A STUDY OF EFFECTIVENESS OF SMART CLASSROOM ON THE ACHIEVEMENT AND RETENTION IN MATHEMATICS AT UPPER PRIMARY LEVEL

DISSERTATION

Submitted In Partial Fulfillment of the Requirement for Award of **Degree of Master of Education (M.Ed.)**

Supervisor

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M. Ed IInd Year

DEPARTMENT OF EDUCATION

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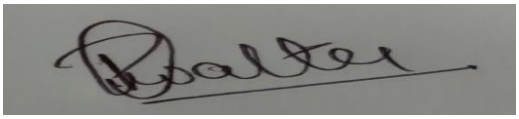
Declaration

This is to certify that I have completed this dissertation work entitled "A Study of Effectiveness of Smart Classroom on the Achievement and Retention in Mathematics at Upper Primary Level" in the Department of Education, Integral University, Lucknow under the supervision of **Dr. E. Ahmad.** The data given in the study are genuine and not given earlier. I am fully responsible for all the quotations, citations, calculations and interpretations.

Date: **PRINCE WALTER**



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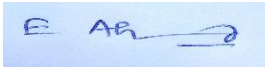
Certificate

This is to certify that M.Ed. Dissertation entitled "A Study of Effectiveness of Smart Classroom on the Achievement and Retention in Mathematics at Upper Primary Level" submitted by **Prince Walter** in partial fulfillment of the requirements for the award of degree of Master of Education (M.Ed.) has been conducted under my guidance and supervision.

In my humble judgment, the work is original and can be considered a contribution to our knowledge of the subject.

Date-

Supervisor



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First and foremost, praises and thanks to the God, the Almighty, for his showers of blessings throughout my course of this work. Writing this page brings memories of some special moments and people who influenced me during the course of this work. Learned souls put me on the right path for the search of truth and enlightened me with their knowledge and experience. I would express my sincere thanks to all of them.

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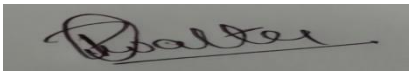
Place: Lucknow **(Prince Walter)**



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CHAPTER - I

1.1 Introduction

In the current era of globalization, the enormous use of technologies has precise the universe in more ways than one can imagine. Technologies has grant in some cases caused paradigm shift in the way business used to be operated in past. Many western nations had already consolidated their economies with optimum use technologies also they rigorously work for innovation and invention of technological advancement. Creative and critical thinking which play dominant role in problem solving skills is now extensively in great demand. This result in great demand of human resource that must be developed, educators are also practicing these new skills in educational settings. The new technologies challenge traditional practices both of teaching and learning and by reorienting how teachers and learners gain access to knowledge have the capacity to transform teaching and learning process.

"ICTs are a complete set of technological tools and resources helpful to communicate, and to create, propagate, store and manage knowledge. Communication and information are the soul of the teaching learning process, in formal and non-formal settings, in programmes provided by governmental agencies, public and private educational institutions, profit corporations and non-profit groups, and secular and religious communities"(www.unesco.org)

The prevailing inference that results in the use of ICTs in the classroom has been to train the young generation of learners competent for a workplace where ICTs, notably computers, the internet and other commonly used technologies, are becoming standard. Technological expertise, or the ability to use ICTs productively and efficiently, is thus recognizing as a cutthroat edge in a progressively globalized world of work force.

Education must make bridge for propagation of ethics, culture and moral values and not form a wall that results in degradation of social values. For achieving this objective, the phenomenon of constructive approaches should and must be employed

till the last node of education system. In simple words, reach of education to every individual should be interactive, simple and affordable.

Smart Technologies in India

"India accepted the use of smart technologies in teaching learning especially in 1984-85 when the Computer Literacy and Studies in Schools (CLASS) was initially introduced as a pilot project with the launch of BBC micro-computers. A total of 12,000 such computers were provided to secondary and senior secondary schools with the help of State Governments. Later on the project was adopted as a Centrally Sponsored Scheme during the 8th plan (1993-98) and was broadened to provide financial grants to institutions which were given BBC Micros and also to cover new Government Aided Secondary/Senior Secondary Schools. Financial grants included annual maintenance grant for BBC micros and purchase as well as maintenance of equipment for new schools"(www.mhrd.gov.in).

"2598 schools having BBC Micros were included in the CLASS scheme during the 8th plan for providing teachers, maintenance of hardware, consumables and textbooks for students and training of teachers in schools. In addition, 2371 schools were covered with new hardware and services which included Rs.1.00 lakh for hardware configuration and Rs.1.30 lakh annually for recurring costs. Rs.0.80 lakh per annum was kept as the recurring costs for schools which had already been covered under the BBC-Micros scheme"(www.mhrd.gov.in).

The concept of SMART schools with emphasis on Information technology and use of skills and values considered pivotal, gained momentum to be started on a pilot demonstrative basis in each state with the provision of Computer Systems to all educational institutions up to Secondary/ Higher Secondary Schools by proper investments.

"A centrally sponsored scheme, Information and Communication Technology (ICT) in School was launched in December 2004, to provide opportunities to secondary state students to develop ICT skills and for ICT-aided learning process as a major accelerator to fulfil the digital gap amongst the students of various socio-economic

and other geographical barriers. The scheme provided support to State/UTs to constitute Computer Labs on a sustainable basis and aimed at setting up SMART schools in KendriyaVidyalaya and NavodayaVidyalayas to act as Technology Demonstrators and to lead in transferring ICT skills among students of neighbourhood schools "(www.mhrd.gov.in).

EDUSAT, India's first dedicated education satellite, was launched at a cost of USD 20 million in September 2004. The Government of India, Ministry of HRD, Department of Secondary and Higher Education issued an order on May 20, 2006, for the Broadband connectivity in all the secondary schools during the 11th five year plan, considered as 'National Educational Plan' by the Prime Minister with an allotment of over 19% of the total budgetary provisions for this new thrust area lay emphasis in secondary education, supporting out its mid-term review suggestion to universalize secondary education on lines of the SarvaShikshaAbhiyan, with a budget permission of ₹411 billion to establish ICT labs for computer enabled learning and EdusatCenters for distance education learning.

"Shiksha India (December 2001), a non-profitable organization set up by the Confederation of Indian Industries (CII), has created a teacher's portal using open source tools and technologies (*Shiksha India Website*)".

- "Edu Reach (ICT) Educomp, with a record of implementing large scale PPP projects, in partnership with thirteen (13) State Governments, namely, Government of Assam, Karnataka, Orissa, Tripura, Gujarat, Uttar Pradesh, West Bengal, Delhi, Haryana, Jharkhand, Rajasthan, Chattisgarh and Andhra Pradesh covering more than 12000 government schools and benefiting 5.5 million students studying in government schools in India, has as its main objective, to equip each student teacher with technology - based educational skills so that teaching and learning can be more interactive and interesting.
- An initiative towards the use of ICT in Non-Formal Education includes computer Based Functional Literacy Program (2004) of Tata Consultancy Services in Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Maharashtra, Utter Pradesh and West Bengal *(Tata Literacy Programme Website)*.

- Hole-in-the wall training system (2002-2003) developed by NIIT is yet another enterprise involving international finance co-operation, a world bank subsidiary which has invested $ 1.6 million for computer kiosks in more than sixty locations to enable underprivileged children in India to learn from web-based curriculum *(UNESCO Website)* .
- With a substantially increased provision for the scheme Mission in Education through ICT to Rs.900 crores in the Union Budget for 2009-10, India has the demographic advantage of a large percentage of young population being modified into dynamic economic units enjoying the right to education and ICT skills" (www.mhrd.gov.in).

Smart Technologies and Student Learning

The National Policy on Education, 1986 as well as the Revised NPE, 1992 have laid emphasis on the use of Educational Technology (E.T.) for improving both the quality and quantity of education for the first time in the history of Indian Education. No earlier document of national significance had pointed out the importance of educational technology so clearly and so strongly as it has been done by the NPE, 1986.

Computer technology is likely to influence education enormously and can play an important role in enhancing the efficiency of the teaching-learning process, making children more creative and providing them with an individualised learning environment. Computer literacy would be crucial in preparing children to cope with microcomputer explosion which has the same potential for social change as the Industrial Revolution. It is essential to integrate the same progressively with the school curriculum.

ET can make education and learning effective and interesting. Previously, the audio-visual aids and approaches were used in education, but these were used in an unplanned and unsystematic manner. It was called Technology in Education. But now technology of education or educational technology is being used and applied in the

field of education in a systems approach and well-planned manner. This ensures cost effectiveness and efficiency in education.

Role of Smart Technologies in Mathematics Learning

Jean Piaget's (1973) revolutionized the world by saying, "Every normal child is capable of learning mathematics" and as a result have put greater pressure on dispensers of mathematical knowledge and producers of knowledge of mathematics education; they cannot escape by transferring the buck of the poor mathematical ability of the learners. New millennium is the age of science and technology, since the traditional teaching techniques are not sufficient to arouse interest among the learners and do not satisfy the intellectual, psychological and emotional needs of the students, the techniques of teaching mathematics need to be revised. The use of smart technology into teaching and learning of mathematics has also not escaped the attention of educators. As a discipline, mathematics too is very much influenced by the speedy development of Information and Communication Technology (ICT) and mathematics educators have been looking at ways to integrate smart technology into the curriculum over the last decade (BECTA, 2003). The key benefits are ICT promotes greater collaboration among students and encourages communication and sharing of knowledge. ICT gives rapid and accurate feedback to students and this contributes towards positive motivation. It also allows them to focus on strategies and interpretations, answers rather than spend time on tedious computational calculations.

Technology facilitates the students to do numerous computations quickly using calculators. Students are thus enabled to check computations quickly and accurately, thus allowing them to check and explore the validity of their conjectures (Hennessy, Fung and Scalon, 2001).

1.5 Need and Significance of the Study

There is an increasing trend that modern world requires that learners be able to work collectively and cooperatively with others, think critically and creatively and reflect on their own learning process. ICTs provide powerful tools to support the shift to student-centered learning and new roles of teacher and student. Ittigson and Zewe

(2003) cited, “technology is essential in teaching and learning mathematics. ICT improves the way mathematics should be taught and enhances student understanding of basic concepts.” Many researches have been carried out to evaluate the benefits of using smart technologies in mathematics. Becta (2003) summarized the key benefits – “ICT promotes greater collaboration among students and encourages communication and sharing of knowledge. ICT gives rapid and accurate feedback to students and this contributes towards positive motivation. It also allows them to focus on strategies and interpretations of answers rather than spend time on tedious computational calculations. ICT also supports constructivist pedagogy, wherein students use technology to explore and reach an understanding of mathematical concepts.”

Mathematics is still not an easy and inaccessible subject to most learners. The fact is not only accepted globally, but it is, consciously or unconsciously, being transferred from one generation to another. Despite this difficulty, mathematics remains a fundamental requirement for all science and technology courses. According to Papert (1980) “failure of so many students to learn mathematics is largely due to a lack of mathematics culture in adults and the scarcity of adults within mathematics who know how to ‘speak mathematics’”.

The main purpose of the present research work is to construct a tool for building knowledge and for facilitating learning. Also, to develop means to understand various spatiotemporal issues in teaching-learning process which will ultimately leads to the nourishment and exercise for the mind of pupil and teacher.

1.6 Statement of the Problem

“Effectiveness of Smart class-room on the achievement and retention in Mathematics at Upper Primary Level”

1.7 Operational Definitions of the Key Terms

A terms used in this research operationally defined with specific meaning as follows.

Smart-class: It is a technology,that makes available a large store house of 3D animated modules and videos mapped to school curriculum with the help of its exclusive collaboration with Eureka, Designate and Discovery.

Achievement: Achievement of the students in Mathematics after administrating the Mathematics Achievement Test.

Retention: The ability to retain facts and figures in memory.

1.8 Objectives of the Study

1. To compare the effect of Smart classroom teaching with traditional classroom teaching.

2. To compare the effect of Smart classroom teaching on achievement.

3. To see the relationship between Pre-test and Post-test on smart class teaching.

4. To see the relationship between Pre-test and Post-test on Retention test scores in Mathematics for students of class VI.

1.9 Hypotheses

1. There is no significant difference in Pre-test and Post-test of smart classroom on the achievement in mathematics among class VI students.

2. There is no relationship between Pre-test and Retention test scores of mathematics achievement test among class VI students.

3. There is no relationship between Post-test and Retention test scores of mathematics achievement test among class VI students.

4. There is no significant difference between male and female students on Pre-test score of mathematics achievement test.

5. There is no significant difference between male and female students on Post-test score of mathematics achievement test.

6. There is no significant difference between male and female students on Retention test score of mathematics achievement test.

1.10 Delimitations of the Study

Keeping in view the time available and limited resources, the study will be delimited to:

(i) The class VI students in the schools of Lucknow District.

(ii) Two units of Mathematics from class VI syllabus as prescribed by U.P. Board.

CHAPTER - II

REVIEW OF RELATED LITERATURE

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

2.1 Studies Done in Abroad

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, modelling and discussion appeared to be under-developed."

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".

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".

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".

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".

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".

Chang (2003) building on previous studies, "compared the achievement of tenth-grade Taiwanese students who experienced teacher directed CAI (TDCAI) with those who undertook student-directed CAI (SCCAI). Both groups used the multimedia CAI software, which was designed to allow users to navigate the various learning sections in a non-linear fashion. The TDCAI approach emphasized direct guidance from the teacher, while the SCCAI stressed student self-paced learning".

BECTA (2004) 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".

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".

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, problematizing 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".

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".

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."

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".

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".

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".

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

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 analysed 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".

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".

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".

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".

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."

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)".

Cepniet. 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 11thgrade 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 19.818.5 in the Experimental Group and 1.75-0.86 in the control group, respectively".

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.”

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".

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 Elazıg. 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."

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."

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."

Morgan (2008) in his study examined, "The impact of interactive whiteboard use on student engagement and appropriate at-task behaviours 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 behaviour 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 behaviour. 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 behaviour. Suggestions for further research are incorporated as part of the study results."

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."

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."

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."

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."

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."

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 Bruneian schools. The first stage of the project was designed to investigate whether or not the integration of interactive whiteboard technology in the Bruneian 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 Bruneian 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."

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 analysed 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."

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."

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 pre-test/post-test 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 pre-test and post-test 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 student's 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."

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."

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."

Ali et. al. (2013) in their research paper titled, "The Role of ICT to Make TeachingLearning 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".

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".

Talebet. 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 differentfunctional 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".

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".

2.2Studies Done in India

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."

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."

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."

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."

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 analysed using frequency, percentage, mean, standard deviation, standard error 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."

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."

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."

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.

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."

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."

Dun and 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 Smart-class 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".

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".

Bharat kumar (2013) in his paper reported, "Classrooms 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."

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 fulfil the gaps in student's knowledge, understanding, and application".

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.

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."

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."

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 GopalNayakar 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 analysed 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".

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".

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".

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 analysed using t-test. The result showed that the teaching through smart class room was more effective at all the three intelligence levels."

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."

Srivastava (2015) in his research paper studied, "Efficacy of Educomp Smart-class, 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."

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".

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 Smart classroom 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 Smart classroom and control Group of 40 students was taught using Conventional classroom. It was found that mean scores of achievement in mathematics of Educomp Smart-class teaching group was higher than Conventional Classroom teaching group. Sex has no effect on the achievement in mathematics among VIII Graders using Educomp Smart-class. Sex has no effect on the

achievement in mathematics among VIII Graders using Conventional Classroom teaching".

Manohari and Shenbagavadivu (2018) in their research paper titled, "A study on scope of smart classrooms in the government schools functioning in and around Coimbatore. The study is an attempt to find out the scope of the functioning of smart classrooms in state board schools. The study has been conducted by adopting survey method among the schools in and around Coimbatore district with the help of questionnaire. The sample size of 72 respondents from the area that was chosen for the study. The scope of study consists of the expectations and the opinion of the respondents toward the smart class. The study was based on descriptive research. Simple random sampling is used for data collection."

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 various other technologies in the classroom. 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.

CHAPTER - III

DESIGN OF THE STUDY

The method and procedure of conducting a research study are, by and large, determined by the design of the study and realization of its objectives, stipulated purposes and testing the variables involved. This would imply sub-heads like:

3.1 Method of research

3.2 Research Design

3.3 Population and Sample

3.4 Description of Tool

3.5 Planning and Preparing of Achievement Test

3.6 Precautions observed

3.7 Constraints and difficulties

3.8 Procedure followed

3.9 Statistical analysis

3.1 Method of Research

Research in common parlance refers to a search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. Research is an academic activity and as such the term should be used in a technical sense.

D. Slesinger and M. Stephenson in the Encyclopedia of Social Sciences define research as “the manipulation of things, concepts or symbols for the purpose of generalising to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art.” Research is, thus, an original

contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment.

Broudy (1963) stated that "Method refers to the formal structure of the sequence of acts commonly denoted by instruction. The term method includes both strategy and tactics of teaching and involves the choice of what is to be taught and the order in which it is to be taught."

Approaches of conducting a research study vary in their nature and intent. Approaches should be based on the nature of the problem. Method of Research is broadly classified in four categories namely: Historical Method, Survey Method, and Descriptive Method and, Experimental Method. This study is an endeavour to study the effect of Smart-class on the student's academic achievements and retention in mathematics. Experimental research method is a type of research method aimed at establishing the possible cause and effect relationship between variable/variables under study through some systematic and well-planned observations carried out in controlled conditions.And, for this purpose Experimental method is needed. Prioritizing this objective, the investigator used pre-test, post-test method to conduct this study.

3.2 Research Design

A design is used to draw a framework of the research. In simple words, the design is helpful to the experimenters in doing experiments in the proper way. Itmakes clear show how all the major component of the research project such as the sample or groups, treatments and method of assignments work together to address the main research question.

There are so many experimental designs available to the researchers in behavioural sciences for conducting experimental studies. They may opt for one of the designs as per the availability of the resources to them in conducting their study, the objectives of their research study, the type of variables to be manipulated in carrying out the experiments, and expertise and competency of the researcher in employing the design.

An experimental design is a blue print of the procedure that enables the researcher to test the hypothesis by reaching valid conclusions about relationship between independent and dependent variables. It refers to the conceptual framework within which the experiment is conducted.

In the present study, the investigator has employed the One-Group, Pre-test and Post-test design. In this design instead of defining experimental and control groups among students of the respective class, whole class is taken as one group. And, first they all have went through the Pre-test, after this the treatment is applies on them they appeared for the Post-test. In this whole procedure randomization has no role to play. Therefore, it is a Quasi-Experimental research.

The teacher's laptop in the smart classroom setup is used in order to create a effective learning environment which ultimately leads to healthy learning experience for the students. Every child gets a visual input of the methods and the concepts were optimally understood. In order to achieve the objective of recapitulation, in the end of each smart class teaching session a set of relevant questions were displayed and same were asked by the teacher to the students. In this teacher tried his best by distributing the questions on the equally distributed pattern as far as possible. And, then students respond in accordance. This part has pivotal role in teaching-learning process as it helps in building strong foundation of respective concepts.

The study includes forty-one students of class VI of Lucknow Christian College School (L.C.C.S.), InayatBagh (Lucknow.)

Table 3. (a): DESIGN OF THE STUDY

GROUP	PRE-TEST	INDEPENDENT VARIABLE	POST-TEST
A	R	SMART CLASS TEACHING	R_1

Where,

A: Students of class VI

R: Result of Pre-test

R_1: Result of Post-test

The study involved four operational stages as identification stage, treatment stage, post-testing stage and retention testing stage. The first stage involved pre-testing of all the students and measurement of achievement in mathematics. The second stage involved the experimental treatment, which is consisted of two units of class VI mathematics taught to the students through Smart class. In third stage, post-testing of the students is conducted using the achievement test in mathematics. The fourth and the last stage were testing the retention in mathematics of the students. A simplified glimpse of the phases of study is provided next in **Table 3.(b)**

STAGES	**ACTION**	
I. Pre-testing	**1.** Measurement of achievement in mathematics.	
II. Treatment	**1.** Teaching mathematics through Smart-Class method.	
III.Post-testing	**1.** Measurement of achievement in mathematics after completion of stage II (Treatment).	
IV.Retention testing	**1.** Measurement of retention in mathematics (Pre-test result will be used).	**1.** Measurement in retention in mathematics (15 days after the post-test).

Table 3(b)

VARIABLES UNDER STUDY

A variable by definition is any characteristic or attribute or condition (of individual and his environment) that is liable to be varied and thus can be attributed with different values. An object or condition by itself is not a variable, but its characteristics are. For example, a particular teaching aid in itself is not a variable, it is an object. Its characteristics in the form of picture,

audio-video or multisensory are the variables. At the same time conducting experimental study in behavioural sciences, the relationship between two form of variables namely independent and dependent variable is studied.

Independent Variable are those variables that are very much in control of the experimenter and are sensitive to conscious manipulation and variation by the experimenter for monitoring their effects on the dependent variable/variables. In the present study 'Treatment' acted as an independent variable. The treatments involved the method of Smart-class teaching.

Dependent Variable are those variables that are supposed to get affected in tune with the introduction and manipulation of the independent variable. In the present study, Achievement in mathematics and Retention in mathematics were taken as dependent variables. Achievement in mathematics was measured twice during the development of the study. First one before beginning the experimental treatment, i.e. at the pre-test stage and then, after applying entire experimental treatment, i.e. at the post-test stage, whereas retention was measured after fifteen days of the completion of the experimental treatment.

Intervening Variables are those variables that are of interest to investigators but which might influence and interfere with the result s of the study in one way or the other. These variables have their effect on the learning outcomes. Therefore, it essentially need to be controlled and neutralized by the investigator to clearly establish the cause and effect relationship between the independent and dependent variables. Intervening variables such as nature of school, class level, subject to be taught, previous knowledge of students, teacher behaviour were successfully controlled .

Control Employed

It is important to control all the intervening variables that may significantly affect the dependent variables.

(i). Nature of School: The sample was selected from a single English medium school, namely Lucknow Christian College School, Inayatbagh, Lucknow (Uttar Pradesh) affiliated to U.P. Board.

(ii). Class level: Only VI class students were selected for the study.

(iii). Subject: Two units of mathematics were taught from prescribed text-book of class VI i.e., Knowing our numbers and Algebraic expressions.

(iv). Teacher Behaviour: The investigator himself taught the content to the whole class i.e., inter-teacher variation was eliminated. He himself prepared achievement test, lesson plans and applied the all experimental treatments on the students.

Some factors like home environment of students, anxiety could have only a marginal effect upon the experiment, so these factors were not taken into consideration.

3.3 Population and Sample

"A population is any group of individuals that have one or more characteristics in common and that are of interest to the researcher(*Best and Kahn, 2006:13*)." In the present study, the term population refers to class VI students studying in English Medium Schools of Lucknow district of Uttar Pradesh.

"Sampling, therefore, may be termed as the process of selecting a few (a sample) from a bigger group (the sampling population) to become the basis for estimating or predicting the prevalence of an unknown piece of information, situation, or outcome regarding the bigger group *(Kumar, 2005:164)*."

We take a sample rather than using the entire population for extracting the information about the population because it is economical in many terms such as of cost, time, labour and efforts. In the present study, the sample of study comprised 41 students studying in class VI of Lucknow Christian College School, Lucknow.

GENDER	N	PERCENTAGE
MALE	30	73.17
FEMALE	11	26.83

3.4Description of Tool

"Achievement test is one designed to measure knowledge, understanding or skills in a specified subject or a group of students(*Freeman*)".

"An achievement test is one designed to measure student's grasp of knowledge or his proficiency in certain skills (*Ebel*)".

The main aim of achievement test is to measure the various aspect of learning outcomes primarily of cognitive domain. Through this test, how much and what a child has learnt, can be determined.

The learning that takes place is assessed not only for the learner's benefit but also for the teacher to evaluate his/her own work as an achievement. This assessment shows up with the usage of a tool, known as Achievement test.

3.5 Planning and Preparing the Achievement Test

In the present study, an achievement test for class VI on the chapters "**Knowing our Numbers** and **Algebraic Expressions**" was prepared by the investigator himself to evaluate the pupil's knowledge and understanding regarding the chapters taught by himself.

Achievement test prepared is based on multiple choice questions (M.C.Q.) pattern. In the final draft there are total 20 questions each carrying 1 marks for the right option. The students were asked to mark the correct option. This was used for pre-test, post-test and retention test.

The Achievement Test covered the following sub-topics:

Ch. 1	**Knowing our Numbers**
(i)	Comparing numbers

(ii)	Reading and Writing of Greater numbers
(iii)	Operations on Numbers
(iv)	Estimation
(v)	Roman Numerals
Ch. 2	**Algebraic Expressions**
(i)	Operations on Literals and Numbers
(ii)	Types of Algebraic Expression
(iii)	Factor of a Term
(iv)	Substitution

3.6 Precautions Observed

Following precautions were taken during the course of experiment (Pre-test – Instructional Programme – Post-test) for optimal precision and effectiveness in experimental condition which may have contributed to the results.

(i). No unnecessary control of any kind was imposed on the students at any time during the course of experiment and experiment was conducted in a congenial environment.

(ii). Care was taken to keep importance of content matter during the course of treatment and it was not underplayed while fitting into the experimental treatment.

(iii). Teaching periods of 40 minutes duration were utilized fully for treatment and time was not wasted during experimentation.

3.7 Constraints and Difficulties Faced During the Experiment

Whenever a research project is in the process, undoubtedly some difficulties would occur at the surface while the execution. But because of the co-operative

and supportive nature of the school authorities the problems sorted by the researcher, such as: Infrastructural lapses, Time-table related difficulties

3.8 Procedure Followed

Procedure of the experiment involve four stages

Stage I: Administration of the Pre-test

Before the beginning of the experiment, the sample units i.e., students were make comfortable by interacting with them and in this process they were oriented about the test. The instructions regarding the test were explained verbally and clearly to the students before the administering the test. The Mathematics Achievement Test used for this purpose is made by the investigator by himself

After this, the students were informed about the experimental treatment which they will be getting so that the curiosity of the student gets answered.

Stage II: Conducting the Instructional Programme

In this stage, the students were taught by Smart-Class method. The instructional treatment was given about 15 working days.

Stage III: Administration of Post-test

After the completion of instructional program (experimental treatment), the investigator conducted the post-test using the same Achievement test of Mathematics which was used for conducting the pre-test.

Stage IV: Administration of Retention-test

The retention test was conducted after the 15 days of administration of the post-test by using the same Achievement test of Mathematics which was used for conducting the pre-test.

3.9 Statistical Analysis

To achieve the objectives of the study, the data collected was statistically analysed using the following techniques:

(i) Descriptive statistics such as mean and standard deviation worked out on the score of achievement in Mathematics.

(ii) 't' test was employed for testing the significance of difference between the means of student's response in the achievement test questions of mathematics in pre-test and post-test marks.

The value of 't' was computed with the help of the following formula:

$$t = \frac{M_1 \sim M_2}{\sigma_D}$$

Where, M_1 = Mean of Pre-test scores

M_2 = Mean of Post-test scores

σ_D = Difference between standard Errors of Means

(iii) Coefficient of Correlation formula was employed for finding the relationship between Pre-test, Post-test, Retention test scores of achievement test.

$$r_{(x,y)} = \frac{\sum xy}{\sigma_x \sigma_y}$$

Where, $\sum xy$ = Co-variance between x and y

x = Standard deviation of x

y = Standard deviation of y

CHAPTER - IV

Data Analysis, Interpretation and Discussion

4.1 Analysis and Interpretation of Data

The next step in the process of research is analysis and interpretation of the data. It is very useful in producing a clear and meaningful picture out of the raw research data. The analysis means a detailed study of anything complex in order to understand it or bring out more meaning understanding of the respective phenomena. And, putting this meaningful analysis together is the purpose of interpretation of data.

The main objective of the present study was to test the effectiveness of Smart-class teaching method on the academic achievement and retention in mathematics at elementary level. The data collected through the achievement test of mathematics for class VI formed the ground for analysis and interpretation. Student's achievement and retention in mathematics of class VI are the variables which are studied in the present study. And, these variables are presented in the tabular along with the graphical representation in this chapter.

Hypothesis-1 There is no significant difference in Pre-test and Post-test of smart classroom on the achievement in mathematics among class VI students.

Table-4.1

Achievement Test	N	Mean	SD	r	t-value	Significance
Pre-Test	41	14.90	0.2505	0.3226	4.089	Significant (at 0.05 level)
Post-Test	41	16	0.2069			

Table 4.1 shows that the t-value is 4.089 which is significant at 0.05 level with degree of freedom 40. Thus, the null hypothesis namely H_{01} i.e. **'**There is no significant difference in the effects of smart classroom and traditional classroom teaching on the achievement in mathematics among class VI students**'** is rejected. Therefore, it can be

concluded that Smart-classroom teaching helps in enhancing the achievement of students in mathematics in comparison to the conventional classroom teaching.

Since, smart classroom teaching methodology enhanced learning with the support of internet facility. This makes learning more attractive, interesting and easy to understand. Also, it encourages the ability of students and motivates them to learn and memorize the topic for a prolonged period of time. It is a prevalent truth, when we learn through visuals, we grab the subject easily rather than just looking into the blackboard and listening.

Hypothesis-2 There is no relationship between Pre-test and Retention test scores of mathematics achievement test among class VI students.

Achievement Test	**R**
Pre-Test(A)	0.312
Retention Test(C)	

Tab.4.2: Correlation between Pre-test and Retention marks of students of class VI

From Table 4.2, we can see that r = +0.312 which signifies the positive relationship between the Pre-test marks and Retention test marks of students of class VI. Thus, the null hypothesis namely H_{02} i.e. 'There is no relationship between Pre-test and Retention test scores of mathematics achievement test among class VI students' is rejected.which means there is a positive relationship between the mean scores of Pre-test and Post-test marks. That is, achievement scores get enhanced after the treatment is successfully employed.

Hypothesis 3. There is no relationship between Post-test and Retention test scores of mathematics achievement test among class VI students.

Achievement Test	R
Post-Test(B)	0.448
Retention Test(C)	

Tab.4.3 : Correlation between Post-test and Retention marks of students of class VI

From Table 4.3, we can see that r = +0.448, which signifies the positive relationship between the Post-test marks and Retention test marks of students of class VI. Thus, the null hypothesis namely H_{03} i.e. 'There is no relationship between Post-test and Retention test scores of mathematics achievement test among class VI students' is rejected. That is, smart-classroom teaching methodology is helpful in enhancing the memorization level for mathematics in students.

Hypothesis 4. There is no significant difference between male and female students on Pre-test score of mathematics achievement test.

Group	N	Mean	σ	t-value	Significance
Male	30	15	1. 5055	0.586	Not Significant (at 0.05 level)
Females	11	14.64	1. 8227		

Tab.4.4: Mean, S.D. and t-value of Achievement in mathematics of male students and female students of class VI using Conventional teaching method.

From Table 4.4, we can see that the t-value is 0.586 which is not significant at 0.05 level (critical value = 1.96) with degree of freedom = 39. Thus, the null hypothesis namely, H_{04} i.e. 'There is no significant difference between male and female students on Pre-test score of mathematics achievement test' is accepted.

Moreover, the mean achievement score of female students is 14.64, which is slightly lower than the mean achievement score of male students i.e. 15. It may

therefore be concluded from the findings that, gender has nothing to do with the achievement in mathematics among students of class VI using conventional teaching method. Also, students irrespective of their gender are equally competent in academic activities.

Hypothesis 5. There is no significant difference between male and female students on Post-test score of mathematics achievement test.

Group	N	Mean	σ	t-value	Significance
Males	30	15.83	1.267	1.308	Not Significant (at 0.05 level)
Females	11	16.45	1.373		

Tab.4.5: Mean, S.D. and t-value of Achievement in mathematics of male students and female students of class VI using Smart-class teaching method.

From Table 4.5, we can see that the t-value is 1.308 which is not significant at 0.05 level (critical value = 1.96) with degree of freedom = 39. Thus, the null hypothesis namely, H_{05} i.e. 'There is no significant difference between male and female students on Post-test score of mathematics achievement test' is accepted.

Moreover, the mean achievement score of female students is 16.45, which is slightly higher than the mean achievement score of male students i.e. 15.83. It may therefore be concluded from the findings that, gender has nothing to do with the achievement in mathematics among students of class VI using Smart-class teaching method.Also, students irrespective of their gender are equally competent in academic activities.

And, smart classroom teaching methodology plays its role very optimally which equips the teachers to regulate their teaching activities in efficient manner with prudent planning. All this leads to improved academic results for all the students who are involved in this teaching-learning process.As smart-classroom enables the access to the whole world, this motivates the learners to start thinking in more logical and improved way.

Hypothesis 6. There is no significant difference between male and female students on Retention test score of mathematics achievement test.

Group	N	Mean	σ	t-value	Significance
Males	30	16.17	0.860	0.197	Not Significant (at 0.05 level)
Females	11	16.27	1.601		

Tab.4.6: Mean, S.D. and t-value of Achievement in mathematics of male students and female students of class VI in Retention test.

From Table 4.6, we can see that the t-value is 0.197 which is not significant at 0.05 level (critical value = 1.96) with degree of freedom = 39. Thus, the null hypothesis, H_{06} i.e. 'There is no significant difference between male and female students on Retention test score of mathematics achievement test' is accepted.

Moreover, the mean achievement score of female students is 16.27, which is slightly higher than the mean achievement score of male students i.e. 16.17. It may therefore be concluded from the findings that, gender has nothing to do with the retention in mathematics among students of class VI using Smart-class teaching method.

Smart classroom teaching methodology enhanced learning with the support of internet facility and potent technologies.This makes learning more attractive, interesting and easy to understand. Also, it encourages the ability of students and motivates them to learn and memorize the topic for a prolonged period of time. A learner's level of

motivation and engagement with study material is greatly increased through taking advantage of interactive learning. It is a prevalent truth, when we learn through visuals, we grab the subject easily rather than just looking into the blackboard and listening.

4.2 DISCUSSION

Pittard et al in his study which was conducted in 2003 found that there is the significant positive association between the use of ICT and higher level of attainment in academic subjects such as English, science, mathematics. Also, **BECTA** (British Educational Communications and Technology Agency) in their study of 2004 stated that "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".

Anju and Sharmain their study which they have conducted in 2016, also found that mean scores of achievement in mathematics of Educomp Smart-class teaching group was higher than Conventional Classroom teaching group. Gender has no effect on the achievement in mathematics among VIII Graders using Educomp Smart-class and gender has no effect on the achievement in mathematics among VIII Graders using Conventional Classroom teaching".

All these previous studies shows that how the technological advancement and it's inclusion in educational phenomenon leads to the qualitative improvement in the outcome of the teaching-learning phenomenon irrespective of the gender difference. ICT blended the conventional trends of education into the new dimensions which needs to be investigate more because of the spatiotemporal nature and requirement of technological advancement.

CHAPTER – V

Findings, Conclusions, Implications and Suggestions for Further Researches

On the basis of the analysis and interpretation of the data, the present chapter is further classified into four sub-parts i.e. findings, conclusions and implications. The results have been presented under the heading of 'Findings' , the possible conclusions related to the study have been presented under the heading of 'conclusions'. And, a variety of implications and suggestions for further research in the related fields of this study have been presented under the heading of 'Implications' and 'Suggestions for further study'

5.1. Findings

The pre-assumption (i.e. null hypothesis) which are rejectedafter the analysis of the data are as follows:

H_{01} :There is no significant difference in the effects of smart classroom and traditional classroom teaching on the achievement in mathematics among class VI students.

H_{02} : There is no relationship between Pre-test and Retention test scores of mathematics achievement test among class VI students.

H_{03} : There is no relationship between Post-test and Retention test scores of mathematics achievement test among class VI students.

After analysing the data it is found that Smart-classroom teaching method helps in enhancing the achievement of students in mathematics in comparison to the conventional classroom teaching method. Also, found that, there is a *positive* relationship between Pre-test and Retention test scores which means there is a positive relationship between the mean scores of Pre-test and Post-test marks. That is, achievement scores get enhanced after the treatment is successfully employed.

And,also there is a *positive* relationship between Post-test and Retention test scores of mathematics achievement test among class VI students. That is, smart-classroom teaching methodology is helpful in enhancing the memorization level for mathematics in students.

Null hypothesis which is are *accepted* after the analysis of the data are as follows:

H_{04} : There is no significant difference between male and female students on Pre-test score of mathematics achievement test.

H_{05} : There is no significant difference between male and female students on Post-test score of mathematics achievement test.

H_{06} : There is no significant difference between male and female students on Retention test score of mathematics achievement test.

This suggests that there is no difference in performance of students of class VI in mathematics on the basis of gender i.e. gender has nothing to do with the achievement in mathematics in class VI students.

5.2 Conclusions

The present study provides very important recommendations for teacher's training institutions. Emphasizing on the spatiotemporal needs of the society, it is very important that during pre-service teacher training, future teachers should master the smart-classroom technology as the evolution of information and communications technology and it's induction in the education is the justifiable truth, which no one can deny . The in-service training may also be given to the existing teachers to teach them the skills for smart-classroom teaching which will increase the efficiency because when assimilation of technology and experience of teachers get intertwine it will be helpful for the education system and also it will help the teacher in matching the pace with technological advancement from time-to-time.

5.3 Educational Implications of the Study

The present study shows that infusion of smart-classroom teaching method in education system improves the quality of teaching-learning process in the efficient way. It also improves the achievement and retention in mathematics in a significant way. Earlier the teacher who used to be the only source of information now can be equipped with the modern skills of smart-classroom teaching and can act as a facilitator in the teaching-learning process who can provide the whole world of knowledge in the classroom.

It is a thing of the past when teaching and learning were restricted to the traditional classroom sessions environment prominently with white chalk, duster and blackboard. Now with the induction of information and communications technology in the education system, teachers along with students can anytime access to the expansive world of online information. Also, the digital tools enable the teacher to make respective topic more interesting and add the peculiarity in the explanation which helps the students to understand the respective topic better.

As the education system get more intertwined with the modern technologies, the policy makers will get equipped to make more effective and result oriented policies for the education system which will be beneficial for the qualitative growth in numerous dimensions of the society. Although the induction of new technology and keeping up-to-date all the time the educational institution will introduce upsurge in financial investment. But the authorities must have to take initiative in purview of educational advancement in a balanced and effective manner.

5.4 Suggestions for Further Study

The present study “Effectiveness of smart classroom on the achievement and retention in mathematics at upper primary level” put up a great figure of contemporary areas to be studied by future researchers. The areas and variables that are not covered by this study, may be put to test to edify the other associate factors. As the technology develops along with the greater depth of infusion of artificial technology, we will get

to know the greater and diverse effects of educational technology on various aspects of human life.

So, the researchers may consider the ensuing areas of study in detail:

(i). The study can be extended to the various class students of a districts and states.

(ii). The study can be extended to the various academic subjects which may be universal, linguistic and regional.

(iii). The study can be extended to the various other teaching methodology and it's comparison with the effectiveness with the inducement of the modern technologies in educational technology

(iv). The study can also be extended to analyse the effectiveness of modern technologies on development of other components of mental faculty and also learning domain.

(v). The study can be extended to the various special group of learners i.e. gifted, the learning disabled or other special group students.

SUMMARY

Introduction

In the current era of globalization, the enormous use of technologies has precise the universe in more ways than one can imagine. Technologies has grant in some cases caused paradigm shift in the way business used to be operated in past. Many western nations had already consolidated their economies with optimum use technologies also they rigorously work for innovation and invention of technological advancement. Creative and critical thinking which play dominant role in problem solving skills is now extensively in great demand. This result in great demand of human resource that must be developed, educators are also practicing these new skills in educational settings. The new technologies challenge traditional practices both of teaching and learning and by reorienting how teachers and learners gain access to knowledge have the capacity to transform teaching and learning process.

"ICTs are a complete set of technological tools and resources helpful to communicate, and to create, propagate, store and manage knowledge. Communication and information are the soul of the teaching learning process, in formal and non-formal settings, in programmes provided by governmental agencies, public and private educational institutions, profit corporations and non-profit groups, and secular and religious communities"(www.unesco.org)

Role of Smart Technologies in Mathematics Learning

Jean Piaget's (1973) revolutionized the world by saying, "Every normal child is capable of learning mathematics" and as a result have put greater pressure on dispensers of mathematical knowledge and producers of knowledge of mathematics education; they cannot escape by transferring the buck of the poor mathematical ability of the learners. New millennium is the age of science and technology, since the traditional teaching techniques are not sufficient to arouse interest among the learners and do not satisfy the intellectual, psychological and emotional needs of the students, the techniques of teaching mathematics need to be revised. The use of smart

technology into teaching and learning of mathematics has also not escaped the attention of educators. As a discipline, mathematics too is very much influenced by the speedy development of Information and Communication Technology (ICT) and mathematics educators have been looking at ways to integrate smart technology into the curriculum over the last decade (BECTA, 2003). The key benefits are ICT promotes greater collaboration among students and encourages communication and sharing of knowledge. ICT gives rapid and accurate feedback to students and this contributes towards positive motivation. It also allows them to focus on strategies and interpretations, answers rather than spend time on tedious computational calculations.

Technology facilitates the students to do numerous computations quickly using calculators. Students are thus enabled to check computations quickly and accurately, thus allowing them to check and explore the validity of their conjectures (Hennessy, Fung and Scalon, 2001).

Need and Significance of the Study

There is an increasing trend that modern world requires that learners be able to work collectively and cooperatively with others, think critically and creatively and reflect on their own learning process. ICTs provide powerful tools to support the shift to student-centered learning and new roles of teacher and student.

Mathematics is still not an easy and inaccessible subject to most learners. The fact is not only accepted globally, but it is, consciously or unconsciously, being transferred from one generation to another. Despite this difficulty, mathematics remains a fundamental requirement for all science and technology courses. According to Papert (1980) “failure of so many students to learn mathematics is largely due to a lack of mathematics culture in adults and the scarcity of adults within mathematics who know how to ‘speak mathematics’”.

The main purpose of the present research work is to construct a tool for building knowledge and for facilitating learning. Also, to develop means to understand various spatiotemporal issues in teaching-learning process which will ultimately leads to the nourishment and exercise for the mind of pupil and teacher.

Statement of the Problem

"Effectiveness of Smart class-room on the achievement and retention in Mathematics at Upper Primary Level"

Operational Definitions of the Key Terms

A terms used in this research operationally defined with specific meaning as follows.

Smart-class: It is a technology,that makes available a large store house of 3D animated modules and videos mapped to school curriculum with the help of its exclusive collaboration with Eureka, Designate and Discovery.

Achievement: Achievement of the students in Mathematics after administrating the Mathematics Achievement Test.

Retention: The ability to retain facts and figures in memory.

Objectives of the Study

1. To compare the effect of Smart classroom teaching with traditional classroom teaching.

2. To compare the effect of Smart classroom teaching on achievement.

3. To see the relationship between Pre-test and Post-test on smart class teaching.

4. To see the relationship between Pre-test and Post-test on Retention test scores in Mathematics for students of class VI.

Hypotheses

1. There is no significant difference in Pre-test and Post-test of smart classroom on the achievement in mathematics among class VI students.

2. There is no relationship between Pre-test and Retention test scores of mathematics achievement test among class VI students.

3. There is no relationship between Post-test and Retention test scores of mathematics achievement test among class VI students.

4. There is no significant difference between male and female students on Pre-test score of mathematics achievement test.

5. There is no significant difference between male and female students on Post-test score of mathematics achievement test.

6. There is no significant difference between male and female students on Retention test score of mathematics achievement test.

Delimitations of the Study

Keeping in view the time available and limited resources, the study will be delimited to:

(i) The class VI students in the schools of Lucknow District.

(ii) Two units of Mathematics from class VI syllabus as prescribed by U.P. Board.

Design of the Study

The method and procedure of conducting a research study are, by and large, determined by the design of the study and realization of its objectives, stipulated purposes and testing the variables involved. This would imply sub-heads like:

Research Design

A design is used to draw a framework of the research. In simple words, the design is helpful to the experimenters in doing experiments in the proper way. Itmakes clear show how all the major component of the research project such as the sample or groups, treatments and method of assignments work together to address the main research question.

There are so many experimental designs available to the researchers in behavioural sciences for conducting experimental studies. They may opt for one of the designs as

per the availability of the resources to them in conducting their study, the objectives of their research study, the type of variables to be manipulated in carrying out the experiments, and expertise and competency of the researcher in employing the design.

An experimental design is a blue print of the procedure that enables the researcher to test the hypothesis by reaching valid conclusions about relationship between independent and dependent variables. It refers to the conceptual framework within which the experiment is conducted.

In the present study, the investigator has employed the One-Group, Pre-test and Post-test design. In this design instead of defining experimental and control groups among students of the respective class, whole class is taken as one group. And, first they all have went through the Pre-test, after this the treatment is applies on them they appeared for the Post-test. In this whole procedure randomization has no role to play. Therefore, it is a Quasi-Experimental research.

The teacher's laptop in the smart classroom setup is used in order to create a effective learning environment which ultimately leads to healthy learning experience for the students. Every child gets a visual input of the methods and the concepts were optimally understood. In order to achieve the objective of recapitulation, in the end of each smart class teaching session a set of relevant questions were displayed and same were asked by the teacher to the students. In this teacher tried his best by distributing the questions on the equally distributed pattern as far as possible. And, then students respond in accordance. This part has pivotal role in teaching-learning process as it helps in building strong foundation of respective concepts.

The study includes forty-one students of class VI of Lucknow Christian College School (L.C.C.S.), InayatBagh (Lucknow.)

DESIGN OF THE STUDY

GROUP	**PRE-TEST**	**INDEPENDENT VARIABLE**	**POST-TEST**
A	**R**	**SMART CLASS**	**R_1**

TEACHING

Where,

A: Students of class VI

R: Result of Pre-test

R_1: Result of Post-test

The study involved four operational stages as identification stage, treatment stage, post-testing stage and retention testing stage. The first stage involved pre-testing of all the students and measurement of achievement in mathematics. The second stage involved the experimental treatment, which is consisted of two units of class VI mathematics taught to the students through Smart class. In third stage, post-testing of the students is conducted using the achievement test in mathematics. The fourth and the last stage were testing the retention in mathematics of the students. A simplified glimpse of the phases of study is provided next in

Table

STAGES	**ACTION**	
I. Pre-testing	**1.** Measurement of achievement in mathematics.	
II. Treatment	**1.** Teaching mathematics through Smart-Class method.	
III.Post-testing	**1.** Measurement of achievement in mathematics after completion of stage II (Treatment).	
IV.Retention testing	**1.** Measurement of retention in mathematics (Pre-test result will be used).	**1.** Measurement in retention in mathematics (15 days after the post-test).

VARIABLES UNDER STUDY

A variable by definition is any characteristic or attribute or condition (of individual and his environment) that is liable to be varied and thus can be attributed with different values. An object or condition by itself is not a variable, but its characteristics are. For example, a particular teaching aid in itself is not a variable, it is an object. Its characteristics in the form of picture, audio-video or multisensory are the variables. At the same time conducting experimental study in behavioural sciences, the relationship between two form of variables namely independent and dependent variable is studied.

Independent Variable are those variables that are very much in control of the experimenter and are sensitive to conscious manipulation and variation by the experimenter for monitoring their effects on the dependent variable/variables. In the present study 'Treatment' acted as an independent variable. The treatments involved the method of Smart-class teaching.

Dependent Variable are those variables that are supposed to get affected in tune with the introduction and manipulation of the independent variable. In the present study, Achievement in mathematics and Retention in mathematics were taken as dependent variables. Achievement in mathematics was measured twice during the development of the study. First one before beginning the experimental treatment, i.e. at the pre-test stage and then, after applying entire experimental treatment, i.e. at the post-test stage, whereas retention was measured after fifteen days of the completion of the experimental treatment.

Intervening Variables are those variables that are of interest to investigators but which might influence and interfere with the result s of the study in one way or the other. These variables have their effect on the learning outcomes. Therefore, it essentially need to be controlled and neutralized by the investigator to clearly establish the cause and effect relationship between the independent and dependent variables. Intervening variables such as nature of school, class level, subject to be taught, previous knowledge of students, teacher behaviour were successfully controlled .

Control Employed

It is important to control all the intervening variables that may significantly affect the dependent variables.

(i). Nature of School: The sample was selected from a single English medium school, namely Lucknow Christian College School, Inayatbagh, Lucknow (Uttar Pradesh) affiliated to U.P. Board.

(ii). Class level: Only VI class students were selected for the study.

(iii). Subject: Two units of mathematics were taught from prescribed text-book of class VI i.e., Knowing our numbers and Algebraic expressions.

(iv). Teacher Behaviour: The investigator himself taught the content to the whole class i.e., inter-teacher variation was eliminated. He himself prepared achievement test, lesson plans and applied the all experimental treatments on the students.

Some factors like home environment of students, anxiety could have only a marginal effect upon the experiment, so these factors were not taken into consideration.

Population and Sample

"A population is any group of individuals that have one or more characteristics in common and that are of interest to the researcher(*Best and Kahn, 2006:13*)." In the present study, the term population refers to class VI students studying in English Medium Schools of Lucknow district of Uttar Pradesh.

"Sampling, therefore, may be termed as the process of selecting a few (a sample) from a bigger group (the sampling population) to become the basis for estimating or predicting the prevalence of an unknown piece of information, situation, or outcome regarding the bigger group *(Kumar, 2005:164)*."

We take a sample rather than using the entire population for extracting the information about the population because it is economical in many terms such as of cost, time, labour and efforts. In the present study, the sample of study comprised 41 students studying in class VI of Lucknow Christian College School, Lucknow.

GENDER	N	PERCENTAGE
MALE	30	73.17
FEMALE	11	26.83

Description of Tool

"Achievement test is one designed to measure knowledge, understanding or skills in a specified subject or a group of students(*Freeman*)".

"An achievement test is one designed to measure student's grasp of knowledge or his proficiency in certain skills (*Ebel*)".

The main aim of achievement test is to measure the various aspect of learning outcomes primarily of cognitive domain. Through this test, how much and what a child has learnt, can be determined.

The learning that takes place is assessed not only for the learner's benefit but also for the teacher to evaluate his/her own work as an achievement. This assessment shows up with the usage of a tool, known as Achievement test.

Planning and Preparing the Achievement Test

In the present study, an achievement test for class VI on the chapters "**Knowing our Numbers** and **Algebraic Expressions**" was prepared by the investigator himself to evaluate the pupil's knowledge and understanding regarding the chapters taught by himself.

Achievement test prepared is based on multiple choice questions (M.C.Q.) pattern. In the final draft there are total 20 questions each carrying 1 marks for the right option.

The students were asked to mark the correct option. This was used for pre-test, post-test and retention test.

The Achievement Test covered the following sub-topics:

Ch. 1	**Knowing our Numbers**
(i)	Comparing numbers
(ii)	Reading and Writing of Greater numbers
(iii)	Operations on Numbers
(iv)	Estimation
(v)	Roman Numerals
Ch. 2	**Algebraic Expressions**
(i)	Operations on Literals and Numbers
(ii)	Types of Algebraic Expression
(iii)	Factor of a Term
(iv)	Substitution

Precautions Observed

Following precautions were taken during the course of experiment (Pre-test – Instructional Programme – Post-test) for optimal precision and effectiveness in experimental condition which may have contributed to the results.

(i). No unnecessary control of any kind was imposed on the students at any time during the course of experiment and experiment was conducted in a congenial environment.

(ii). Care was taken to keep importance of content matter during the course of treatment and it was not underplayed while fitting into the experimental treatment.

(iii). Teaching periods of 40 minutes duration were utilized fully for treatment and time was not wasted during experimentation.

Procedure Followed

Procedure of the experiment involve four stages

Stage I: Administration of the Pre-test

Before the beginning of the experiment, the sample units i.e., students were make comfortable by interacting with them and in this process they were oriented about the test. The instructions regarding the test were explained verbally and clearly to the students before the administering the test. The Mathematics Achievement Test used for this purpose is made by the investigator by himself

After this, the students were informed about the experimental treatment which they will be getting so that the curiosity of the student gets answered.

Stage II: Conducting the Instructional Programme

In this stage, the students were taught by Smart-Class method. The instructional treatment was given about 15 working days.

Stage III: Administration of Post-test

After the completion of instructional program (experimental treatment), the investigator conducted the post-test using the same Achievement test of Mathematics which was used for conducting the pre-test.

Stage IV: Administration of Retention-test

The retention test was conducted after the 15 days of administration of the post-test by using the same Achievement test of Mathematics which was used for conducting the pre-test.

Statistical Analysis

To achieve the objectives of the study, the data collected was statistically analysed using the following techniques:

(iii) Descriptive statistics such as mean and standard deviation worked out on the score of achievement in Mathematics.

(iv) 't' test was employed for testing the significance of difference between the means of student's response in the achievement test questions of mathematics in pre-test and post-test marks.

The value of 't' was computed with the help of the following formula:

$$t = \frac{M_1 \sim M_2}{\sigma_D}$$

Where, M_1 = Mean of Pre-test scores

M_2 = Mean of Post-test scores

σ_D = Difference between standard Errors of Means

(iii) Coefficient of Correlation formula was employed for finding the relationship between Pre-test, Post-test, Retention test scores of achievement test.

$$r_{(x,y)} = \frac{\sum xy}{\sigma_x \sigma_y}$$

Where, $\sum xy$ = Co-variance between x and y

x = Standard deviation of x

y = Standard deviation of y

Findings, Conclusions, Implications and Suggestions for Further Researches

On the basis of the analysis and interpretation of the data, the present chapter is further classified into four sub-parts i.e. findings, conclusions and implications. The results have been presented under the heading of 'Findings' , the possible conclusions related to the study have been presented under the heading of 'conclusions'. And, a variety of implications and suggestions for further research in the related fields of this study have been presented under the heading of 'Implications' and 'Suggestions for further study'

Findings

The pre-assumption (i.e. null hypothesis) which are rejectedafter the analysis of the data are as follows:

H_{01} :There is no significant difference in the effects of smart classroom and traditional classroom teaching on the achievement in mathematics among class VI students.

H_{02} : There is no relationship between Pre-test and Retention test scores of mathematics achievement test among class VI students.

H_{03} : There is no relationship between Post-test and Retention test scores of mathematics achievement test among class VI students.

After analysing the data it is found that Smart-classroom teaching method helps in enhancing the achievement of students in mathematics in comparison to the conventional classroom teaching method. Also, found that, there is a *positive* relationship between Pre-test and Retention test scores which means there is a positive relationship between the mean scores of Pre-test and Post-test marks. That is, achievement scores get enhanced after the treatment is successfully employed.

And,also there is a *positive* relationship between Post-test and Retention test scores of mathematics achievement test among class VI students. That is, smart-classroom teaching methodology is helpful in enhancing the memorization level for mathematics in students.

Null hypothesis which is are *accepted* after the analysis of the data are as follows:

H_{04} : There is no significant difference between male and female students on Pre-test score of mathematics achievement test.

H_{05} : There is no significant difference between male and female students on Post-test score of mathematics achievement test.

H_{06} : There is no significant difference between male and female students on Retention test score of mathematics achievement test.

This suggests that there is no difference in performance of students of class VI in mathematics on the basis of gender i.e. gender has nothing to do with the achievement in mathematics in class VI students.

Conclusions

The present study provides very important recommendations for teacher's training institutions. Emphasizing on the spatiotemporal needs of the society, it is very important that during pre-service teacher training, future teachers should master the smart-classroom technology as the evolution of information and communications technology and it's induction in the education is the justifiable truth, which no one can deny . The in-service training may also be given to the existing teachers to teach them the skills for smart-classroom teaching which will increase the efficiency because when assimilation of technology and experience of teachers get intertwine it will be helpful for the education system and also it will help the teacher in matching the pace with technological advancement from time-to-time.

Educational Implications of the Study

The present study shows that infusion of smart-classroom teaching method in education system improves the quality of teaching-learning process in the efficient way. It also improves the achievement and retention in mathematics in a significant way. Earlier the teacher who used to be the only source of information now can be equipped with the modern skills of smart-classroom teaching and can act as a facilitator in the teaching-learning process who can provide the whole world of knowledge in the classroom.

It is a thing of the past when teaching and learning were restricted to the traditional classroom sessions environment prominently with white chalk, duster and blackboard. Now with the induction of information and communications technology in the education system, teachers along with students can anytime access to the expansive world of online information. Also, the digital tools enable the teacher to make respective topic more interesting and add the peculiarity in the explanation which helps the students to understand the respective topic better.

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APPENDIX

Appendix A: Tool of study

Achievement Test

MATHEMATICS TEST **MAX.MARKS:20**

DURATION:20min.

NAME…… CLASS …… ROLL.NO. ……

A. Tick mark the correct answer. **(7 × 1)**

1. The successor of the number 36 is

(a) 34 (b) 35 (c) 37 (d) 38

2. The predecessor of the number 20 is

(a) 18 (b) 19 (c) 21 (d) 22

3. The place value of the underlined digit **2**96 is

(a) Two (b) Ones (c) Tens (d) Hundreds

4. The product of 9 × 13 is

(a) 127 (b) 117 (c) 107 (d) 97

5. 24 ÷ 4 equals to

(a) 6 (b) 8 (c) 10 (d) 12

6. Round off of 24 to the nearest ten is

(a) 10 (b) 20 (c) 30 (d) 40

7. Roman numeral for 50 is

(a) V (b) X (c) L (d) C

B. Choose the correct mathematical form. **(7 × 1)**

1. The sum of x and 7 is

(a) x -7 (b) x (c) x + 7 (d) y + 7

2. m decreased by 8

(a) m - 8 (b) m + 8 (c) 8 - m (d) 8m

3. 6 times n

(a) 3n (b) 6 + n (c) $6n^2$ (d) 6n

4. Product of 3 and q

(a) 3q (b) 3 + q (c) 3 - q (d) 3 ÷ q

5. The square of the radius r

(a) r (b) 2r (c) r^2 (d) r^3

6. 3 more than 5 times z

(a) 5z + 3 (b) 3 > 5z (c) 5z < 3 (d) 5z = 3

7. Two times p is greater than q

(a) 2p < q (b) 2p > q (c) $p^2 > q$ (d) p > 2q

C. Fill in the blank with correct option. **(4 × 1)**

1. 1 thousand = _____Hundreds. (10 / 100)

2. 53 _____ 52. (> / <)

3. The literal factor in **-8x** is _____.(-8 / x)

4. **ab** is a _____. (Monomial / Binomial)

D. If x = 5, y = 6 and z = 10, find the value of **xy ÷ z** . **(1)**

(a) 1 (b) 2 (c) 3 (d) 4

E. The cost of a Pencil is Rs. 5.Find the cost of 12 Pencils. **(1)**

(a) Rs.7 (b) Rs.17 (c) Rs.70 (d)Rs.60

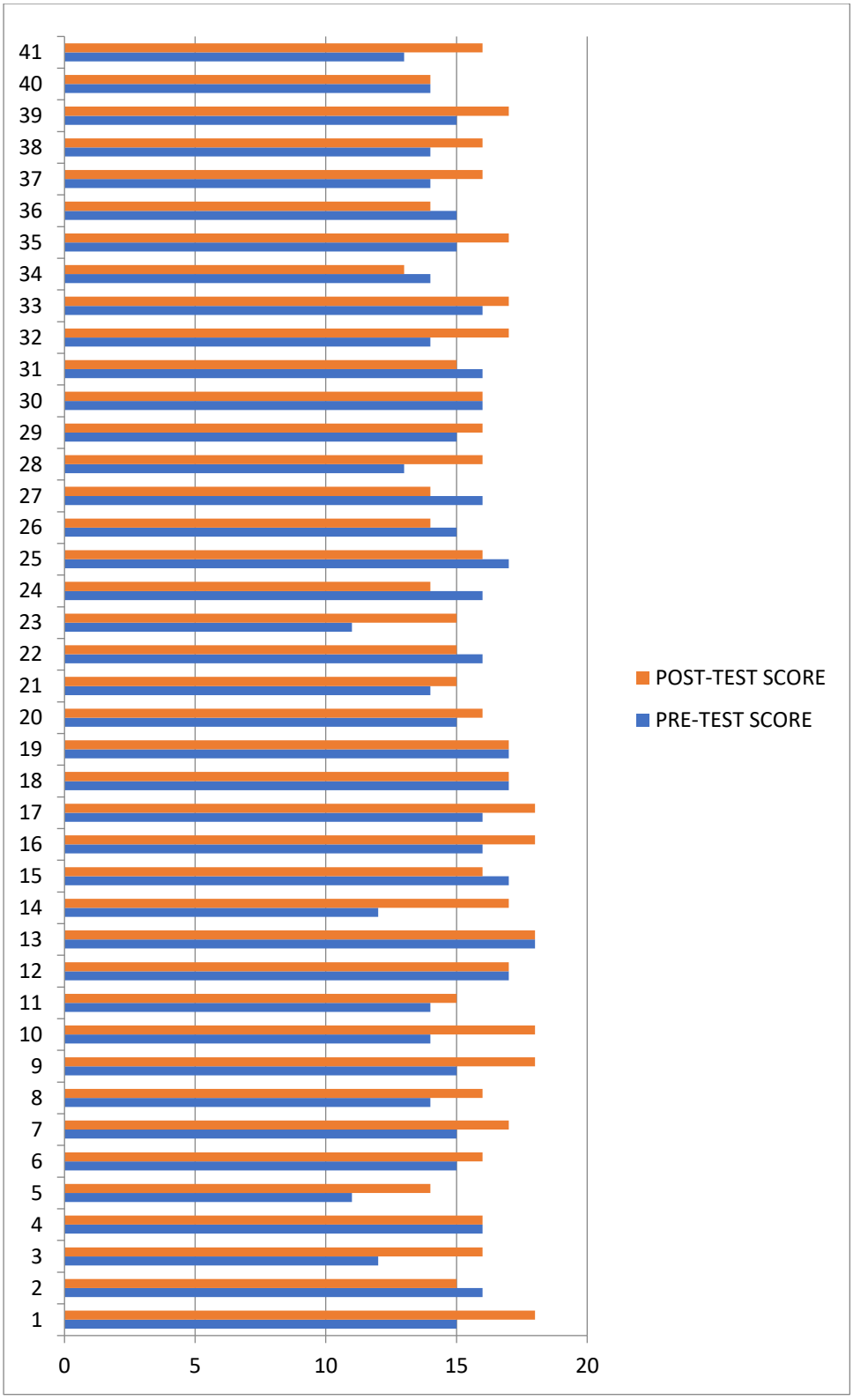
Appendix B: Raw Data

S.No.	Name	M.M.	Pre-Test Marks	Post-Test marks	Retention Marks
1.	AMNA BANO	20	15	18	16
2.	ABHINAV RAWAT	20	16	15	15
3.	ABHISHEK GUPTA	20	12	16	16
4.	AKASH VERMA	20	16	16	16
5.	ALIFIYA HAMEN	20	11	14	12
6.	ANSHIKA SINGH	20	15	16	16
7.	ANUSHKA RAWAT	20	15	17	17
8.	APARNA	20	14	16	16
9.	ASHWANI PATEL	20	15	18	17
10.	FAIZ KHAN	20	14	18	17
11.	FARUKH ALI	20	14	15	16
12.	HARSHIT MEHROTRA	20	17	17	16
13.	IFFAT MARIYA	20	18	18	17
14.	JAYA YADAV	20	12	17	17

15.	KRISHNA BHATT	20	17	16	16
16.	LAIBA KHAN	20	16	18	16
17.	MANTASHA KHAN	20	16	18	16
18.	MASIHULLAH	20	17	17	17
19.	MD. AMAAN I	20	17	17	16
20.	MD. AMAAN II	20	15	16	16
21.	MD. ARAISH	20	14	15	16
22.	MD.ASAD QURAISHI	20	16	15	15
23.	MD. AYAN	20	11	15	15
24.	MD. DAUD I	20	16	14	15
25.	MD.HAMMAD KHAN	20	17	16	17
26.	MD. KAIF	20	15	14	15
27.	MD. LARAIB KHAN	20	16	14	18
28.	MD. SAMEER	20	13	16	16
29.	MD. SIBGAT	20	15	16	16
30.	NISHA	20	16	16	19
31.	PIYUSH THAPA	20	16	15	15
32.	SALIHA RIZWAN	20	14	17	17
33.	SHADMAN KHAN	20	16	17	17

34.	SHOBIT KUMAR	20	14	13	15
35.	SIDDHARTH BHATT	20	15	17	18
36.	SRISHTI VERMA	20	15	14	16
37.	SURYANSH BHATT	20	14	16	16
38.	TAMISH SHOEB	20	14	16	16
39.	VAIBHAV SRIVASTAVA	20	15	17	17
40.	VISHU SINGH	20	14	14	17
41.	ZARGAN ABBASI	20	13	16	17

Tab.A.1: Pre-test, Post-test and Retention Marks of Class VI students



Graph A.1: Scores of Pre-test and Post-test of achievement test of students of class VI

Appendix B1

S.No.	Name	M.M.	Pre-Test Marks	Post-Test marks	Retention Marks
1.	AMNA BANO	20	15	18	16
2.	ALIFIYA HAMEN	20	11	14	12
3.	ANSHIKA SINGH	20	15	16	16
4.	ANUSHKA RAWAT	20	15	17	17
5.	APARNA	20	14	16	16
6.	IFFAT MARIYA	20	18	18	17
7.	JAYA YADAV	20	12	17	17
8.	LAIBA KHAN	20	16	18	16
9.	NISHA	20	16	16	19
10.	SALIHA RIZWAN	20	14	17	17
11.	SRISHTI VERMA	20	15	14	16

Tab.A.2: Pre-test, Post-test and Retention test scores of Girls of Class VI students

S.No.	Name	M.M.	Pre-Test Marks	Post-Test marks	Retention Marks
1.	ABHINAV RAWAT	20	16	15	15

2.	ABHISHEK GUPTA	20	12	16	16
3.	AKASH VERMA	20	16	16	16
4.	ASHWANI PATEL	20	15	18	17
5.	FAIZ KHAN	20	14	18	17
6.	FARUKH ALI	20	14	15	16
7.	HARSHIT MEHROTRA	20	17	17	16
8.	KRISHNA BHATT	20	17	16	16
9.	MANTASHA KHAN	20	16	18	16
10.	MASIHULLAH	20	17	17	17
11.	MD. AMAAN I	20	17	17	16
12.	MD. AMAAN II	20	15	16	16
13.	MD. ARAISH	20	14	15	16
14.	MD.ASAD QURAISHI	20	16	15	15
15.	MD. AYAN	20	11	15	15
16.	MD. DAUD I	20	16	14	15
17.	MD.HAMMAD KHAN	20	17	16	17
18.	MD. KAIF	20	15	14	15
19.	MD. LARAIB KHAN	20	16	14	18
20.	MD. SAMEER	20	13	16	16

21.	MD. SIBGAT	20	15	16	16
22.	PIYUSH THAPA	20	16	15	15
23.	SHADMAN KHAN	20	16	17	17
24.	SHOBIT KUMAR	20	14	13	15
25.	SIDDHARTH BHATT	20	15	17	18
26.	SURYANSH BHATT	20	14	16	16
27.	TAMISH SHOEB	20	14	16	16
28.	VAIBHAV SRIVASTAVA	20	15	17	17
29.	VISHU SINGH	20	14	14	17
30.	ZARGAN ABBASI	20	13	16	17

Tab.A.3: Pre-test, Post-test and Retention test scores of Boys of Class VI students