper discussed, “the results of a research project which aimed to capture, analyse and communicate the complex interactions between students, teachers and technology that occur in the classroom. Teachers and researchers used an innovative research design developed through the Inter-Active Education Project (Sutherland et al., 2003). Video case studies were carried out in four classrooms, focusing on the use of interactive whiteboard technology for teaching and learning. The case studies were analyzed using Studio Code, an analytic tool which allows researchers to
mark and code segments of video data into categories and themes. Teachers developed coding systems drawing on the learning aims and objectives of their particular lessons. The case studies illustrate that the introduction of interactive whiteboards (IWBs) into the classroom involves much more than the physical installation of the board and software. Teachers are the critical agents in mediating the software, the integration of the software into the subject aims of the lesson and appropriate use of the IWB to promote quality interactions and interactivity”.

Othman et al. (2005) conducted a study, “to examine the effects of computer-animated instruction (CAInI) 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 CAInI 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 CAInI 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 CAInI or a CLI group. Data collected from the post-test were analysed to examine the statistical significance of differences amongst the CAInI and the CLI groups.”

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”.

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Valentine et al. (2005) found that, “the 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”.

Baurer and Kenton (2005) conducted 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 and 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) conducted 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.”

**Blokzij and Naeff’s (2004)** in their survey research “surveyed 69 Dutch students’ reactions to PowerPoint as a tool and to lecture 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”.

**Passey et al. (2004)** The most significant research study on, “the motivational effect of ICT on pupils aiming to identify and, where possible, to quantify impact and to relate it to aspects such as learning outcomes, behaviour, school attendance, truancy, anti-social 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”.

**Beauchamp et al. (2004)** in their research studied, “the growing use of the interactive whiteboard (IWB) in primary school teaching formed part of a number of initiatives within the schools of the United Kingdom to develop the use of information and communications technology (ICT) in teaching and learning. The IWB presented both challenges and opportunities to teachers, particularly in terms of staff development and training. This study used classroom observation and semi-structured interviews with teachers now working in a recently built, technology-rich primary school to develop a generic progressive framework and developmental model for schools introducing the IWB. This framework could be used to assess and guide teacher progress on the continuum towards becoming a synergistic user. As teachers made this transition there was a fundamental requirement to adopt an interactive teaching style, alongside the gradual development of specific ICT skills? The study also examined implications for teacher education and training for schools, both prior and subsequent to the introduction of the IWB into classroom use. These included specific technical and pedagogical competencies which needed to be addressed for effective interactive use of the IWB in classroom teaching”.

**BECTA (2004)** in his research compared, “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”.

**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”. 
Goldberg, et al. (2003) in their systematic review found that “on an 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-analysis 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) in their study 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”.

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Passey, et al. (2003) in their study established 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”.

Allan et al. (2003) reported, “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 and Hennessy (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 different 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.”

Bartsch and Cobern (2003) in their research 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”.

McFarlane and Sakellaron (2002) investigated, “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”. 


**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 microorganisms. 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 it 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.

**Goodison (2002)** conducted a research on, “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”.

**Chang (2001)** in his research 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”.

**Hennessy et al. (2001)** in their PIGMI (Portable Information Technologies for supporting Graphical Mathematics Investigations) Project investigated, “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”.

Higgins & Moseley (2001) in their research studied, “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 was 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 (PSPs) 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”.

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**BECTA (2000)** in its research studied, “the relationship of ICT resources and student’s achievement 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 STED inspection results for the 2,500 primary school inspected in the year 1998-99”.

**Szabo and Hastings (2000)** in their study 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”.

**Chang (2000)** in his research studied, “multimedia computer facilities, including guided inquiry, animated weather-satellite images, virtual field trips and internet usage sought to evaluate different pedagogical approaches and 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”.
**Wheeler et al. (1999)** in their research study, “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”.

**Lowry (1999)** in his research studied, “three hundred ninety 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”.

**Moseley 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”.

Evan’s (1998) in a pilot study, “collected data from 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 they liked PowerPoint better than transparencies”.

Enigo (1997) in his research study compared, “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”.

Means et al. (1997) in their study found, “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”.

Tharp et al. (1997) in a four month study of 261 mathematics and science teachers found, “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 research 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”.

Elliott and Hall (1997) found, “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”).

Szabo and Pochkay (1996) found, “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, “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 his study”.

Bresse et al. (1996) investigated, “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.”

Underwood, Cavendish, Dowling, Fogelman and Lawson (1996) Researchers from Leicester University in their research study found, “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) in his study compared, “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
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”.

Carter (1994) in his study suggested, “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”.

Lazarowitz and Huppert (1993) in their research found, “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”.

**Gardner et al. (1992)** in their study 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 out-performed 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”.

**Wood (1991)** in his study explored, “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 e 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”.

**Zollman et al. (1989)** in their study titled, “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”.

### 2.3 STUDIES IN INDIA

**Anju and Sharma (2016)** in their research paper titled, “Effectiveness of Educomp smart classroom teaching on achievement in mathematics at elementary level analysed
the effect of Educomp Smartclassroom teaching on achievement in Mathematics at elementary level. The study consists of 80 students of class VIII of Navyug Public School, Sonipat (Haryana). Achievement test containing 60 Questions was used to collect the data. Experimental group, consisting of 40 students, was taught using Educomp Smartclassroom and control Group of 40 students was taught using Conventional classroom. It was found that mean scores of achievement in mathematics of Educomp Smartclass teaching group was higher than Conventional Classroom teaching group. Sex has no effect on the achievement in mathematics among VIII Graders using Educomp Smartclass. Sex has no effect on the achievement in mathematics among VIII Graders using Conventional Classroom teaching”.

Anju and Sharma (2016) in their research paper titled, “Effectiveness of Educomp Smart Classroom Teaching on Retention in Mathematics at Elementary Level, analysed the effect of Educomp Smartclass room teaching on Retention in Mathematics at elementary level. The study consists of 80 students of class VIII of Navyug Public School, Sonipat (Haryana). Achievement test containing 60 Questions was used to collect the data. Experimental group, consisting of 40 students was taught using Educomp Smartclass room and control Group of 40 students was taught using Conventional classroom. It was found that the mean retention scores of experimental and control groups’ in mathematics differ significantly. Educomp Smartclass teaching helps in enhancing the retention of students in mathematics in comparison to the Conventional classroom teaching. The mean retention in mathematics of male and female VIII Graders using Educomp Smartclass teaching does not differ significantly. Sex has nothing to do with the retention in mathematics among VIII Graders using Educomp Smartclass teaching. The mean retention in mathematics of male and female VIII Graders using Conventional Classroom teaching does not differ significantly. Sex has nothing to do with the retention in mathematics among VIII Graders using Conventional Classroom teaching”.

Bano (2016) in her research paper titled, “Impact of Smart Classroom Learning Environment on the Performance of First Grade Students in English investigated the
effect of smart classroom learning on the performance of first grade students in English subject. The present study is an experimental one and is conducted in Srinagar district of Kashmir. The investigator has taken 30 first grade students from Govt. High school Bakshipora. The investigator conducted experiment on the basis of pre-test and post-test. Performance test standardized by the investigator was used for the collection of data and t-test (correlated groups) was used to analyse the data. The result reveals smart classroom learning positively affects the performance of students in English”.

Srivastva (2015) in his research paper studied, “Efficacy of Educomp Smartclass, the effectiveness of Educomp smart class for enhancing student’s academic performance and studied the attitude of students when multimedia was used in classroom. The study revealed that Multimedia Instructional Strategy enhanced the student’s cognitive achievement and also interest in Mathematics. The students' cognitive achievement and interest in Maths were enhanced mostly by the multimedia strategy and minimally by the conventional strategy irrespective of sex. It is evident that the use of video tape in teaching math’s concepts provides precise visual feedback and hence incontrovertible evidence of what happened in the class. The Educomp Smart Class program had an overall positive impact on students more in terms of generating curiosity and grasping complex concepts rather than capturing attention, while it helped teachers in managing time better. The use of an interactive whiteboard as an instructional tool in a ninth grade classroom proved to be statistically significant in increasing student participation. The objective of this study was to examine the effectiveness of using an interactive whiteboard Active Board, to increase student participation in the classroom. I felt that the students would appreciate the greater opportunities to use the Active board as they had demonstrated past excitement and eagerness in use. The results indicated that the students who participated in the survey enjoy the use of the multimedia as an instructional tool and believed that it helps to provide additional opportunities for learning.”

Menon (2015) in her research paper analyzed, “the effectiveness of smart classroom teaching on the achievement in Chemistry of secondary school students. The study investigated 320 Class IX students from Amritsar city. Achievement test in Chemistry of
50 items was used to collect the data. Experimental group was taught in smart classrooms and control group was taught by conventional mode of instruction. The results revealed that students achieved higher when taught in smart classes as compared to conventional mode of instruction. Learning styles of students did not affect their achievement in experimental and control group. No interaction effect of instructional strategies and learning styles was found.”

Chachra (2015) in his research paper titled, “Effect of smart classroom assisted teaching on academic achievement of students of different intelligence level in Social Science, tried to study the effectiveness of Smart classroom assisted teaching over the traditional method of teaching in social science on the academic achievement of students of different intelligence level namely below average, average and above average (classification as per Stanford-Binet Scale fifth edition). The study was conducted in Dehradun district of Uttarakhand. The study was experimental in nature and the sample of the study consisted of 100 students of class eighth drawn from five different English medium schools having smart classroom facility. Data was analyzed using ‘t’ test. The result showed that the teaching through smart class room was more effective at all the three intelligence levels.”

Gupta and Thakur (2014) in their research paper titled, “The Effectiveness of IT Enabled Teaching in Classroom Environment concluded that ICT, through an e-learning intervention, can improve student performance as measured in test scores. Critically, this improvement was not global, and some students showed reduced numerical outcomes despite a reported enjoyment of the altered environment. All learning environments are complex, and arguably, there is difficulty in drawing global conclusions from any setting. The stinging nettles for research in ICT education are identified here as being (1) ICT as an agent of learning, (2) site specificity, and (3) global improvement. ICT can be a positive agent in learning in both the attainment of knowledge and more effective outcomes, but the agency will not be evidenced in the same way by all students”.

Chaudhary and Agrawal (2014) in their research article titled, “A Review on Applications of Smart Class and E – Learning, concluded about the much growing technology SMART CLASS
and E-LEARNING. The usage of smart teaching techniques is now more prevalent in school as well as other colleges and institutes. It was generated back in 1980s and is growing since then. This new technology helps the students with the benefit of learning with a different experience. The methods of e-learning make the classroom more interactive and interesting. It has also created a greater impact on our society as well as on education system. The government has also started implementing this idea of e-learning in the schools. There are several examples available in the market that encourage the idea and work for its betterment. The smart classes have their own merits and demerits but this new technology s welcomed by the society in a great manner”.

Balamurugan and Pazhanivelu (2014) in their research paper titled, “Effect of Smart Classroom Learning Environment in Tamil Grammar. The present study is an experimental one and conducted in Thirunelvelli district of Tamil Nadu in South India. The investigator has taken 40 High school students from Gopal Nayakar Government Higher Secondary School by using simple random sampling technique. For conducting experiment the investigator has used two group randomized pre-test and post-test design. For collection of data the investigator has used an achievement test which is constructed and standardized by the investigator. The collected data were analyzed and found the initial difference if any, Experimental pre-test and post-test between the male and female students scores by using t-test.the result shows that there is a significance difference is student performance between traditional teaching method and Smart classroom teaching method. Smart class learning helped to develop cognitive dimension, and Supplementary material provided to students”.

Ram Mehar & Sekhri (2014) in their study investigated, “the effect of smart class instructions on achievement and retention in Chemistry in relation to academic anxiety. The sample consisted of class 9th students selected from two different schools of Chandigarh (UT). Instructional materials based on smart class instruction were prepared and utilized to teach the experimental group after pre-testing and gain scores were computed after implementing post and retention-test on all the students. The academic anxiety test was also administered. Analysis of variance (2×2) was used to arrive at conclusions: (i) The smart class instruction group was found significantly higher achievement scores as compared to the control group (ii)
Performance of students with different academic anxiety group through smart class instruction was found significant at immediate level, (iii) Significant interaction effect was found to exist between the two variables at immediate performance level.”

**Tyagi (2013)** in her research titled, “Development and Validation of Computer Assisted Instruction Module in learning Biology concluded that Computer Assisted Instruction provides greater opportunities for the students to learn. CAI is better than the traditional method of learning. It brings an enhancement in achievement and provides new multisensory learning experiences for the learners.”

**Jena (2013)** in his study, an experimental one, conducted in Jalandhar district of Punjab. The investigator had taken 60 secondary school students from Royal Convent School by using simple random sampling technique. For conducting experiment the investigator had used two group randomized pre-test and post-test design. For collection of data the investigator had used an achievement constructed and standardized by the investigator and t-test has also used for analysis and interpretation data. The result of the study revealed that smart class learning environment was better to teach both low achievers and high achievers than traditional class.

**Kumari and Denisia (2013)** in their article titled, “Emerging Technology of Smart Class Teaching for Secondary School Teachers concluded that the use of emerging technology of smart class teaching is very important both for teachers and students. Its overall effectiveness needs to be enhanced by better planning and implementing of soft skills of multiple intelligences. More research is needed to discover and the way of using emerging technology of smart class teaching for secondary school teachers. The rate at which multiple intelligences will be used to enhance education in smart class and in other fields depends mainly upon state and national monetary commitment, followed by the willingness of individual schools to provide goods and services. This technological approach of emerging technology of smart class teaching for secondary school teachers will fulfill the gaps in students’ knowledge, understanding, and application”.

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Bharatkumar (2013) in his paper reported, “class rooms have changed from being teacher centered to being student centered, traditional teaching aid are being replaced by modern teaching aids. New ages classrooms are fast replacing the teachers with the computers and a new era of smart classes have emerged. Students feel difficulty in hearing Sanskrit Grammar. To make the Sanskrit learning easy, number of efforts is being made by various scholars. In the era of computer, any Sanskrit scholars are trying to develop program of smart class for teaching Sanskrit efficiently and effectively in a case manner. This research aims to study the effectiveness of these classes in references to the achievement of the students of standard X in Sanskrit grammar.”

Chirag (2013) in his Ph.D. research titled, “Development of Multimedia Teaching Package in Mathematics for Class V and its effectiveness, showed the effectiveness of Multimedia Teaching Package in Mathematics. The study established the effectiveness of MMTP by comparing the achievement scores of V class students of two groups (i.e. experimental and control) by teaching the selected content of mathematics syllabus prescribed by CBSE board. The students of experimental group were taught by using MMTP and the students of control group were taught through conventional method. A sample of 100 students of class V from English medium private schools of Rohtak City (affiliated to CBSE board) was selected through Multistage Random Sampling Technique. The results of the analysis are statistically significant and have vital practical implications in the field of education. The findings clearly suggest that the inclusion of multimedia teaching package strategy in Mathematics for class V students is very effective. Multimedia teaching package with its variety in the presentation of content helped learners in concentration, better understanding, and long retention of information which is not possible otherwise”.

Dun & Bradstreet (2010) in their research titled, “Study of Effectiveness of Educomp Smart Class Program, concluded that the Impact of Educomp Smart Class Program was found to vary by topic even within a subject, while the topic Sound in Physics saw a significant difference between the control and test sections in standard IX, the topic Charged / Uncharged Particles had a directional advantage between the two sections in standard VIII. Subjects such as Physics, Chemistry, History, EVS, Biology and Science were covered in the research exercise. However,
from the test scores, it cannot be definitively commented whether the Educomp Smartclass programme has higher impact on science subjects than languages or social sciences. Majority of the standards tested across categories, were found to have been impacted significantly by the use of the Smart Class program that reflected in their mean scores”.

**Anjali Khirwadkar (2008)** in her research paper explored, “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 Rao (2008)** in a study found, “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 on a 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.”

**Kumar (2007)** made an attempt to find, “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 (2007) in her study determined, “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.”

Shankar and Subasri (2006) in their research paper tried to study, “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 Power Point presentations in classroom teaching.”

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 at the rate of 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 (2005) in his research 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 selected from 29 District Institutes of Education and Training from Tamil Nadu, 71 English teacher educators and 200 teacher trainees were selected using probability sampling method for the study. Questionnaire, Attitude scale, Interviews and 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.”

Desai (2004) in his research “developed a multimedia package for teaching the subject of nutrition (Protein) to the undergraduate level students of Home Science to find 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.”

Natesan (2001) in his research compared, “the effectiveness of teaching concepts in mathematics through video-cassette with that of traditional method and 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.”

**Meera (2000)** in her research study tried, “to find out whether there was any significant
difference between the Conventional Lecture Method and the Computer Assisted Instructions
(CAI) as an individualized Instructional strategy in terms of their effectiveness in realizing the
instructional objectives in Biology for 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 Instructions viz. Drill, Practice and
Simulation were more effective than conventional lecture method in realizing the instructional
objectives in Biology for Class XI as well as in enhancing the retention of cognition of what
have already learnt as shown by the learner’s performance in the retention test.”

**Anjali Khirwadkar (1999)** in her research paper 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 the academic achievement was also found to
exist there.”

**Anshuman Das (1998)** conducted a research titled, “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. 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) in her research paper titled, “comparison of 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.”

Bhangoo and Sidhu (1997) conducted experimental research titled, “the impact of selected audio-visual aids on food hygiene knowledge of secondary school students and found that students of experimental group taught through visual materials performed better than those of the controlled group taught through traditional method.”

Rangaraj (1997) in his research study, “the effectiveness of computer assisted instruction in teaching Physics found that Computer Assisted Instructions as Support System (CAISS) were much better than CAI as individualized instruction. Retention also was higher when taught through CAISS.”
Joshi and Mahapatra (1995) in their research study tried to find out, “the effectiveness of computer software and concluded that Learners of experimental group taught through computer software package significantly performed better than the group taught through conventional method of teaching.”

Mahajan (1994) in his research, “studied the effectiveness of Computer Assisted Instructions for teaching singular and plural at grade II, and found that Computer Assisted Instructions were more effective than the traditional method.”

Bhat (1982) in his experimental research, “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.”

Mohanty et al. (1976) in their research 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, while dubbing of programmes was not appreciated. Radio broadcasts were generally appreciated.”

2.3 Over-View

The studies conducted during last few years contribute to the problem of use of Smart Technologies, use of power point presentations, use of computers and other technologies in the classroom; though very few contribute in the field of Educomp Smartclass. The review of studies shows that use of smart technologies affects academic achievement, motivation, interest, intelligence, creativity, student participation and retention. Being a multi prolonged problem, it remains still the question of further research: as the deeper it is studied, the more tangible it is liable to yield the yet more explored areas to be probed in, to contribute to the teaching-learning process, hence its relevance for the study in hand.