

SUMMARY

Introduction

“In the current era is of globalization, the large scale use of technologies has narrowed the universe in more ways than one can imagine. For example, the way industries and economies have substantially changed. The speedy transfer of data and information has made possible cross-border cooperation to be more successfully executed, thus facilitating businesses to be run more handsomely and successfully. Outsourcing thus becomes common and as a result new economies such as those of India, China and Brazil have flourished. Technology has contributed and in some cases caused complete shift in the way business used to be operated in past. Creative and critical thinking as well as problem solving skills are now in great demand. There is a great demand of human resource that must be developed; educators are also practicing these new skills in educational settings. The inclusion of information and communication technologies (ICTs) in teaching learning process has revolutionised it and has produced a more educated and skilled knowledge-based work force” (Friedman, 2006).

“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 processes. ICTs provide a variety of powerful tools that may help in converting the ongoing isolated, teacher-dominated and bookish classrooms into attractive, student-dominated interactive knowledge environments” (The UNESCO World Education Report, 1998).

“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).

“A lot has been said regarding the use of film, radio, telephones and television in teaching learning because use of digital tools, applications and networks continues to grow throughout world and media are readily available in digital form, ICT-use in
teaching learning can be expected to increase dramatically. Recent innovations in information and communication technologies (ICTs) have brought new challenges for teaching learning that 21st century means more than basic reading, writing and computer skills in the context of modern life” (C.F. Cuban, 1986; De Korte, 1967).

“The illiterate of 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn.”

In the ongoing situation, this demand of technically skilled youths & professionals are in demand year after year. Technically trained people in the 21st century should know the way of using ICT tools e.g. PC’s, internet and its related technologies, plus audio, video, and other media and multimedia equipments which facilitate masses to work efficiently at workplace and in their day to day lives, using such tools like spread sheets for calculation, budgeting and building scenarios, graphic and multimedia softwares for presentations; data bases for research; and networks for establishing contacts with others.

A common reason that results in the use of ICTs in the classroom has been to train the young generation of learners efficiently for a workplace where ICTs, particularly computers, the internet and other commonly used technologies, are becoming common. Technological efficiency, or the ability to use ICTs effectively and efficiently, is thus seen as a competitive edge in a progressively globalized world of work force.

Engauge, North Central Regional Educational Laboratory (U.S.) says, “We have framed what we call 21st Century Skills, which include digital age literacy (comprising of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy and global awareness), innovative thinking, higher level thinking and sound reasoning, effective communication and high productivity. The capacity of ICTs to promote the learning of these skills is related to their use as a tool for establishing educational equity, including promotion of a learner-centered approach”.

Internationally, the worth of using ICTs in teaching learning, specially, smart learning has already been established. It has been completely realised that smart technologies have the capacity to provide more valuable and efficient and effective learning for all, everywhere and all time with all time interactivity, which is not possible with the help of traditional face-to-face class room learning. As a result, learners from countries who have
not adopted ICTs in teaching learning are left behind and as a result serious skill and cognitive difference.

“It is perhaps a wonderful opportunity in the present scenario for us that a technology of potential to enable education for all, everywhere and all time, has become a reality. The process of converging the globe into a global village is something that has brought in a paradigm shift in the way future economies will develop. It is this very quality that requires nations to use ICTs in the everyday lives of their people. The sooner it is done, the better it would be for countries to become part of the global information society. Technology has become a part of nearly everything we do. But does it have a place in the teaching learning process”? (www.csdms.in)

**Student Curiosity and its Effects on Learning**

Syracuse University School of Information Studies conducted a research investigating curiosity and the role it plays in student learning; directly affecting motivation, engagement, and interest. The study suggests researchers to find new ways to study and develop curiosity through the use of information technologies.

“If parents and educators do not recognize the role of curiosity in both informal and formal learning environments, how will they know when curiosity has the potential to enhance a learning experience versus when it may actually distract from learning” (Arnone, 2011 p. 184)?

Arnone states that not sufficient current research exists on the role curiosity plays on learning. There is a history of research that was done in the 1950’s up through years until the 1980’s, but this research is much before the large scale use of computer technologies in classrooms. Studies from Berlyne, Beswick, Tallmadge, White, Deci, and Piaget are all post dated 1970s or later. The only studies 1980 or newer mentioned by Arnone are from Reio et al, Litman and Jimerson, Tapscott, Palfrey and Gasser. These newer studies investigate the structure of curiosity deeper; attempting to find out causes. Alessi (2001), mentions motivational studies done by Leeper and Malone in the 1980’s and makes a differentiation between sensory and cognitive curiosity. “Sensory curiosity is stirred by ocular or auditory effects that are surprising or attractive attention. Cognitive curiosity is aroused by information that conflicts with the learner’s present knowledge or
expectation, is contradictory, or is in some way incomplete. These situations motivate the learner to search for new information that rectifies the conflict” (Alessi, 2001 p. 25).

Arnone gives a different definition of curiosity as “a desire for new information or experience afforded by new media environments and includes a trigger or multi-trigger scenario evoked by dynamic media environments” (p. 185).

“The desire starts a reaction and a resolution (satisfied or non-satisfied). If the learner is satisfied, new learning will take place; further increasing student interest. Arnone argues that curiosity is affected by personal, situational, and contextual factors. Examples of personal factors are the learners own motivation, competence, developmental differences, and cognitive abilities. Situational factors refer to the “in the moment” factors which tempt curiosity such as personality, predispositions, emotions, etc. Contextual factors are the “setting” factors such as a classroom, or online learning environment which would influence the curiosity” (Arnone, 2011).

Smart Technologies and Student Learning

“Used effectively, technology can play a role in exhilarating curiosity and interest and in facilitating and holding up purposeful engagement. More ever, technology can play a role in triggering and addressing personal, situational, and contextual factors that support autonomy and competence and enhance active, deep learning” (Arnone, 2011 p. 182).

Smart technologies are being used because they are said to “enhance learning” by arousing student “interest” through “active participation” (Smart Technologies). Theoretically, we should be able to see how Smart Board affects all three forms of engagement (affective, participative, and cognitive) since student interest does not fully develop until at the highest level of engagement according to Arnone’s model. Since Smart Board claims to increase student participation, there is the possibility that it even increases student interests through the affective and participative domain.

A common finding is that Smart technologies motivate students to learn through active participation and engagement. Motivation is hard to measure but is categorized as either being intrinsic or extrinsic according to Malone’s Motivation Theory (Alessi, 2001, p.
Extrinsic motivation may help to explain the reasons for affective and participative engagement. There is usually some external source (reward) that encourages the learner to participate. Extrinsic motivational tactics are said to be the least affective because the rewards become the focal point of the learner’s interests rather than the learning content. (Alessi, 2001, p. 26). However, they may be the best way to get students engaged that normally wouldn’t be.

In contrast, intrinsic motivation is highly effective and described as rewards that “come from within the person” (Alessi & Trollip, 2001, p. 25). This is the cognitive engagement that occurs when the learner has developed self-interest in the learning content and therefore finds satisfaction investigating the content deeper. There are four primary elements that further motivate intrinsic learners: challenge, curiosity, control and fantasy (Alessi & Trollip, 2001, p. 25).

“The more a program includes these four elements, the more successful learning is because people enjoy it more” (Alessi & Trollip, 2001, p. 25).

Why to Evoke Curiosity in a Classroom?

There are many reasons why an educator would want to evoke curiosity in a classroom. Students that become curious develop an interest in the learning material. Once student interest is captured students are more likely to be involved and fully engaged; further helping to establish a learning environment with less behavior problems (Arnone, 2011) which in turn minimise distractions.

Studies have suggested that varying between curiosity questions and the phases of interest can lead to better student engagement and deeper levels of learning (Arnone, 2011). As an educator, one of the goals we are taught is to strive to make students progress to higher levels of thinking and apply that knowledge to create and evaluate content.

Role of Smart Technologies in Instruction of Specific Content Areas / Skills

Van Daal et al. (2000) demonstrated, “Kindergarten children, given a reading and spelling program, dramatically improved their performance, relative to peers not given access to the same program”. Similar positive results are reported by Nixon-Ponder (1999).
“A National Survey of teachers was conducted and concluded that teachers report improvement in children’s writing as a result of the use of a computerized programme” (Becker, 2000). Sadiah (2003) and Sharifah et al. (2001) “found that students provided with animated mode of lesson presentation using power point not only improved students’ performance but also enhanced their interest in learning biology”. Hennessy et al. (2001) “too reported a positive effect of ICT on the students’ interest in biology”.

“The developed software in Chemistry for standard XI science students was found to be effective in terms of academic achievement of the students. The students and teachers were found to have favourable opinion towards the software package” (Anjali Khir Wadkar, 1999).

“The use of computer technology and graphing instruments in a weather project increased student motivation, enjoyment and understanding of graphing technique” Hennessy (2000).

Koetter et al. (1990) found, “through systematic evaluation that, although the use of computers to teach geography concept was viable, the 5th grades students responded most positively and performed best with live instruction”. Yusuf (1994) found, “7th and 8th graders had a significantly deeper understanding of Fundamental geography concepts with computerized instruction than that of the control group”.

Role of Smart Technologies in Schools

Discussing about the present state of teaching learning nearly one hundred years ago, Dewey (2001) noted:

“From the view point of the child, the great waste in school may come from his inability to utilize the experience he gets outside…while on the other hand, he is unable to apply in daily life what he is learning in school. This is the isolation of the school – its isolation from life”.

“Now a day, there is a great change in schools, of which much can be credited to technological advances occurring in our world today, including access to an abundance of information, and advances in computers, the internet, communications and networking. A New York author gave the term digital native to refer to these new learners born into a
world of technology and they think and act differently than students in the past who grew up without technology” (Prensky, 2001).

Start of technology can be seen as the driving force in development and education is promoted as a means to change from an industrial age to an emergent information age. Schools are under pressure to provide access to the educational technology as quickly as possible (Cuban et al., 2001). School is the core of learning and epicenter for development of any society and nation. The secondary schools in India work in a variety of academic and social contexts. Equipping institutions with smart technologies promises a high return on investment as Information Communication Technology (ICT) is the faster growing field in India. Secondary education is a deciding stage in the educational hierarchy as it prepares the students for higher education and also for the world of work. McFarlane (1999) studied, “the introduction of integrated learning system (ILS) into schools found improved teacher attitudes and use of computers. Technology is most influential when incorporated with curriculum and assessment. It can have the greatest impact when unified with curriculum to attain clear and measurable educational objectives. Unification of technology with curriculum and professional growth enhances students’ achievement. Significant student achievement gains for technology integrated with standards were demonstrated by an eight year longitudinal study of SAT1, performance at New Hampshire’s Brewster Academy. Students participating in the technology unified with school reform efforts (School design model) demonstrated average increases of 94 points in combined SAT1 performance over students who participated in the traditional independent school experience”.

**Smart Technology and the Teacher**

According to Fullan (1991), “*Educational change depends on what teachers do and think. It is as simple and as complex at that.*”

“In classrooms today, the role of the teacher needs to change from the traditional role of prescriptor to that of orchestrator of learning – which necessitates the designing of ICT integrated classrooms promoting higher order cognitive skills” (Fullan, 1991).

“Teachers are rich resources in the implementation of any innovation, for they bring with them rich practical know-how of the classroom, for example, the Japanese
lesson study approach has shown that classroom-based material developed jointly by teachers and external consultants provide resources that can be practically used in the mathematics lessons” (Isoda, et al. 2007).

“Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and much of it is available to students as well as teachers at the same time” (Perraton et. al.2001). “As new concepts of learning have evolved, teachers are expected to facilitate learning and make it meaningful to individual learners rather than just to provide knowledge and skills. Modern developments of innovative technologies have provided new possibilities to teaching profession, but at the same time, have placed more demands on teachers to learn how to use these new technologies in their teaching” (Robinson and Latchem, 2003).

**Educomp Smartclass**

“Educomp Smartclass, is a technology solution within the classroom that has revolutionized teaching and learning, across over 10,000 schools, reaching out to millions of students. Using mapped to curriculum 2D-3D digital content across all school subjects it has, (as testified by a Dun and Bradstreet research) paved the way for vastly improved teaching learning outcomes. For learners it has meant aroused interest levels, more engagement, and yes better comprehension of critical concepts. For teachers it has meant ease of facilitation and superior teaching outcomes. It’s a unique solution, with four interlocked components:

1) Content- Educomp smartclass ‘Class transformation System (CTS)’ is arguably the most versatile application that covers every aspect of the teaching learning process. Over half a million teachers have been benefitting from its meticulously mapped to curriculum instructor led Digital Content. CTS is also equipped with highly effective facilitation tools including, Teaching Ideas, MCQ bases Assessments, Diagram Maker, Mind-Maps, Simulations, Worksheets, Topic Synopsis and a vast directory of topic relevant weblinks.

2) Technology – ‘Digital Teaching System(DTS)’ is a proprietary hardware with built-in computing, interactivity, power back-up, stereo speakers and a Document camera. DTS is designed keeping stringent conditions of classrooms in mind.
3) Academic Support – A dedicated ‘Academic Support Group (ASG)’, ensures that schools adopting Educomp smartclass are able to make a smooth transition to the digital learning environment. Teachers are trained to handle hardware and structure lesson plans around digital content. Vriti, set of processes, ensures optimal use of Smartclass.

4) Affordability - For mass adoption model, Educomp offers smartclass at affordable monthly installments to schools” (www.eletsonline.com).

**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 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.

**Need of the Study**

“Smart Technology offers many benefits to enhance education. Most importantly, technology integration has the potential to increase student motivation (Anderson, 2000).”
The research studies of Brophy (1983); Meece (1991); Miller & Meece (1999) indicate, “Smart Technologies empower learners by engaging them in the learning process. The nature of the task shifts from teacher centered to student-centered. Research indicates that challenging and engaging academic tasks that build upon students’ prior knowledge and enable students to construct their own understanding of the content are more apt to enhance student motivation and increase student self-confidence in the cognitive abilities.”

Research also identifies the benefits of smart technology integration as the technical aspects to improve the quality of work, encourage resources within reach, positively impact student learning, and improve student meta-cognitive skills (Heafner & McCoy, 2001; Scheidet, 2003).

Levin (2005) acknowledged, “the ways people live, work and communicate are already being changed through ICT. First, the way people live and work is changing.”

For modern learners, there is a much greater need for understanding of modern world and its diverse cultural awareness. So, today’s learners no longer want to be passive recipients in the information transfer model of learning. Rather they want to be active participants in the learning process.

As noted by Driscoll (1994), “we no longer can view learners as empty vessels waiting to be filled, but rather as active organisms seeking meaning.”

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’”.

Because of concerns about low levels of mathematical attainment, new recommendations for classroom practices have emerged over the last decade that aimed at allowing students to understand mathematics concepts, rather than memories facts. This focus on the Learner’s role in mathematics understanding began the development of reforms in mathematics instruction programs that attempted to incorporate new skills of thinking and working in mathematics. Both curriculum and methodology in mathematics classrooms moved from a behaviourist approach using role learning and practices examples towards an interactive problem-solving approach in specific contexts.

In the modern world, pedagogues need to be kitted out not only with subject expertise and effective teaching techniques but with the capacity to support learners to meet demand of the emerging knowledge based society with new forms of smart technology and need to have the skill to use that smart technology to improve the quality of learning.

The search for methods to integrate smart technology into mathematics education is influenced by two main factors. First is the explosion of smart technologies that is influencing all spheres of human life and the development of human resource. Knowledge-based workers need to be smart technology savvy as well as having critical and creative thinking skills. Second is the mathematics education reform that is now emphasizing the development of mathematical processes. With the emphasis on mathematical process, the scope of the use of smart technology in the mathematics classroom has, in fact, increased. With smart technology, boring calculations are easily solved, multiple examples of geometric figures effortlessly produced. Combined with
variety of visuals, smart technology as a result provides an approach of realizing classroom lessons that encourage mathematics thinking.

The use of smart technology can, in fact, make easier the latest reform of mathematics, teaching designs that focus on mathematical processes as it offers quick and accurate calculations as well as moving visuals as those found in geometry and graphs. This then provides learners and teachers more time to emphasise on the mathematical processes in the classroom. Learners can develop and demonstrate more understanding of mathematical concepts and are able to deal with more advanced mathematical contents than in ‘traditional’ teaching environments.

During the last twenty years, investigators have become more concerned about the important role teachers play for learner’s achievement, with the implicit supposition that better teacher performance in terms of mathematical subject knowledge, teaching methodology and technology integration in addition to the knowledge about research outcomes would sufficiently prepare teachers for an easy and effective integration of smart technology into their classrooms. Hence, the need for the study effect of Educomp Smartclassroom on the achievement & retention in Mathematics at Elementary level.

**Statement of the Problem**

“Effectiveness of Educomp Smartclassroom on the Achievement and Retention in Mathematics at Elementary Level”

**Operational Definitions of the Key Terms**

A few terms have been frequently used that have got specific meaning for the present investigation. Given below are the operational definitions some of such key terms.

**Educomp Smartclass**: Educomp Smartclass is a new technology based digital trailblazer plan invented by Educomp 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 administering the Mathematics Achievement Test.

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

Objectives of the Study

1. To develop an Achievement test in Mathematics for VIII Graders.

(A) Objectives Related to Achievement In Mathematics

2. To compare the effect of Educomp smart classroom and conventional classroom teaching on achievement in mathematics among VIII graders.

3. To compare the effect of Educomp smart classroom and conventional classroom teaching on the achievement in mathematics among male VIII graders.

4. To compare the effect of Educomp smart classroom and conventional classroom teaching on the achievement in mathematics among female VIII graders.

5. To compare the mean Achievement scores of male and female VIII graders in mathematics to be taught through Educomp Smart Classroom teaching.

6. To compare the mean Achievement scores of male and female VIII graders in mathematics to be taught through Conventional Classroom teaching.

7. To compare the effect of Educomp smart classroom and conventional classroom teaching on the academic achievement in mathematics among urban VIII graders.

8. To compare the effect of Educomp smart classroom and conventional classroom teaching on the academic achievement in mathematics among rural VIII graders.

9. To compare the mean Achievement scores of urban and rural VIII graders in mathematics to be taught through Educomp Smart Classroom teaching.

10. To compare the mean Achievement scores of urban and rural VIII graders in mathematics to be taught through Conventional Classroom teaching.

(B) Objectives Related to Retention In Mathematics

11. To compare the effect of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among VIII graders.
12. To compare the effect of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among male VIII graders.

13. To compare the effect of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among female VIII graders.

14. To compare the mean Retention scores of male and female VIII graders in mathematics to be taught through Educomp Smart Classroom teaching.

15. To compare the mean Retention scores of male and female VIII graders in mathematics to be taught through Conventional Classroom teaching.

16. To compare the effect of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among urban VIII graders.

17. To compare the effect of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among rural VIII graders.

18. To compare the mean Retention scores of urban and rural VIII graders in mathematics to be taught through Educomp Smart Classroom teaching.

19. To compare the mean Retention scores of urban and rural VIII graders in mathematics to be taught through Conventional Classroom teaching.

Hypotheses

(B) Hypotheses Related to Achievement In Mathematics

1. There will be no significant difference in the effects of Educomp smart classroom and conventional classroom teaching on the achievement in mathematics among VIII graders.

2. There will be no significant difference in the effects of Educomp smart classroom and conventional classroom teaching on the achievement in mathematics among male VIII graders.

3. There will be no significant difference in the effect of Educomp smart classroom and conventional classroom teaching on the achievement in mathematics among female VIII graders.
4. There will be no significant difference in the mean achievement scores of male and female students in Mathematics to be taught through Educomp Smart Classroom teaching.

5. There will be no significant difference in the mean achievement scores of male and female students in Mathematics to be taught through conventional classroom teaching.

6. There will be no significant difference in the effects of Educomp smart classroom and conventional classroom teaching on the academic achievement in mathematics among urban VIII graders.

7. There will be no significant difference in the effect of Educomp smart classroom and conventional classroom teaching on the academic achievement in mathematics among rural VIII graders.

8. There will be no significant difference in the mean achievement scores of urban and rural VIII graders in Mathematics to be taught through Educomp Smart Classroom teaching.

9. There will be no significant difference in the mean achievement scores of urban and rural VIII graders in Mathematics to be taught through conventional classroom teaching.

(B) Hypotheses Related to Retention In Mathematics

10. There will be no significant difference in the effects of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among VIII graders.

11. There will be no significant difference in the effects of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among male VIII graders.

12. There will be no significant difference in the effect of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among female VIII graders.
13. There will be no significant difference in the mean retention scores of male and female students in Mathematics to be taught through Educomp Smart Classroom teaching.

14. There will be no significant difference in the mean retention scores of male and female students in Mathematics to be taught through conventional classroom teaching.

15. There will be no significant difference in the effects of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among urban VIII graders.

16. There will be no significant difference in the effect of Educomp smart classroom and conventional classroom teaching on the retention in mathematics among rural VIII graders.

17. There will be no significant difference in the mean retention scores of urban and rural VIII graders in Mathematics to be taught through Educomp Smart Classroom teaching.

18. There will be no significant difference in the mean retention scores of urban and rural VIII graders in Mathematics to be taught through conventional classroom teaching.

**Method of research**

The present study is an attempt to study the effect of Educomp Smartclass on the students’ academic achievements and retention in mathematics. It is obvious that the effect of Educomp Smartclass cannot be studied through survey or historical method. It needs an experimental setting. Keeping this thing in mind, the investigator used pre-test, post-test experimental method to conduct this study.

In the present study, pre-test post-test control group quasi experimental, design was employed with a purposive sample in the form of intact sections of class VIII of Navyug Public School, Sonipat (Haryana).
RESEARCH DESIGN

The study included a control group (40 students) and an experimental group (40 students). The experimental group was taught through Educomp Smartclass and the control group through traditional method.

The selected sections were equated on intelligence and socio-economic status.

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 of both groups on intelligence, socio-economic status, and achievement in mathematics. The second stage involved the experimental treatment, which consisted of two units of VIII grade mathematics taught through Educomp Smartclass used teaching and through traditional teaching to control group. The third stage dealt with post testing of the control and experimental group using the achievement test in mathematics. The fourth and the last stage were testing the retention in mathematics of the students.

**Dependent Variables**

Achievement in mathematics and retention in mathematics were taken as dependent variables. Achievement in mathematics was measured twice during the course of the study. First, before beginning the experimental treatment, i.e. at the pre-test stage and then, after completing the experimental treatment, i.e. at the post-test stage, where as retention was measured only after completing the experimental treatment, i.e. at the post-test stage.

**Intervening Variables**

There are certain variables known as intervening variables which have their effect on the learning outcomes, and influence both independent and dependent variables. Intervening variables such as nature of school, grade level, subject to be taught, intelligence of pupils, socio-economic status of pupils, previous knowledge of pupils etc. were successfully controlled experimentally.

**Control Employed**

It is necessary to control all those variables that may significantly affect the dependent variables. Hence, such intervening variables were controlled by employing suitable controls.
1. **Nature of school**
The sample was selected from a single English medium public school i.e. Navyug Public School, Sonipat (Haryana) affiliated to CBSE.

2. **Grade Level**
Only VIII class students were selected for the study and grade level was thus kept constant during the study.

3. **Teacher Behaviour**
The investigator herself taught the content to both the experimental and the control group i.e., inter-teacher variation was eliminated. She herself outlined the entry level behaviour, prepared achievement test, lesson plans etc. Hence there was equal familiarity with all the treatments.

4. **Subject**
The two groups were taught same two units of mathematics of class VIII NCERT prescribed text book i.e. Algebraic Expressions & Identities and Understanding Quadrilaterals.

5. **Socio-Economic Status**
The experimental group and the control group were given S.E.S. Test. t-test was applied to find out the difference between S.E.S. test scores of the two groups.

**POPULATION AND SAMPLE**
The term ‘Population’ is used in research to describe any group of individuals, events or observations in which the researcher is interested. In the present study, the term population refers to class VIII students studying in English Medium Public Schools of Sonipat district of Haryana.

**PROCEDURE FOLLOWED**
Procedure of the experiment comprised of two main stages, that is, selection of the sample and conducting the experiment.

**Stage1: Selection of the sample**
The sample of the study comprised of 80 students of class VIII (40 as control group and 40 as experimental group) studying in Navyug Public School, Sonipat (Haryana).
Selection of Experimental Group:
For the experimental group, a total of 40 learners studying in VIII standard, section A was chosen from Navyug Public School, Sonipat (Haryana).

Selection of Control Group: The control group consisted of 40 learners studying in VIII standard; section B of the same school. The group was exposed to traditional method of instruction. No novel treatment was given to the control group of students.

Stage2: Conducting the experiment
The experiment consisted of four phases:

Phase I: Administration of the Pre-test
Before the start of the experiment, the sample subjects were contacted and rapport was established with them. They were oriented about the tests to be used. Three pre-tests i.e., S.E.S., Intelligence, Achievement Test were administered to the students of two groups by the researcher herself. The class teacher co-operated the researcher for administering the tests properly. The instructions pertaining to the tests were explained verbally in clear terms to the students before administering the test. The administration of the tests was carried out as per norms and instructions contained in respective test manuals.
After this, the students of both the groups were provided orientation and instructions about the treatment to be allotted to them to get over the anxiety and curiosity of the students. The students of the experimental group were given a trial of their respective materials, which helped them in getting over the curiosity and anxiety around via the electronic system being applied in the classroom setting. The students of the control group were also made familiar about the objectives, etc, of the tests to elicit their cooperation in the conduct of the study.

Phase II: Conducting the Instructional Programme
The second phase of the experiment was the real execution of the experiment. In this phase, the experimental group students were taught by Educomp Smartclass teaching and the control group students were taught by traditional method of teaching. The instructional treatment was given about 40 days to the experimental group, where as the control group was taught by the traditional method for the same period of time. Same content was taught to both the groups.
Phase III: Administration of Post-test
Immediately after the instructional treatment was over, the researcher tested the subjects of experimental group and control group on the dependent variables (Mathematics Achievement Test).

Date Schedule of the Instructional Phase for both the groups:
Phase 1: Pre-test Stage
01 April 2014-Administration of Achievement Test in Mathematics
Phase 2: Instructional Programme

Phase IV: Administration of Retention-test

STATISTICAL ANALYSIS
To achieve the objectives of the study, the data collected was statistically analysed using the following techniques:
1. Descriptive statistics such as mean and S.D worked out on the score of achievement in Mathematics.
2. ‘t’ value was computed in order to adjudge pupil’s intelligence and socio-economic-status.
3. ‘t’ test was employed for testing the significance of difference between the means of pupils’ achievement in mathematics on pre - test, post - test and gain scores.
4. t’ test was employed for testing the significance of difference between the means of pupils’ retention in answering the test questions in mathematics on pre - test, post - test and gain scores.

DESCRIPTION OF TOOLS
In the present research, the following tools were accordingly chosen or self – developed as per the requirement of the research:

A. Standardized Test
1. Group Test of Intelligence (GGTI) by Dr. G.C. Ahuja (1990)
B. Self developed Tools

3. Mathematics Achievement Test (Developed by investigator)

Main Findings

- The mean scores of achievement in mathematics of Educomp Smartclass teaching group are higher than Conventional Classroom teaching group. The Educomp Smartclass teaching helps in enhancing the achievement of students in mathematics in comparison to the conventional classroom teaching.

- The mean scores of achievement in mathematics of male students of Educomp Smartclass teaching group are higher than Conventional Classroom teaching group. The Educomp Smartclass teaching helps in enhancing the achievement of male students in mathematics in comparison to the Conventional classroom teaching.

- The mean achievement score of Educomp Smartclass teaching group is significantly higher than the mean achievement score of Conventional Classroom teaching group. The Educomp Smartclass teaching helps in enhancing the achievement in mathematics of female students in comparison to the conventional classroom teaching.

- The mean achievement score of Educomp Smartclass teaching group male and female students is comparable. Sex has nothing to do with the achievement in mathematics among VIII Graders using Educomp Smartclass.

- The mean achievement score of male students is 44.95, which is slightly higher than the mean achievement score of female students i.e. 43.45. Sex has nothing to do with the achievement in mathematics among VIII Graders using Conventional Classroom teaching.
• The mean achievement score of experimental group is 52.00, which is significantly higher than the mean achievement score of control group i.e. 43.85. It may therefore be concluded that Educomp Smartclassroom helps in enhancing the achievement of urban students in mathematics in comparison to the conventional teaching.

• The mean achievement score of experimental group is 50.95, which is significantly higher than the mean achievement score of control group i.e. 44.55. It may therefore be concluded that Educomp Smartclassroom helps in enhancing the achievement of rural students in mathematics in comparison to the conventional teaching.

• The mean achievement score of urban students is 52.00, which is slightly higher than the mean achievement score of rural students i.e. 50.95. It may therefore be concluded that Educomp Smartclassroom teaching helps in enhancing the achievement in mathematics of rural and urban students equally.

• The mean achievement score of urban students is 43.85, which is slightly lower than the mean achievement score of rural students i.e. 44.55. It may therefore be concluded that Conventional classroom teaching helps in enhancing the achievement in mathematics of rural and urban students equally.

• The mean achievement score of experimental group is 49.80, which is significantly higher than the mean achievement score of control group i.e. 40.075. It may therefore be concluded that Educomp Smartclass teaching helps in enhancing the retention of students in mathematics in comparison to the Conventional classroom teaching.
The mean retention score of experimental group is 50.10, which is significantly higher than the mean retention score of control group i.e. 40.85. It may therefore be concluded that Educomp Smartclass teaching helps in enhancing the retention of male students in mathematics in comparison to the conventional teaching.

The mean retention score of experimental group is 49.50, which is significantly higher than the mean retention score of control group i.e. 39.30. It may therefore be concluded that Educomp Smartclass teaching helps in enhancing the retention in mathematics of female students in comparison to the conventional classroom teaching.

The mean retention score of male students is 50.10, which is slightly higher than the mean achievement score of female students i.e. 49.50. It may therefore be concluded from the findings that sex has nothing to do with the retention in mathematics among VIII Graders using Educomp Smartclass teaching.

The mean retention score of male students is 40.85, which is slightly higher than the mean achievement score of female students i.e. 39.30. It may therefore be concluded from the findings that sex has nothing to do with the retention in mathematics among VIII Graders using Conventional Classroom teaching.

The mean retention score of experimental group is 50.45, which is significantly higher than the mean retention score of control group i.e. 39.80. It may therefore be concluded that Educomp Smartclass teaching helps in enhancing the retention in mathematics of urban students in comparison to the conventional classroom teaching.

The mean retention score of experimental group is 49.15, which is significantly higher than the mean retention score of control group i.e. 40.35. It may therefore
be concluded that Educomp Smartclass teaching helps in enhancing the retention in mathematics of rural students in comparison to the conventional classroom teaching.

- The mean retention score of urban students is 50.45, which is slightly higher than the mean retention score of rural students i.e. 49.15. It may therefore be concluded that Educomp Smartclassroom teaching helps in enhancing the retention in mathematics of rural and urban students equally.

- The mean retention score of urban students is 39.80, which is slightly lower than the mean achievement score of rural students i.e. 40.35. It may therefore be concluded that Conventional classroom teaching equally helps in enhancing the retention in mathematics of rural and urban students.

**Discussion of Results Related with Achievement in Mathematics**

The mean scores of achievement in mathematics of Educomp Smart classroom teaching group are higher than Conventional Classroom teaching group. The Educomp Smart classroom teaching helps in enhancing the achievement of students in mathematics in comparison to the conventional classroom teaching. The Educomp Smart classroom teaching helps in enhancing the achievement of male students in mathematics in comparison to the Conventional classroom teaching. The Educomp Smart classroom teaching helps in enhancing the achievement in mathematics of female students in comparison to the conventional classroom teaching. The mean achievement score of Educomp Smartclass teaching group male and female students is comparable. Sex has nothing to do with the achievement in mathematics among VIII Graders using Educomp Smartclass. The mean achievement score of male students is slightly higher than the mean achievement score of female students. Sex has nothing to do with the achievement in mathematics among VIII Graders using Conventional Classroom teaching. The mean achievement score of experimental group is
significantly higher than the mean achievement score of control group. It may therefore be concluded that Educomp Smart classroom helps in enhancing the achievement of urban students in mathematics in comparison to the conventional teaching. The mean achievement score of experimental group is significantly higher than the mean achievement score of control group. It may therefore be concluded that Educomp Smart classroom helps in enhancing the achievement of rural students in mathematics in comparison to the conventional teaching. The mean achievement score of urban students is slightly higher than the mean achievement score of rural students. It may therefore be concluded that Educomp Smart classroom teaching helps in enhancing the achievement in mathematics of rural and urban students equally. The mean achievement score of urban students is slightly lower than the mean achievement score of rural students. It may therefore be concluded that Conventional classroom teaching helps in enhancing the achievement in mathematics of rural and urban students equally.


Results Related with Retention in Mathematics

- Educomp Smartclass teaching helps in enhancing the retention of students in mathematics in comparison to the Conventional classroom teaching.
- Educomp Smartclass teaching helps in enhancing the retention of male students in mathematics in comparison to the conventional teaching.
- Educomp Smartclass teaching helps in enhancing the retention in mathematics of female students in comparison to the conventional classroom teaching.
- The mean retention score of male students is comparable with the mean achievement score of female students. It may therefore be concluded from the
findings that sex has nothing to do with the retention in mathematics among VIII Graders using Educomp Smartclass teaching.

- The mean retention score of male students is comparable with the mean achievement score of female students. It may therefore be concluded from the findings that sex has nothing to do with the retention in mathematics among VIII Graders using Conventional Classroom teaching.

- The mean retention score of experimental group is significantly higher than the mean retention score of control group. It may therefore be concluded that Educomp Smartclass teaching helps in enhancing the retention in mathematics of urban students in comparison to the conventional classroom teaching.

- The mean retention score of experimental group is significantly higher than the mean retention score of control group. It may therefore be concluded that Educomp Smartclass teaching helps in enhancing the retention in mathematics of rural students in comparison to the conventional classroom teaching.

- The mean retention score of urban students is comparable with the mean retention score of rural students. It may therefore be concluded that Educomp Smartclassroom teaching helps in enhancing the retention in mathematics of rural and urban students equally.

- The mean retention score of urban students is comparable with the mean achievement score of rural students. It may therefore be concluded that Conventional classroom teaching equally helps in enhancing the retention in mathematics of rural and urban students.

Ram Mehar & Anuradha (2014) in their research investigated the effect of smart class instructions on retention in Chemistry in relation to academic anxiety on IX class students selected from two different schools of Chandigarh (UT) and found similar results.

**Conclusions**
The study provides very important recommendations for teacher training institutions. Considering the present widespread use of Educomp Smart classroom at all gradess and
for all subjects, it is very important that during pre-service teacher training, future teachers should master the smart technology. NCTE and SCERTS should include Smart classroom as a mandatory facility in teacher training institutions so that future teachers could be skilled for smart classroom teaching. The future teachers will acquire the skill of smart technology during pre-service teacher training; in-service training may also be given to the existing teachers to teach them the skills for smart classroom teaching that is teaching efficiently, interestingly, technically and meaningfully.

**Educational Implications**

The present investigation shows that this shift from a traditional ‘*chalk and talk*’ method to Educomp Smartclass teaching method not only enriches teaching learning of the classroom, it also improves their achievement and retention in mathematics in a significant way. It shows that Educomp Smartclass teaching method proves to be more successful in its effectiveness on achievement and retention in comparison to the traditional classroom method. It proves more practical and is widely acceptable to learners. It also minimises individual differences and enables all types of learners to perform better. It has many other advantages.

- Educomp Smartclass can be substituted for almost anything in the classroom: blackboard, charts, book, TV, encyclopedias, models, map, library and many more.
- Educomp Smartclass can be used as a supplement in a large group classroom teaching. It is easier to control learners in Educomp Smartclass than in the traditional classroom.
- Educomp Smartclass can be used individually, in small or large groups by the teachers.
- Educomp Smartclass suggests a new role for the teacher. Earlier the teacher who used to be the only source of information for the passive learners in the classroom, has now changed to a facilitator in the teaching-learning process and brings a whole world of knowledge in the classroom:
  - Educomp Smartclass helps students in active learning.
  - Educomp Smartclass draws diagrams easily and accurately.
  - Educomp Smartclass takes the learners in real life situations.
The teacher can easily monitor the involvement of learners of all levels; high achievers, average and low level achievers and learners can be motivated for better performance.

Educomp Smartclass can be used to enhance teaching by presenting information in different ways and in different forms. Pupils can manipulate and make changes to information so that they can develop understanding of the relationship between different types of information or through the process of changing that information dynamically.

Educomp Smartclass used learning sessions in class may act as a source of edutainment (education plus entertainment) as well. The sessions may include games, recreational activities like solving puzzles and riddles, holding group discussions on some general topics related to current affairs to create more interest among students. So, teacher becomes more resourceful.

Important skills such as critical thinking, creative problem solving and synthesis of knowledge can easily be accomplished through Educomp Smartclass used learning in the class.

Findings of this research show that Educomp Smartclass can be considered as a big agent for change in education, and there is a possibility for research in this area of research. Educomp Smartclass used teaching can replace the traditional teaching methods and make it more effective. The findings show that Educomp Smartclass plays a very important role in Mathematics teaching-learning, so, educationists should develop clear understanding of the conditions, circumstances, means and mechanisms through which Educomp Smartclass can be closely connected to the young students and particularly for mathematics teaching.

**Suggestions for further Study**

- This study could be reproduced to find out how Educomp Smartclass teaching affects the various abilities of the students as cognitive, emotional, social, personal and motivational aspects.
- There is a need to investigate Educomp Smartclass used teaching method with other methods of teaching at different grade levels.
➢ The study could be reinvestigated on a larger sample for validation and for a longer duration of time to study the effects on non-cognitive variable like social skills or some personality variables which take more time to bring about a change.

➢ There is a need to study the combined effects of Educomp Smartclass used teaching with other institutional treatments.

➢ Research is needed to study the effect of Educomp Smartclass on special groups of learners e.g. gifted, the learning disabled and other special groups’ students.

➢ Research need to be conducted with school subjects other than mathematics and to find out the extent of effect of Educomp Smartclass on different school subjects.