Chapter – 1

INTRODUCTION

Education is the soul of a society as it passes from one generation to another. It is one of the vital and vibrant instruments in carving the personality of every individual so as to lead a better life in the knowledge society where he or she lives and it finally navigates them to transform the society. It is not constrained only to school text-books. But it is a holistic process and continues throughout an individual’s life so as to acquire the quintessence of universal values and it is the gradual and incessant process of his/her all-round development – physical, mental, aesthetic, moral, spiritual, social and economic aspects of human life. Society must view education also as an engine of advancement in an information era propelled by its wheels of knowledge and research leading to development rather than looking at education simply as a means of achieving social uplift. Every educated person has the ability to change the world with confidence and is assured of making the right moves.

Education not only imparts knowledge, skills and inculcates values, but also it is responsible for building human capital which breeds, drives and sets technological innovation and economic growth. On the platform of education, a teacher can develop his/her wards into a wholesome personality. In the digital era, information or knowledge stands out as an imperative and significant input for the growth and survival of an individual. The old methodology and technology of teaching a concept vary from the present one. To be competent with the teaching styles of foreign students whose curriculum is a techno-based one, the Indian teachers should also go with the spirit of teaching their wards via technology. Students live in the age of science which has brought about tremendous transformation in their learning style and education as well. They are closely linked with the digitalized global society from where they emerge. As they live in the digital era, they feel
the impact of science and technology. The growth of science has brought not only fundamental changes in ideas about the material world but also, through technology, a transformation in the society (Ramakrishnan, 2014). Science is considered to be one of the most important subjects of the students, right from their step one.

1.1 PROCESS OF TEACHING AND LEARNING

1.1.1 Teaching

Teaching is an art. It is not simply telling what the teacher has already learnt or experienced but it is the communication between two or more persons who influence each other by their ideas and learn something in the process of interaction. It has been carried out by human beings and even by animals to teach their young ones for successful adjustment in the environment. The process of teaching has undergone several changes from non-formal to formal. Teaching is conventionally understood by a traditional teacher in the act of disseminating information to the learners in the classroom. One may observe the teacher delivering information; the students reading from the text and others watching him/her silently and following it in their own text books in a traditional classroom. Perhaps, this is the way or manner of teaching by most of the teachers.

Over the past fifty years, a number of researches have been conducted on teaching-learning process. New methods and techniques have been developed on the basis of research findings. The stereotyped traditional teaching styles have been replaced by new strategies and innovative techniques in the last two decades. Students can benefit from these new methods and techniques if they are implemented in their classrooms. The art of teaching is not only imparting information but also making the pupils understand the concept in a better way. It can be achieved well when teachers are very enthusiastic to employ technology during the process of their
teaching. A shift from teacher-centred instruction is needed to enable students to acquire the new dimensions of knowledge and skills (Rani & Jose, 2013).

1.1.2 Learning

Learning is a process of growth, progress and improvement during which an individual acquires knowledge, habit, skills and attitudes which further change his/her behaviour. The direction of change is the key factor that has to be considered with great care. If the change takes place in positive direction, it may account for great improvement in the life of the students but if it is not navigated in a proper direction, it will have a degraded influence on the personality of the learner. Hence, this never ending process of learning should be propelled on the right path so that useful knowledge can be built by valuable information from every outlet, making this lifelong journey of learning more satisfactory.

The complex process of learning wraps nearly all domains such as cognitive, affective and psychomotor of the learner.

It is very essential to instil in students the purpose of learning and so they become motivated to learn constantly in the future as well. When they are really made to feel that learning is delightful, interesting and beneficial, their level of motivation will increase and it determines the success of learning. Another important factor that determines the outcome of learning is the opportunities students get to learn by different styles such as auditory, visual and kinaesthetic. The students are thrilled at the concept of innovative and interactive learning process (Rani, 2014). When teachers employ innovative techno-pedagogical practices in their classrooms, their wards may be driven to a different, inquisitive learning climate and it will create a change among students. Similarly, team learning is also considered to be an effective teaching strategy which provides the students ample opportunity in developing their learning spirit and leads them to be the responsible leaders of the society. Offering appropriate and timely feedback and reward or reinforcement to the students in their period of learning is also an effective practice to attain the ultimate goal.
1.1.3 Technology in the Modern Era

In the modern era, technology plays a very significant role. Education in the global village undergoes a massive transformation as a result of the digital revolution. Multitude of people learn their education with the assistance of new technologies; children play complex video games; workers interact with simulations that put them in challenging situations, students take courses at online high schools and colleges, and adults consult Wikipedia. Integration of ICT in education is inevitable in the digital era (Rani & Jose, 2013). New technologies create learning opportunities that challenge traditional schools and colleges. Technology in learning techniques is essential to keep in touch with changes (Kapur, 2006). Education can now be obtained even out of schools and libraries. Internet cafes help students to decide what they want to learn, when they want to learn, and how they want to learn.

The central challenge which lies in schools is whether they incorporate the technology-driven learning for the next generation or not. If schools cannot successfully integrate new technologies into the education system, the students may pursue their learning outside the school. Hence, it is very important that the teachers should make use of the modern technology in their process of teaching.

Educational Technology has given a significant contribution in education by taking into consideration the individual differences of the learners and catering to their needs. The emerging trend all over the world is towards more individualized and flexible forms of learning with an emphasis on the individualized methods of instructions. It has laid a special emphasis on using computers in the teaching and learning process specially for providing instructions in the classroom situations. It has specially emphasized computer literacy. The entry of computers in the classroom has changed the entire scenario. The computer is now regarded as the super-teaching machine (Chabra, & Dhamija 2013).
Technology is a tool which helps teachers to accomplish their complex tasks and engage students in extended and co-operative learning experiences. The effect of technology on students' access to knowledge is determined by the pedagogical knowledge and skill of teachers. Technology enables teachers with well-developed working theories of student learning. Teachers have to use technology to support more student-centred approaches to instruction, so that students can conduct their own scientific inquiries and engage in collaborative activities while the teacher assumes the role of facilitator (Rani & Jose, 2013). Students need to be skilled in accessing the vast array of information available through advanced technology and be able to process the information. Students must know how to use computers and be familiar with various types of technology.

To prepare students to be lifelong learners requires a new approach to teaching, in which students are taught how to learn on their own. The world shrinks as technologies now allow everyone to communicate both synchronously and asynchronously with peers around the world. Technology has proved to accommodate learning styles and to be an effective motivator for students with specific learning needs. Furthermore, students working in collaborative-team learning settings appear to function better when learning events are accompanied by technology use.

1.1.4 Technology: A Catalyst for Teaching and Learning

Today’s world is empowered by information technology. There is nothing which is untouched with the use of technology. Education sector is also not an exception. There are lots of innovations of science that we are using in the field of education today for its betterment (Gupta & Chirag, 2014). The use of technology is an integral part of pupils’ everyday lives, and it reflects the importance of developing pupils’ skills. It is essential that every school should plan to enhance teaching and learning using technology. Technology is fundamental to the everyday lives of students and teachers have to continually seek innovative ways of incorporating new technologies into the curriculum that are relevant to learners. The close affinity and links between
Technology and teacher have been noted by Millis and Cottell (1998) in their assertion that co-operative learning and technology are natural partners. This is because use of technology involves human dimensions of caring, community, and commitment. (Yusuf & Afolabi, 2010) Furthermore, using technology in ways that promote sequenced learning within groups can lead to more in-depth processing of course content and, hence, more retention of information.

Technology can be seamlessly incorporated into a classroom. Application of technology in the classroom does several things to student learning. It increases interest even in rote tasks; it allows for individual student differences and it can affect students’ attitude toward learning. Teachers should realize that today’s students are “digital natives.” They have grown up with technology and often are more proficient in its use than their teacher is. These students also have no understanding of why technology would not be used in the classroom. Parents of these digital natives believe that technology provides a way to enrich their children’s social lives and academic abilities. It’s important to give staff time to refresh and renew their skills and to try out new technologies. Technology cannot replace teaching. It enables pupils to take a step forward through engagement – to want to learn more in ways that are fresh and relevant.

The teaching and learning is a complex process that interacts with each other. Teaching through technology makes the students involve in the process of learning and makes their learning easy and effective. Teaching via technology can be classified into four well-defined components- that is manpower, methods, materials and media. Learning involves going beyond simply acquiring new information and adding it to the students’ existing knowledge and modifying, updating and rethinking their ideas in the light of new information. Teaching and learning strategies are important areas of educational policy and practice.

1.2 METHODS EMPLOYED IN TEACHING & LEARNING
Education cannot be of quality without effective teaching. The instructional method which is employed by the teachers plays an important role in the acquisition of instructional contents for meaningful learning and development of necessary skills. Teacher-centred instructional methods make students passive with less interaction (James & Olumorin, 2013). Different teaching methods are used to instruct students in a learning environment. The methods used by a teacher will depend on the skills or information which the teacher would like to convey their students. Some of the most common teaching methods are memorization, class participation, recitation, drills and demonstration. Even though these teaching methods are widely used, every instructor has a specific teaching method of his/her own. They are flexible in their methods and often adjust their style of teaching to accommodate their students according to their learning style.

Efficient teaching methods are the essential tools that can help teachers to make the students achieve success in the classroom. Each student has a different personality and their learning ability also differs. There are several factors that a teacher must consider when choosing a teaching method for the students. Some determining factors for selecting a teaching method include the students’ interest and background knowledge, as well as their environment and learning abilities.

Every teacher wants to find better ways to motivate students and to inspire and ensure learning in the classroom. Teachers also help their students learn with various learning aids such as Auditory, Kinaesthetic and Visual. Instructors use these teaching methods to help students understand and complete class assignments. It is the need of the hour that both teachers and the taught ought to come forward to effectuate learning through teaching with the aid of sophisticated devices (Jose & Raja, 2011). Effective teaching methods benefit both teachers and students.

The investigator lists out the following teaching methods employed in teaching learning process and shows how Computer Assisted Instruction (CAI) and Co-operative Learning (CL) surpass those methods.
1.2.1 Lecture Method

Lecture Method is the most commonly used method of teaching science in colleges and schools usually in huge classes. In this method teacher, as a sole resource in classroom instructions, delivers lecture and students are passive listeners and they are fed readymade knowledge. The students may not actively pay constant attention to the lecture (Kaur, 2011). As it is a teacher-controlled and information-centred method, students get bored and some of them sometimes may feel drowsy. Due to this spoon feeding the students lose interest and their power of reasoning and observation gets no stimulus. The teacher goes ahead with the subject matter at his own speed and may make use of blackboard at times and also dictate notes. This teacher-oriented method in its extreme form does not expect any question or response from the students (Yadav, 2009).

1.2.2 Project Method

It is a dynamic and democratic approach to teaching, particularly suitable for the stage of higher education. This method centres round a project which is a practical unit of activity having educational implications and it aims at achieving not only knowledge, but also understanding, application and skills. It involves investigation, documentation and solution to problems. This is a student-centred method and planned by the student with the help of the teacher and conducted in a natural and real life situation. It is not feasible to cover the entire syllabus by this method and the teacher guiding the students should be enthusiastic and efficient (Holubova, 2008).

1.2.3 Seminar Method

Francis Bacon an English essayist, rightly said long ago, “Reading makes the full man, writing the exact man and conference the ready man.” That is the skill of reading, writing and speaking is essential for development of personality. These skills are well-combined and well-developed through the seminar method. The term seminar generally refers to a structured group
discussion that may precede or follow a formal lecture. It may be either in the form of an essay or a paper presentation. It may be done by experts or academicians at a seminar or conference organised by an institution or an association or by individual students in a class or group of peers as a part of the source of work. In any case, the audience critically examines the paper and discusses the content or findings of the paper. They make queries for clarification or elucidation on any point and the writer of the paper is required to clarify these queries with further facts and figures.

The special nature and the professional setting distinguish the seminar from group discussion. The seminar method is very suitable for higher education or professional discussion when the level of attainment of the group is relatively high and the nature of discussion is expected to be analytical and technical (Zaidi, 2004).

1.2.4 Discussion Method

It is said that “two heads are better than one.” When a number of heads combine to solve a problem, results become wonderful. Discussion method makes use of these tests particularly in teaching social sciences. An issue or a problem, in which there is a difference of opinion, becomes a fit topic for discussion method of teaching. In this method ideas are initiated, expressed and exchanged, and the factual basis is traced out. The participants are engaged in interaction, interpretation and interpolation of facts (Cooper & Simonds, 1995).

1.2.5 Historical Method

It is believed that children’s ideas and thinking follow the same historic route of the original discovery of a scientific phenomenon. Therefore, some teachers advocate this method of tracing the growth of a theory or a principle through all the stages of its evolution, as a natural process of developing the subject.

That is to start from the discovery of the scientific phenomenon and pass through the actual course of its development from the earliest beginnings. This way of developing the topic is mesmerizing and fascinating to the pupils and it appeals to them. The beginners can see how the beliefs of the scientists changed with time and with discovery of new facts. They will be able to
observe how one theory replaced the other with the passage of time and hypotheses. They will realize that a hypothesis or law is true as long as it can explain all observed phenomena. This realization has important educational value and helps to inculcate proper scientific attitude. They can see the whole process of the development of a scientific principle or phenomenon from the “original crude attempts at forming hypothesis to the modern refined method of investigation” (Pannerselvam & Rajendiran, 2005).

1.2.6 Biographical Method

Young people are usually fascinated by interesting stories. Therefore, this method is very often convenient to teach science. The lives of famous scientists are described in an interesting manner and simultaneously their achievements are discussed in the class. The events of struggle and achievements are discussed in the class. They arrest their attention and make the study of science interesting.

The life history of scientists inspires the students and provides great incentive to the study of science. In fact, extracts from the lives of the scientists can most advantageously be used to introduce many topics, for example, the life of Galileo and the law of falling bodies, the Curies and the discovery of radium, Luigi Galvanic and the effect of electricity on of blood, Newton and his laws, etc., The protagonists of this method of teaching science suggest that the pupil should try “to project himself into the life of the original discoverer; to experience his successes and frustrations; and to appreciate his hopes and achievements (Pannerselvam & Rajendiran, 2005). But this method cannot be used in every situation in the process of teaching and learning.

1.2.7 Assignment Method

Assignment Method is the embodiment of both lecture-demonstration method and the individual laboratory work by the students. So, it includes the merits of both the methods and is best suited for students of Higher Secondary Classes, provided, the assignments should be well-planned and drawn up according to the age, interests, aptitudes and intelligence of the students.
The whole of the prescribed course is divided into a number of well-connected portions to cover in a week or so, and are called assignments (Sharma, 2005). But in this method, the students will be aloof from the instructor.

1.2.8 Heuristic Method

Science is not a thing to be talked about but it is a practical subject and the correct way to learn is by doing. The method of teaching ensures the use and development of the senses of touch, sight and hearing. This aspect of science teaching was totally neglected in the early years of science introduction in schools which revolutionised the thinking of science educators in the last part of nineteenth century.

The basic idea of the method is that the student should discover everything he learns about from his own observations and experiments. Instead of imparting facts the teacher should provide activities in which the students work independently and by this means get training in scientific method (Sharma, 2005).

1.2.9 Inductive Method

In Inductive Method of teaching, the pupils are led from particular instances to general conclusion. Concrete examples are given and with their help, students are helped to arrive at certain conclusions and principles. In this method, the child is led to discover truth for himself. Inductive method is a very suitable method for the teaching of Sciences, Mathematics and Grammar.

1.2.10 Deductive Method

Deductive Method is the reverse of Inductive method. In this method rules, generalizations and principles are provided to the students and they are asked to verify them with the help of particular examples. We proceed from general to particular and from abstract to concrete. The teacher’s work is much simplified by giving a rule and asking the pupils to verify it by application to several concrete examples.

1.2.11 Demonstration Method
A technique that is designed to show or illustrate a procedure, process or phenomenon is called a demonstration. Demonstration in science is effective and provides excellent learning experiences. Successful demonstration activities carried out in teaching process provide concrete experiences and can be used for structuring future information for students. However, demonstration method can be successful if it has the following characteristics. A good demonstration should be visible to all students and the demonstration set up should be at good height for proper visibility. The classrooms must have good lighting and ventilation and provisions must be made to take care of glare, reflections etc. All the topics in the syllabus are not feasible to be paid attention by demonstration method.

1.2.12 Scientific Method

Scientific Method is one of the methods of discovery. Training in scientific method necessitates discouraging traditional demonstrations and laboratory experiments. When teaching is by scientific method, the students do not perform the prescribed list of experiments in which emphasis is on the verification of some already known science principles and laws. Instead they are involved investigatory problems whose solutions are not available either in textbook or lab manuals (Zaidi, 2004).

1.2.13 Problem Solving Method

Problem solving takes place only when student’s previous knowledge is insufficient to enable him to provide an acceptable solution, and solution becomes possible only when he acquires new knowledge which he did not have before. A method to solve a problem is called a problem-solving method (Zaidi, 2004).

1.2.14 Co-operative Learning Technique
Co-operative learning is a learning situation in which two or more students work together to complete a common task (Siegel, 2005). It refers to an instructional technique in which students work in small groups or as a team to solve a problem, complete a task or accomplish a common goal (Oludipe & Awokoya, 2010). Co-operative learning offers a pleasant learning situation for all students, all students have equal opportunity, competition is amended as friendship, the spirit of co-operation and participation is reinforced, and all students are entitled to be thoughtful and creative (Lavasani & Khandan, 2011).

Integrating Co-operative Learning strategies have proven to be effective in increasing student achievement across all grade levels and subject areas (Johnson & Johnson, 2003; Johnson, Johnson, & Stane, 2000; Rossini & Jim, 1997; Springer, 1999). The use of Co-operative Learning is an effective teaching and learning strategy. Schools are faced with pressure to produce competent students and they have raised many questions about what the best way to teach science is. Co-operative Learning is a teaching approach in which students work co-operatively in small teams with individuals of different talents, abilities and background to complete a common goal.

The Effectiveness of Co-operative Learning (CL)

According to Johnson (2005), co-operation is not assigning a job to a group of students where one student does all the work and the others put their names on the paper. On the contrary, CL is a teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is being taught but also for helping team-mates learn, thus creating an atmosphere of achievement. Students work through the assignment until all group members successfully understand and complete it (Brown, 1994). Teachers are faced with many different options while choosing a specific Co-operative Learning. As teachers incorporate CL strategies into the classroom teaching, characteristics such as positive interdependence, individual accountability, face-to-face interaction, social skills, and group
processing are developed which can lead to increased understanding and acceptance of all members of society.

Co-operative Learning techniques have also been shown to increase student motivation and retention of the learning material. While more research needs to be done, Co-operative Learning can have a positive impact on the classroom. Integrating Co-operative Learning strategies have proven to be effective in increasing student achievement across all grade levels and subject areas (Johnson & Johnson, 1987). The use of CL is an effective teaching and learning strategy and inculcates self confidence among the students.

1.2.15 Computer Assisted Instruction

Computer Assisted Instruction (CAI) refers to an interactive instructional technique whereby a computer is used to present the instructional material and the instructor monitors the learning that takes place among students. It is the instructional work carried out with the help of computers in simple terms (Mangal, 2002). CAI is defined as the use of a computer to provide instructional contents, allows for interaction between user and computer with immediate feedback (Seo & Bryant, 2009). According to Yenice (2006), Computer Assisted Instruction (CAI) is an instruction or remediation presented on a computer to illustrate a concept through attractive animation, sound, and demonstration (Rani & Jose, 2013). CAI is a kind of instruction that exploits computer software to assist teachers to teach information or skills related to a particular topic and students can interact directly with lessons programmed into the computer system, (Roblyer, 2004).

Computer Aided/Assisted Instruction (CAI) has existed for over four decades, but it was not widely used until the advent of the personal computer. CAI started making inroads in the workplace when network personal computers started becoming widespread in the late1980s. In the early 90s, CAI as an alternative to the traditional classroom training was implemented by large businesses with robust instructional budgets, yet there remains a need for small to medium size employer to find an efficient method for delivering effective, reasonably priced instruction to their students.
CAI could benefit human resources by opening up a greater number of training topics required for job advancement and provide new skills in using technology in the learning processes. Initially, the use of computer-assisted instructional material (CAI) to enhance teaching became a novel concept. However, increasing pressures at all levels of education perpetuated a need for time-efficient, effective teaching modalities that maintained the quality of teaching.

1.3 COMPUTERS IN EDUCATION

Today’s exponential rate of technological development is causing fundamental changes in many fields of education in the world and also offers challenges in society as a whole. It is observed that technology-based instruction in education and training employs various technologies that improve instructional processes and products. The role that computers are playing in education has vastly increased in recent years and attracted the attention of practitioners and researchers (Singh, et.al., 1991).

Computers are the valuable gift of science and technology to the mankind. It has made miracles in all most all walks of life. In the present era there is no corner of human life which remained untouched by the computer. Just like the other fields of life computer are used in education discipline in different ways including the actual work of teaching (Hussain et al., 2014). Computer Assisted Instructions are the type of instructions with the help of computers, which are one step advance in the use of teaching machines. Computer is one step ahead of the teaching machines because it can perform more and multiple tasks as compared to teaching machine. The CAI is not the use of Microcomputer in education but it is the type of instructions in which course contents are provided to the learner at their own pace. The CAI is an interactive system in which students can gain according to their own abilities and skills (Mangal & Mangal, 2011).

In Goodman’s (2001) view, the computer-mediated instruction modules can be self paced and designed in a wide range of formats that accommodate diverse learning styles. Computers have
been heralded as saviours of schools, replacements for teachers and as students’ best friend but the new technology frequently lacks integration in most school curricula even though it offers exciting prospects. Computers have great potential for enhancing teaching in the educational settings and the classroom teacher can use computer in different ways to aid teaching by providing information to the students through that medium.

The use of computers in secondary education curriculum has grown very rapidly in the last ten years. This is due to the increased role of computers playing in all the activities of life. In the field of education computer is used for various purposes. Computer has been helping the teacher in preparing timetable and schedules; maintaining the progress cards efficiently and confidentially; providing individual tuition to large number of students; offering information data for guidance and reference; allocating the learning materials according to individual needs and interests and using as storage of information. Thus computer plays a major role in the field of education.

1.3.1 Students and Computers

Students of this modern era cannot be separated from current and innovative technology. They expect the same technology to be used as an instrument of learning strategies. They like to learn from the teachers whose teaching should be inter-woven with techno-oriented aspects. Most of the students are facilitated with internet connector mobile phones, laptops and tablet PCS. These modern electronic devices are inseparable from the lives of the student community (Rani & Jose, 2013). The advantages of the internet are library resources such as e-mail, chat-room, news groups and World Wide Web. Students can take credit in learning courses without even entering a classroom. Since their inclination is towards techno-oriented devices, it is better for the teachers to adopt them in their teaching-learning process as well.

1.3.2 Modern Education versus Computer Technology

Technology has become an integral part of our everyday lives (Sowunmi & Aladejana,
Computer technology that has made known its vast potential in different fields has ultimately established that it can enrich effect on the classroom teaching and empower students with more learning excellence (Aladejana, 2013). The computer integrated classroom teaching successfully implemented in some schools is found to be extra special because of the interest it creates and the wealth of information it can provide. The measure of creativity and attractiveness contained in it is depicted rightfully by the amount of activities that can be created, huge amount of creative possibilities with it and by the impact, it can create on the teaching-learning process.

In many educational institutions, by successfully incorporating the possibilities of information technology in classrooms, teachers and students are making enthusiastic approaches to acquire more knowledge, organize their understanding and present their creativity in diverse and more satisfying manner. This multi-dimensional technology has all the strength to promote learning that is more authentic; provides impressive learning experiences and sustains the taste to learn. It can also arouse interest for self-learning and make learning a lifetime event.

Teachers acquiring the knowledge and skill of using the computer technology can effectively employ its various provisions to design the selected topic-presentation, impressively use it in the classroom and transform their teaching methods and style. This method of teaching has several advantages like its capacity to enhance student's motivation to learn, qualify the comprehension of information into a highly retainable form, help in interpreting the information in an appealing way and enable the students to acquire the knowledge and skills that builds their capacity to use information technology for better learning.

1.3.3 Origin of CAI
The origin of CAI might have started in two different stages. The first stage of CAI is the Census Bureau in 1951, in the USA and the very first attempt in CAI took place after a decade around 1961 especially after the development of PLATO (Programmed Logic for Automatic Teaching Operations) by the University of Illinois. The second stage of development of CAI took place after the development of computerized tutorials in arithmetic and reading for elementary school children by Patrick Suppers of Stanford University in 1966 and he is considered to be the father of CAI.

### 1.3.4 Role of Teachers with CAI

In CAI the role of the teacher has changed from the traditional method of delivering lectures to a supervisor or a facilitator. No computer can replace a teacher, as teacher’s role is very important in the process of teaching and learning. In fact, the CAI will definitely increase the scope and quality of the contribution of teachers to society. In CAI the teacher has to play various roles like computer engineer, lesson plan writer and a system operator. In today’s world teachers need to be equipped not only with subject expertise and effective teaching methodologies but with the capacity to assist students to meet demand of the emerging knowledge based society with the new forms of CAI and need to have the ability to use that technology to enhance the quality of learning (Sharma & Jain, 2013).

Contemporary children are the part of the world with an information explosion and rapidly progressing communication technologies and they, being the part of it, need to equip themselves well, embracing the best possible knowledge and practical ideas about them. Several schools have taken up steps to bring in the best of the information technology and successfully integrate it into teaching procedures. In other schools, appropriate measures need to be taken up with initiatives from teachers to meet the emerging needs of the students due to the expanded communication and technological revolution. So both teachers and learners need to learn how to process that information and transform it into knowledge.
and real life situations (Poonam, 2011). Teachers should also focus on this aspect of teaching resource and has to continuously work out to develop their personal technological skills and integrate the technology into the classroom teaching. It will magnify the effects of learning and it will enable the students to use it as a resource to facilitate their self-learning.

Computer-based instructions provide ample opportunities for open-ended investigations, problem-solving, planning and communication, along with the development of technical skills. In some cases, it is found that it is possible to help children with special needs by employing this method, mainly because it functions as a good chance in attracting the attention of such children. An increasing number of software programmers act as a 'frame-work' to support the intended educational objectives.

To begin with, the presentation of knowledge using the word processor or publishing packages will give the teachers further ideas to make their classroom demonstrations more fascinating, real and meaningful. Teachers should carefully select specific topics and activities that can be best taught by incorporating technology. They can prepare a computer-based presentation by providing the best impetus from the technology and use this method of instruction to make students experience the real value and joy of learning (Sharma & Jain, 2013). Successfully implementing computer-based instructions will better meet the needs of children today, and above all quickly spread motivation and enthusiasm among students, thereby improving the schooling. Teachers can better transform their style of teaching using the opportunities available around them.

Now-a-days, many textbooks come along with CDs containing knowledge and attractive learning activities. The availability of computers in classrooms and access to them will help the students to absorb knowledge from such CDs, thereby strengthening the depth of their understanding. Also teachers' initiatives and proactive approaches to expose properly the wealth of
creative activities contained in the technology and integrate them well, will vastly contribute to making educational efforts more student-centered and such steps of teachers will be highly appreciated.

Due to the growing importance of adopting computer-based instruction, and growing attractiveness of the technology-based learning, it is necessary for teachers to make required attempts to know how the integration of computer technology can support, enhance and make learning from their subjects of teaching more productive. They should also know how it can be used to develop and implement variety of learning activities and possibilities of making student's learning interesting by utilizing it. They should know how to gain access to the computer technology equipment and resources that can be effectively applied to classroom and other teaching situations; how to organize the classroom and the students for computer technology applied teaching learning to demonstrate the ideas and knowledge effectively and present the computer-based instructions more impressively; how to apply self-thought and evolving new approaches and creativity to discover new possibilities and potentials of teaching and learning; how to identify the programmers and activities that best suit the level and needs; how to use all sorts of additional software’s programmers that are designed from time to time to help students to become more imaginative, thoughtful, creative, critical and analytical; how to keep in touch with the suppliers of teacher support materials, information technology co-coordinators of the area in order to get guidance and solutions to the problems, technical experts of local institutions, software developers and promoters to get conflicting information and advice and how to download subject related e-resources and make use of them for their teaching.

Sometimes, teachers may feel that it is hard and irritating to work with the technology. However, teaching in the future will not be sufficiently attractive and productive without incorporating it. Therefore, the only best solution is to accept technology, appropriately train, get adapted to it, and thus sustain compatibility, efficiency and consistency of teaching.
1.3.5 Advantages of Using Computer Technology

Computer Assisted Instruction is not to exclude the teacher from the classroom. Machines mean relief from the more mechanical aspects of the teacher’s work. Teachers need no longer be ‘talking books’ or ‘paper correcting automations’. They can henceforth, work in areas like evaluation, planning, curriculum revision, guidance and human relations. Although teachers cannot forecast the areas wherein computers may be helpful in future, the possibilities of their effective use in the educational scene are enormous. According to Worthington et al. (1996), computerized study guides can impact and improve students’ overall level of mastery. Also, they emphasize that testing may be improved if students complete tests on computer screens and receive immediate feedback about their performance. Cotton (1997) says that the use of CAI as a supplement to conventional instruction produces higher achievement than the use of conventional instruction alone. The efficient use of Computer Technology enhances attitude towards the learning process, helps in achieving higher cognitive skills and makes learning a joyful experience (Panda & Chaudhary, 2000).

Computer Assisted Instruction in the classroom proves better than all other aids in several respects. It not only saves time in learning but also performs well in processing the data. This unique characteristic helps the teacher and the taught to determine subsequent activities in the process of teaching and learning situations. Since a large amount of information can be stored in a computer the learner can make use of them at their own space. The dynamic interaction between the student and the instructional programme is not possible to be secured in any other medium but with CAI.

Before computers can be of any use, they must be carefully programmed to perform desired functions. It requires thorough planning of every step and prior thinking. Computers are simple-minded. They demand instructions spelled out in explicit detail. Human beings are brilliant but rather sloppy thinkers; computers are stupid but accurate (Muthuja, 2009). CAI facilitates active
learning, enrichment of collaborative learning, encouragement of greater students’ independence and task-based teaching (Spinelli, 2001; Basturk, 2005).

Integration of computer technology into the formal and non-formal learning modes practiced in the school will support several emerging needs and make learning an interesting endeavour. The opportunity to use the computer technology in classrooms by the teachers will prove to be an enterprising execution and an advanced extension of other usual teaching strategies and methods. CAI emphasises on active learning, enrichment of collaborative learning, encouragement of greater students’ independence and task-based teaching (Worthington et al., 1996; Spinelli, 2001; Prvan et al., 2002).

Computer education for students should include the part of training that helps them to use the technology to frame information in the required form, download, search and refer the information from the websites of the internet and above all, get opportunities to apply their creativity for substantial contributions. Empowering them with basic skills and knowledge to use the technology for their learning advantage, will further help them to upgrade it and use it for the advantage and thus advance progressively. Right from the school level, it can be used as an experimental tool for making them independent life-long learner by encouraging them to gather and explore data, recording information and presenting ideas, sorting out and designing innovative programmers.

The proper utilization of the technology will also help in building a spirit of enterprise among the learners. By systematically integrating it into the schemes of teachers’ work, teachers can set the platform for more satisfying teaching-learning and make the learner become more confident and competent as they enter the vibrant world of advancements.

1.3.6 Enhancing the Classroom Presentation

Careful selection of topics, planning of its presentation, accumulating and feeding the information in the system, creatively organizing and effectively presenting it to the students will
make teaching extra special. There is also a view that, the present teaching system creates alienation and much boredom among the students. It happens mainly when one presumes that the conventional methods of teaching untouched by the ingress of new methodologies are sufficient to transfer information to the students. Making an impact with the technology will certainly improve the quality of teaching.

1.3.7 Need for CAI

The main aim of teaching is to enable the student’s comprehension and communication ability. In the 21st era, all the fields are stunned with technology including the teaching-learning process. So the educational field is forced to use computers. Computers have an important role to play in the present educational scenario to produce the best future citizens of India. The National Policy on Education (1986) emphasized the introduction of technology in education.

1.3.8 CAI in Chemistry

According to Aladejana (2007), science teaching at various levels retains the old conservative approach with the teacher, in most cases, acting as the repertoire of knowledge and the students the dormant recipients. But teachers should not fail to know how they can so beautifully explain the concept of their subject via CAI.

As CAI is becoming an increasingly popular technique for education, teachers cannot simply brush aside this strategy; instead they have to make use of it in their classroom teaching. In school, students face a lot of problems in learning. It raises the importance of individualizing the instruction and computers to serve this purpose. CAI may be the effective way of providing instruction in Chemistry. There is tremendous excitement among educationists regarding the application of CAI in teaching English, whereas limited number CAI packages are being prepared for chemistry teaching.
Use of technology in teaching and learning is a new frontier that Higher Secondary school students need to conquer today. A comprehensive, reusable, self-learning Computer Assisted Instructional (CAI) package for chemistry was developed in this research with the supplementary objective of exposing students to an illustrative use of technology for instruction. If they themselves find CAI to be effective in bringing about learning, they can develop positive attitudes towards its use in their own classrooms.

1.3.9 Effectiveness of CAI

Computer-assisted instruction means that learning no longer needs to be a passive experience as the learners all sitting in front of the teacher and learning by telling but it makes learning an active experience. CAI makes learning exciting and engaging. Hard and boring subjects can be made easier, more interesting and appealing with CAI learning. Learners are encouraged to communicate, collaborate and share knowledge via CAI; in this way CAI can support learners to manage their own learning. Students can learn different ways of reading, watching, exploring, researching, interacting, and sharing knowledge and experiences. CAI brings new dimensions not only for school students but also for employees/teachers who go through ongoing training and development. Computer Assisted Instruction supports and encourages this type of learning by facilitating knowledge and information on the web. Interaction with others on the global basis enhances wider learning capabilities. The global learning community is at fingertips with CAI.

Many teachers are now spending half of their precious time outside their school like travelling, visiting other offices etc. Both students and teachers all over the world know about the optimal use of learning during this time with the use of online learning. There is enough evidence to prove that learning has moved from the class room to the laptop. Every learner is empowered to manage their own learning. Through computer assisted instruction, learners have access to a wide range of learning resources of both materials and people. Learning is made more enjoyable and more effective, exciting, interesting and challenging.
By the use of Computer Assisted Instruction, the collaboration among the students becomes much easier. Since many projects involve collaborative learning, the online is much easier to work. Today the government and many organizations have realized that the improved time, competency, learning effectiveness and increased productivity of learners are through their computer-assisted instruction.

Education is facing a significant challenge in preparing students and teachers for future “knowledge-based society”. In recent years, CAI is quickly becoming more accessible in the field of education. CAI is not a single technology but it is a combination of hardware, software, media and delivery system. CAI can influence much in developing teaching and learning environment in the following ways, which are quite different from older technologies.

At present, CAI may be of some use. It is a well-known fact that not a single teacher is capable of giving up-to-date and complete information in his own subject. The CAI can fill this gap because it can provide access to different sources of information. It will provide correct information as comprehensive as possible in different formats with different examples. CAI provides online interaction facility. Students and teachers can exchange their ideas and views and get clarification on any topic from different experts, practitioners, etc. It helps learners to broaden the information base. CAI provides flexibility to learners who are denied by the traditional process and method. Flexibility is a must for mastery in any type of learning and quality learning (Sampath, 2007).

1.4. CO-OPERATIVE LEARNING IN EDUCATION

The word, ‘Co-operate’ means to work or act together for a common purpose. The educational meaning of cooperation is an approach to teaching and learning in which classrooms are set so that students work together in small groups to achieve their desired goal. Co-operative Learning is a teaching approach in which students work co-operatively in small teams with
individuals of different talents, abilities and background to complete a common goal. It may be defined as an active education strategy with small groups in order that the students will develop the learning of both themselves and the group members (Abrami, Poulsen, & Chambers, 2004; Johnson, & Johnson, 1999). It is an activity that increases the students' class participation, academic achievement and motivation toward learning (Polloway, Patton & Serna, 2001). Since co-operative learning is a group working, it is similar to the set working method (Aschettino, 1993).

But every group working is not co-operative learning. A group working becomes co-operative learning if every member of the group knows that he or she can't be successful unless the other members are successful. It is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping teammates learn, thus creating an atmosphere of achievement. Students work through the assignment until all group members successfully understand and complete it. Co-operative efforts result in participants striving for mutual benefit so that all group members gain from each other's efforts and recognize that all group members share a common fate. They also know that one's performance is mutually caused by oneself and one's team members and jointly celebrate when a group member is recognized for achievement.

According to Deutsch (1949), the effort of a student to reach his goal has a supportive effect in the co-operative case; an obstructive effect in the competitive case and a neutral effect in the individualistic case on the other students. In this method students listen, argue, discuss, explain and teach in their efforts to help each other and master the academic content. Group members are responsible for making sure all the members understand the material. Co-operative learning exists when students work together to accomplish shared learning goals (Johnson & Johnson, 1999). Each student can then achieve his or her learning goal if and only the other group members achieve theirs (Deutsch, 1962). Each student is motivated internally by need for
freedom, love, and fun (Schultz, 1999). Among all the instructional strategies for enhancing science achievement, emphasis is laid on the importance of group work (Alebiosu, 1998).

The co-operative learning (CL) is a structured form of small group work based on interdependence, accountability, social skills, and group processing where students work together to achieve a common goal: mastery of a concept, solution of a problem, or accomplishment of an academic task, and in doing so, they will “maximize their own and each other’s learning” (Johnson, Johnson & Smith, 1991). The CL requires co-operative interaction and negotiation of meaning among heterogeneous members engaged in tasks in which each group member has both something to contribute and something to learn from other members.

Teachers must understand the nature of the CL and the essential components of a well-structured co-operative lesson in order to effectively use the CL, which contains five essential components in instructional activities (a) positive interdependence (b) individual accountability (c) face-to-face interaction (d) social skills and (e) group processing (Johnson & Johnson, 1987; Slavin, 1995).

**Elements of Co-operative Learning**

The elements of Co-operative Learning are expected to be more productive under certain conditions. The followings are the five basic elements of co-operative learning.

**a. Positive Interdependence**

The first prerequisite for an effectively structured Co-operative Learning environment is that students believe they “sink” or swim together. (Johnson, Johnson & Stanne, 2000) That is, cooperation occurs only when students perceive that the success of one depends on the success of the other. Whatever task students are given to perform, each group member must feel that his or her contribution is necessary for the group’s success. Students have to learn to work together in order to
accomplish tasks. This is why learning task must be designed in a way that makes them believe, “they sink or swim together.” Through the assigned material, students learn to achieve the goal. Therefore, a number of ways of structuring positive interdependence such as reward, resources, or task responsibilities are carried out to supplement goal interdependence.

b. Face-to-Face Interaction

The second element of Co-operative Learning requires face-to-face interaction among students within which they promote each other’s learning and success. Johnson (2005) suggests that it is necessary to maximize the opportunities for them to help, support, encourage, and praise each other.

c. Individual and Group Accountability

The third element leads to the belief “What students can do together today, they can do alone tomorrow.” The main reason that students are put in co-operative learning groups is so they can individually achieve greater success than if they were to study alone. Thus, each student must be held individually responsible and accountable for doing his or her own share of the work and for learning what needs to be learned. As a result, each student must be formally and individually tested to determine mastery and retention of the targeted learning outcomes or training objectives. The group knows who needs more assistance, support, and encouragement in completing the job. Johnson & Johnson (1991) suggest some common ways to structure individual accountability. These include giving an individual test to each student, randomly selecting one student to represent the entire group, or having students teach what they have learned to someone else.

d. Interpersonal & Small – Group Skills
Students must be taught social skills and be motivated to use them. Social skills which are needed for both teamwork and task work include leadership, decision-making, trust-building, communication, and conflict-management skills (Johnson, Johnson, & Holubec, 1993).

**e. Group Processing**

Group members should think about how well they have co-operated as a team and how to enhance their future co-operation. Some of the keys to successful processing are allowing sufficient time for it to take place, emphasizing positive feedback, maintaining student involvement in processing etc. To be co-operative, group members must promote each other’s learning and success face-to-face, hold each other personally and individually accountable to do a fair share of the work, use the interpersonal and small group skills needed for co-operative efforts to be successful, and process as a group how effectively members are working together. These five essential components must be present for small group learning to be truly co-operative. There needs to be an accepted common goal on which the group will be rewarded for their efforts (Johnson & Johnson, 1991).

Co-operative Learning is the way scientists work to solve problems. Scientists and engineers work in teams rather than as isolated investigators. Science teaching should start with questions about nature and its surroundings engage students actively, concentrate on the collection and use of data or evidences, wholly using a team approach to learning. This method is based on the assumption that each one can teach others as well as learn from others.

In addition to helping students to gain knowledge, Co-operative Learning strategy attempts to develop certain inter-personal skills also. Quietly working in groups carrying out assigned task, generating alternative answers and understanding others’ point of view are some of the skills that the learner develops. At the end of the activity, the members of the group can reflect on how they performed as individuals, team and whole class. The teacher can also give feedback to individual teams at the end.
Research shows that students are well motivated in work and learn more material when they work together co-operatively. Students also benefit by showing greater gains in self-esteem, spending more time on the task and showing improved ability to work effectively with others. This method can be used by teachers along with existing methods as this gives opportunity for learning through self-efforts.

1.4.1 Instructional Strategies of Co-operative Learning

Now-a-days, student-centred teaching model, method and technique are used. According to Slavin (1996), Co-operative Learning is one of the most successfully explored instructional strategies in the history of educational research. Here are a few instructional strategies which are considered to be effective in the process of teaching and learning environment.

a) Reading-Writing-Presentation

In this technique, students are divided into heterogeneous groups that consist of 2-6 members in class taking into account the physical condition of the class where the course is processed, the number of students, and students’ academic achievements (Simsek, 2013).

Reading-Writing-Presentation Method consists of three stages. In the reading stage, all groups in the class read the topic of course using different sources that each student has brought during one lesson. In the writing stage, groups which completed the reading stage pass the stage of writing removing all sources. Students in all groups make a report of what they have learned during the class hours. Reports are evaluated by the teacher. As a result of evaluation the groups of low-grade return to the stage of reading. The groups of high-grade pass the stage of presenting. In the presentation stage groups make presentations in the classroom about 20 minutes. After the presentation the points that are doubtful and vague are discussed.

b) Group Investigation
Group Investigation (GI) is a learning strategy that involves task specialization (Slavin, 1995). In this method, the class is divided into several groups that study in a different phase of a general issue. Working in small co-operative groups, students investigate a specific topic. The study issue is then divided into working sections among the members of the groups. Students pair up the information, arrangement, analysis, planning and integrate the data with the students in other groups. The information collected is then compiled into a whole and presented to the entire class (Sharan & Sharan, 1992).

c) Think-Pair-Share

It involves a three-step co-operative structure. During the first step individuals think silently about a question posed by the instructor. Individuals pair up during the second step and exchange thoughts. In the third step, the pairs share their responses with other pairs, other teams, or the entire group (Kagan, 1992).

d) Three-Step Interview

In this technique, each member of a team chooses another member to be a partner. During the first step individuals interview their partners by asking clarifying questions. During the second step partners reverse the roles. For the final step, members share their partner’s response with the team.

e) Round-Robin Brainstorming

In this technique, the class is divided into small groups (4 to 6) with one person appointed the recorder. A question is posed with many answers and students are given time to think about answers. After the "think time," members of the team share responses with one another in round robin style. The recorder writes down the answers of the group members. The person next to the recorder starts and each person in the group give an answer until time is called.
f) Three-Minute Review

In this technique, teachers stop any time during a lecture or discussion and give teams three minutes to review what has been said, ask clarifying questions or answer questions.

g) Numbered Heads Together

In this technique, a team of four is established. Each member is given numbers of 1, 2, 3, and 4. Questions are asked of the group. Groups work together to answer the question so that all can verbally answer the question. Teacher calls out a number (two) and each two is asked to give the answer (Klimoviene, Urboniene & Barzdziukiene, 2006).

h) Team Pair Solo

In this technique, students do problems first as a team, then with a partner, and finally on their own. It is designed to motivate students to tackle and succeed at problems which initially are beyond their ability. It is based on a simple notion of mediated learning. Students can do more things with help (mediation) than they can do alone. By allowing them to work on problems they could not do alone, first as a team and then with a partner, they progress to a point they can do alone that which at first they could do only with help.

i) Circle the Sage

In this technique, first the teacher polls the class to see which students have a special knowledge to share. For example the teacher may ask who in the class was able to solve a difficult math homework question, who visited Mexico, who knows the chemical reactions involved in how salting the streets help dissipate snow. Those students (the sages) stand and spread out in the room. The teacher then has the rest of the classmates each surround a sage, with no two members of the same team going to the same sage. The sage explains what they know while the classmates listen,
ask questions, and take notes. All the students then return to their teams. Each in turn explains what they learned. Because each one has gone to a different sage, they compare notes. If there is disagreement, they stand up as a team. Finally, the disagreements are resolved.

\textit{j) Partners}

In this technique, the class is divided into teams of four. Partners move to one side of the room. Half of each team is given an assignment to master to be able to teach the other half. Partners work to learn and can consult with other partners working on the same material. Teams go back together with each set of partners teaching the other set. Partners quiz and tutor teammates. Team reviews how well they learned and taught and how they might improve the process.

\textit{k) Peer Editing}

When the teams turn in written lab reports and/or give oral presentations, the usual procedure is for the instructor to do the critiquing and grading. A powerful alternative is peer editing, in which pairs of groups do the critiquing for each other’s first drafts (written) or run-throughs (oral). The groups then revise their reports and presentations taking into account the critiquing teams’ suggestions and then submit or present to the instructor. This activity lightens the grading load for instructors, who end up with much better products to grade than they would have without the first round of critiquing. If a grading checklist or rubric is to be used for grading the team reports (which is always a good idea), it should be shared with the students before the reports are written and used for the peer editing. This practice helps the students understand what the instructor is looking for and invariably results in the preparation of better reports, and it also helps assure that the peer critiques are as consistent and useful as possible. If several rounds of peer editing are done and the instructor collects and grades the checklists or rubrics for the first one or two rounds, the students will end up giving much the same rubric scores as the
instructor gives, and in good classes the instructor may only have to do spot checks of peer grades instead of having to provide detailed feedback on every report.

1) Peer-Led Team Learning

In peer-led team learning (PLTL), lectures are supplemented by weekly 2-hour workshops in which students work in six to eight person groups to solve structured problems under the guidance of trained peer leaders. The problems must be challenging and directly related to the course tests and other assessment measures. The course professor creates problems and instructional materials, assists with the training and supervision of peer leaders, and reviews progress of the workshops. The materials prompt students to consider ideas, confront misconceptions and apply what they know to the solution process. The peer leaders clarify goals, facilitate engagement of the students with the materials and one another and provide encouragement, but do not lecture or provide answers and solutions. The students are confronted with difficult problems and must rely primarily on one another to develop solutions, which promotes positive interdependence, and face-to-face interaction. Students are tested individually on the knowledge required to solve the problems, and a function of the peer leader is to get team members to explain their understanding to their team-mates, both of which provide individual accountability. There is no formal instruction in teamwork skills in PLTL, but informal instruction invariably occurs as the peer leaders facilitate the group interactions.

m) Co-operative Learning Loosely Structured (CLLS)

In this CLLS technique, the teacher assigns students to small heterogeneous groups on the basis of their performance in the first achievement test with each group containing three to five members who are high, average or low achievers. In this method short presentation by teacher is followed by students’ group work. During the group work, the teacher works as facilitator and ensures that group members are involved in verbal interaction during group work. Individual
accountability is ensured by administering verbal or written individual quizzes. However, these quiz scores are not considered for team recognition or certificate distribution. The reason is that the students take the quizzes sitting in their groups not in formal testing conditions. The students are expected to learn the presented material through discussions i.e. asking questions, answering questions, summarizing and drawing conclusions. The teacher will inform the individual scores the next day following each quiz. However, there is no group reward.

**n) Student Teams-Achievement Divisions**

Student Teams-Achievement Divisions is a Co-operative Learning strategy created by Robert Slavin in which groups of four works together within their teams to master a lesson presented by the teacher. This phase employs four out of five components of the STAD model i.e. (a) teacher’s presentation (b) students’ group work (c) individual quizzes (d) team recognition and rewards (Gaith, 2003). In this technique, first the teacher presents the lesson and it is followed by group work. After the group work, students take individual quizzes sitting in formal testing conditions. In the next class, students are informed as both their individual scores and team scores. First three teams are recognized as Super team, Great team and Good team. All the members of the winning teams are invited to receive their certificates (teacher made). Each certificate contains a team score and individual scores of team members. Thus, the cycle of each CL (STAD) lesson will be completed. The winners discuss how they won and losers realize their defeat.

**o) Learning Together**

Learning together (LT) is a Co-operative Learning Strategy created by David W. Johnson and Roger T. Johnson. Learning together was originally designed to train teachers how to use Co-operative Learning groups in the classroom at the University of Minnesota in 1966. In the LT strategy, co-operative effort includes five basic elements: face-to-face interaction, social skills, group processing, positive interdependence, and individual accountability (Johnson & Johnson,
1989). During the learning together process, students complete worksheets in groups of four or five. An emphasis is placed on team building and group self-reflection. Team grades are determined by the teacher. The learning together teaching method had a positive effect on mean scores in the social studies classroom (Slavin, 1995).

**p) Teams-Games-Tournament**

Teams-Games-Tournament (TGT) is a Co-operative Learning strategy developed by David Devries, Keith Edwards, and Robert Slavin. Teams-Games-Tournament is similar to Student Teams Achievement Divisions except students do not take individual quizzes. Instead, students participate in academic games with members of other teams and contribute points to their team scores. Slavin has found in his research an increase in mean scores through the use of Teams-Games-Tournaments (Slavin, 1991).

**q) Word Chains**

Students have to think of 10 words where the last letter of the word would be the beginning of the following one. The teams have to create a paragraph, employing all the words. The paragraphs are read aloud and the teams are asked to select the best one. Finally, the students have to prove why they have selected one or another paragraph as the best (Klimoviene, Urboniene and Barzdziukiene, 2006).

**r) Jigsaw I & II**

It was first introduced by Elliot Aronson, Stephen, Sikes, Blancy and Snapp in 1978 (Sarah & Cassidy, 2006). It was later modified by Slavin in 1983. The whole class is divided into base groups or home groups with four to six heterogeneous members. Individual members of base groups are then given separate parts of whole academic textual materials. Having learnt something
about their parts in their base or home groups, team members who have similar parts for learning come together in expert’s groups to study, discuss and refine their understanding of their shared parts. After that they return to their home groups and take turn to teach what they learnt in expert groups to their team mates. Teams are evaluated by the sum of their members’ scores on quizzes and tests which they take individually (Simsek, 2012).

**Steps of Jigsaw:**

1. Students are divided into five or six Jigsaws. The groups should be diverse in terms of gender, ethnicity, race and ability.

2. One student from each group is appointed as the leader. Initially this person must be the most mature student of the group.

3. The teacher divides the day’s lesson into five or six segments.

4. The teacher assigns each student to learn one segment making some students have direct access only to their own segments.

5. The teacher gives time to read over their segments at least twice and become familiar with it. There is no need for them to memorise it.

6. The teacher forms temporary ‘Expert Groups’ by having one student from each base group join the other student assigned to the same segment. Enough time is given to discuss the main points and to release the presentation in their base groups.

7. The students come back to their base groups.

8. The teacher asks each of the students to present his/ her segment to the group and encourages others in the group to ask questions for clarifications.
9. The teacher drifts from group to group observing the process and if any group is having trouble, she makes appropriate intervention.

10. At the end of the session the teacher gives a quiz on the materials so that the students quickly come to realise that these sessions are not just for fun and games, but really count.

**Advantages of Jigsaw Technique**

i. It is an efficient way to learn the material.

ii. It builds up deep knowledge.

iii. It develops team spirit and co-operative working skills.

iv. It facilitates interaction among students.

v. It encourages active participation.

vi. Students learn to appreciate and value each other’s opinions by sharing and enhancing information.

vii. It enables even the students of below average to learn from others in their expert groups.

viii. It builds up interpersonal and interactive skills.

ix. Students are held accountable among their peers.

The investigator after studying the strategies meticulously selected the Jigsaw technique as it is very effective, interesting and easy for the students to cope with their learning.

**1.4.2 Significance of Co-operative Learning**

Significance of CL as an educational tool lies in both its affective and cognitive impacts. For many students, the feelings of self-confidence and self-esteem they gain from learning co-operatively with their fellow students may be as important to their education as the specific knowledge they attain. Proponents of Co-operative Learning often disagree on methodological details such as whether groups must be heterogeneous or what specific course content best lends itself to a Co-operative Learning environment, but most do agree on basic requirements of the method.
Many educationists in the field now stress the importance of testing group members individually to ensure that each student will actively contribute to the group and not let others do all the work though it was a controversial point in the past. Other elements considered to be important for successful Co-operative Learning are recognition of group achievement and providing group members with a worthwhile goal they have in common. To spark motivation within a secure learning environment, competition is often encouraged between groups, but it must not be interpersonal or take place within the group. Finally, students need to be trained in interpersonal and small group skills and to be able to interact most effectively. A continuing point of controversy surrounding co-operative learning is whether high ability students in heterogeneous co-operative groups are penalised by working with low ability students.

Among a few studies that measure the effects of co-operative learning in science, there is wide variation in quality, with some succumbing to the pitfalls of research involving human subjects, including small sample size, lack of random distribution and assignment to test conditions of students and teachers, and built-in bias in training teachers and teaching material. However, several good studies have shown that Co-operative Learning strategies are effective for learning certain types of biological concepts.

1.4.3 Need for Co-operative Learning

The basic elements of Co-operative learning can be considered essential to all interactive methods. Student groups are small, usually consisting of two to six members. Grouping is heterogeneous with respect to student characteristics. Group members share the various roles and are interdependent in achieving the group learning goal. While the academic task is of primary importance, students also learn the importance of maintaining group health and harmony, and respecting individual views.
Co-operative Learning can take place in a variety of circumstances. For example, brainstorming and tutorial groups, when employed as instructional strategies, provide opportunities to develop co-operative learning skills and attitudes. Co-operative Learning is a significant method for children’s learning. In this process they learn to co-operate, to know each other and to share responsibilities. They recognise mutual talents and make use of their talents to create a synergy. Therefore, the ability to participate and be co-operative is an important learning skill. Co-operative Learning is an interactive learning. Classroom interaction takes place among the teachers and students, and they interact with environment, with teachers, with peer groups, with particular print or electronic media. Hence, interactive learning is essential for achieving high levels of cognition and needs to be developed among children (Yadav, 2009).

1.4.4 Effectiveness of Co-operative Learning

The effectiveness of Co-operative Learning is found in classroom from pre-school to college and beyond, in a wide variety of disciplines. Co-operative learning has been applied in the Physical Sciences, Mathematics and Biology, as well as in the Social Sciences and Humanities. The value of Co-operative Learning as an educational tool lies in both its effective and cognitive impacts. In CL, learning takes place in an environment of mutual respect and trust. When students know each other as human beings, speak freely, take risks with ideas, and offer mutual support, the classroom becomes a learning community that includes everyone. Developing democratic process among students is important in establishing this sense of community and the right of all students to participate in classroom decisions.

Leadership, not just of small groups, but of the class, should be shared. The intent is to equalise, as much as possible, power differences between students and between teacher’s expertise
and ultimate responsibility for the class. The teacher needs to seek feedback from students and be willing to become a learner in the classroom. As both teacher and students learn, students discover that knowledge is a dynamic entity, and that no one has all the answers.

Cognitive and Affective learning should be integrated, enhancing student’s self-esteem and confidence. A teaching environment in which concepts and ideas are emphasised connects science to the real world of their own experiences and to the learning activities. This will help students make connections between classroom learning and new scientific information after they leave the classroom. It is effective in reducing prejudice among students and meeting the academic and social needs of at-risk students in terms of education (Sudzina, 1993).

Active learning engages student’s attention and imagination. Students become fully involved with what they are learning and thereby learn more. Classes that involve active learning are more stimulating than those where teachers talk about ideas and students listen (Sharma, 2005).

1.4.5 Characteristics of CL

i) Co-operative learning task is designed based on shared learning goals and outcomes.

ii) Co-operative behaviour involves trust building activities, joint planning and understanding of team and conduct.

iii) It develops group work skills-explicit teaching and small group team building exercises.

iv) The teacher should always monitor group activity and answer student’s questions and guide discussions.

v) Individual and group assessment is done in all activities.

1.4.6 Advantages of CL

i) Co-operative learning and group activities solve students’ problems. It has not only reduced the difficulties of students and to facilitate communication but also to provide for each student to express their ability to meet the development needs of individual students.
ii) Co-operative learning develops higher levels of thinking skills.

iii) Through co-operative learning, a team spirit of students can be fostered so that students learn from one another.

iv) It improves the performance of the weaker students when grouped with high achieving students.

v) It promotes students’ learning and academic achievement. It increases students’ retention.

vi) It enhances students’ satisfaction with their learning experiences.

vii) Students learn through mutual interpretation, content, and asking to everyone to answer so that they must find a way to organize their thoughts and language to explain their point of view.

viii) It develops students’ social skills.

1.5 Conventional Method vs CAI and CL Strategies

**Computer Assisted Instruction** means that learning no longer needs to be a passive experience as the learners all sitting in front of the teacher and learning by telling but it makes learning an active experience. CAI makes learning exciting and engaging. Hard and boring subjects can be made easier, more interesting and effective by dint of CAI. Computer Assisted Instruction is a powerful instrument which simplifies a complex content into a simple one. Here, learners are encouraged to communicate, collaborate and even share their knowledge with their peers. In this way, CAI can support learners to manage their own learning.

Similarly, **Co-operative Learning** is also one of the teaching strategies and it paves a way for effective learning. According to Johnson *and Johnson (2003)*, the CL is a structured form of small group of students, enabling them to be interdependent, accountable and socially skilful. Students in the group work together to achieve a common goal: mastery of a concept, solution of a problem or accomplishment of an academic task, and in doing so, they will “maximize their own and each other’s learning” (Johnson & Johnson, 1991). The CL requires interaction and conciliation of
meaning among heterogeneous members engaged in tasks in which each group member has both something to contribute and to learn from other members. It is the way scientists work to solve problems. This strategy is based on the techniques such as Jigsaw, Learning Together, Group Investigation, Think-Pair-Share, Three-Step Interview, Round Robin Brainstorming, Three minute, Numbered Heads Together, Team Pair Solo, Circle the Sage and Partners etc. As a result, the practice of Co-operative Learning can be easy, interesting and effective.

1.6 Need and Significance of the Study

Every individual in society has the ability and aptitude to learn. Each one is different but they can all learn. Not all individuals learn in the same way and it should therefore be taught in different ways. Universally, science is taught as one of the subjects in schools, colleges and universities. Chemistry is one of the most important subjects in the field of education. Chemistry is considered as the king of all sciences. It is an essential subject taught to the students to develop the skills. Majority of the pupils feel that chemistry is a difficult subject and it can be understood and followed only by intelligent students. Those who fail in the subject develop hatred towards it. At present majority of the chemistry teachers follow traditional methods of instruction and learners tend to be passive listeners.

Among the Higher Secondary students the difficulty recognized in learning chemistry is the unit “Chemical Bonding”. Students suffer severely to understand the facts and concepts about the chemical bonds when taught by traditional method. The student’s achievement in Chemistry used to be very low when compared to that in other subjects. It may be due to lack of using proper instructional strategies. Even though the conventional method helps the students to achieve their goal in their process of learning, it seldom leads them to attain the expected outcome especially in Chemical Bonding. No lesson can be effectively learned unless there is active pupil participation in it. In order to teach a heterogeneous group, teachers need to use a variety of different instructional strategies. It is impossible to teach every student in the classroom by using only one instructional strategy. Students learn chemistry by connecting new ideas to ideas that they
already know. Teachers of chemistry need to be able to understand what students know and how they can present new material with their prior knowledge of chemistry. Hence, there is an imperative need to adopt learner-centred approaches in the classroom.

CAI may bring about effective learning experience as it can develop positive attitudes towards its use among students. A first-hand experience in learning through CAI may help the teachers and students to use CAI successfully in their own teaching-learning process. Moreover, CAI is an increasingly popular technique as it raises the importance of individualizing the instruction.

Co-operative learning refers to instructional methods and techniques in which students work in small groups and are rewarded in some way for performance as a group. Significance of Co-operative Learning as an educational tool lies in both its affective and cognitive impacts. For many students, the feelings of self-confidence and self-esteem they gain from learning co-operatively with their fellow students may be as important to their education as the specific knowledge they attain. In co-operative learning, students work together for a common goal; motivate their peers by depending on each other; encourage their teammate during the task of learning and augment positive contact among their group members. Co-operative learning as an instructional strategy will help the teachers to overcome the major difficulties that they face in the conventional method of teaching. The co-operative learning fulfils the psychological and social development of learners.

Co-operative learning is based on the belief that students learn more when they are actively involved in the learning process. Active involvement results in better understanding than in passive learning. It challenges students to develop skills and achieve more by using appropriate learning resources. It is an act of believing in and practicing face to face interactive learning so as to encourage creativity and foster critical thinking through group processing.

Kessler (1992) observes that co-operative learning raises the level of learners’ curiosity and their spirit of questioning, infesting in them a democratic and scientific
way of investigation of facts and findings and facilitating them to integrate critical thinking. In co-operative learning peer relations become more active. Peer tutoring and peer reviews are done with delight and the students learn the subject matters thoroughly through teaching their team-mates. Co-operative learning endeavours are more effective, since they emphasis learning and acquiring skills through the process of a fully learner centred techniques and strategies. Co-operative learning groups are the most beneficial ones, since they encourage activities related to social affective aspects.

In the above context, the investigator being a teacher-educator wanted to investigate “The Effect of Computer Assisted Instruction (CAI) and Co-operative Learning (CL) on the Achievement of Higher Secondary Students in Chemistry”. Hence, the investigator has taken this piece of research work.

1.7 Epitome

Education is an engine for the augmentation and evolution of any society. It is a powerful tool to revolutionize the society. Education is to enhance the personality of an individual’s all round development – physical, mental, aesthetic, moral, spiritual, social and economic aspects of human life. It is a continuous process which transfers the morals, values; of our culture to the next generation. Education can now be obtained even out of schools and libraries. Internet cafes help students to decide what they want to learn, when they want to learn, and how they want to learn. The effect of technology on students' access to knowledge is determined by the pedagogical knowledge and skill of teachers. Technology enables teachers with well-developed working theories of student learning. Through computer-assisted instruction, learners have access to a wide range of learning resources of both materials and people. Learning is made more enjoyable and more effective, exciting, interesting and challenging. Similarly, the Co-operative Learning is one of the most successfully explored instructional strategies in the history of educational research. It is a structured form of small group work based on interdependence, accountability, social skills, and group processing where students work together to achieve a common goal: mastery of a
concept, solution of a problem, or accomplishment of an academic task, and in doing so, the students will maximize their own and each other’s learning. Learning through CAI and CL will do justice in achieving the goals of the learners and their learning will be effective, interesting, easy and retentive.

The study of reviewed literature is followed in the next chapter.