CHAPTER - I
INTRODUCTION AND CONCEPTUAL FRAMEWORK
“Education is the shaping of personality”
James L. Mursell

1.1 OVERVIEW

This chapter brings out the conceptual framework of the study so as to provide the introductory phase of the report. It comprises fourteen sections. The first section outlines the overview of the entire chapter. The second section gives introduction. The third section defines education. The fourth section brings out the importance of teaching science. The fifth section deals with the importance of teaching Chemistry at higher secondary level. The sixth section explains the way of using educational technology in teaching Chemistry. The seventh section highlights the importance of Computer Assisted Instruction (CAI). The eighth section deals with importance of Chemistry teaching through CAI. The ninth section portrays the evaluation of Chemistry learning from higher secondary students. The sub-divisions of ninth section deals with achievement in Chemistry, Competency based learning Chemistry, psychological variables like Aptitude of learning Chemistry, Attitude towards learning Chemistry, Perception on learning chemistry and personality. The tenth section explains the significance of the study. The eleventh section highlights the need for this study. The twelfth section gives the delimitations of the study. The thirteenth section highlights the limitations of the study. The fourteenth section deals with conclusion of the first chapter.

1.2 INTRODUCTION

The term ‘education’ has been defined by different educationists, philosophers and thinkers in different ways. The goal of education is to shape people so that they develop integral, multifaceted personalities and are able to carry out fully their social role by developing their intellectual, physical and spiritual capacities and encouraging a more elevated level of human feeling.
and aesthetic taste, thus turning the ideological principle into personal connections and habits of day today behavior.

Education today reflects the influence of modern technology. This new technology demands new interpretations of the instructional process and those charged with educating the next generation must engage in a continual cycle of evaluation and re-evaluation in the light of technological influence at all levels. By all means, computer must be brought into practice. Teachers must have freedom to use the necessary operating systems suitable for their students aptitude, interests and availability of time. Teaching through Computer Assisted Instruction offers an interactive environment for all subjects and skills. Young children as well as adults respond quickly and naturally to appropriate technologies, which frequently offer a high level of physical control and quick feedback in a variety of forms. Use of technology enhances effectiveness of a teaching experience. Teaching must be refocused towards a more flexible and student centred environment. A technology rich teaching environment is characterized by collaborative and investigative approaches to learning. Increasing integration of content across the curriculum and a significant emphasis upon concept development and understanding can help teachers and students become co-learners through the use of technology tools. The teacher should train the students to make use of such technology tools.

1.3 EDUCATION

Education means the modification of behaviour. Education is an activity or a process which transforms the behaviour of a person from instinctive behaviour to human behavior. Education is the deliberate and systematic influence, exerted by the mature person, upon the immature through instruction, discipline and harmonious development of physical, intellectual, aesthetic and social and spiritual powers of the human being, according to individual and social needs and directed towards the union of the educand with his creator as the final end (Redden 1956, P. 21).
Mahatma Ganthiji speaks of education as “By education, I mean an all-round drawing out of the best in the child and man-body, mind and spirit”. (Taneja, 2001, P. 4).

According to Radhakrishnan “Education must include not only the training of the intellect but also the refinement of heart and discipline of the spirit”. (Aggarwal 1996 P. 5).

According to John Dewey, “Education is the process of living through a continuous reconstruction of experience. It is the development of all those capacities in the individual which will enable him to control his environment and fulfill his possibilities”. (Bhatia and Bhatia 1986, P. 4).

Education may help the individual in bringing out and realizing all latent potentialities of the child development, of a well-balanced personality, cultivation in him, flexibility and adaptability, growth of social virtues, his preparation for a complete living etc., The term ‘education’ has been defined by different educationalists, philosophers and thinkers in different ways. According to James L. Mursell, “Education is the shaping of personality”.

David W. Johnson states that, “education” is the structuring of situations in ways that help students change, through learning, in international and sometimes un-international ways.

The Oxford Universal Dictionary (1974) defines education as the systematic instruction, schooling or training given to the young (and by extension, to adults) in preparation for the work of life. It is the whole course of scholastic instructions which a person, often qualified as classical, legal, medical and technical.

Education is a human development effort which contributes towards the cultural transformation of citizens. It is a powerful instrument of social economic and cultural development. If education is to achieve this end, it must be planned to enable every individual in a society to develop his innate potentialities and aptitudes to the maximum extent, so that the country can
achieve full economic growth and healthy social order. Education is thus both a product of, and a feed back from, the developmental process.

Education is a process of aiding the all round development of an individual, physical, intellectual, social, moral and spiritual. The teacher as such is expected to function not only as a purveyor of knowledge but also molding the child’s total personality.

The different aims of education, development of the human personality, pursuit of knowledge, preservation of culture, development of character, promotion of social justice, scientific temper, democracy, secularism and so on are just so many varied educational expressions of the constituents of the good life.

Education is the aggregate of all the process by which a person develops abilities, attitudes and other forms of behaviour of positive value in the society in which he lives.

The goal of education is to shape people so that they develop integral, multifaceted personalities and are able to carry out fully their social role by developing their intellectual, physical and spiritual capacities and encouraging a more elevated level of human feeling and aesthetic taste, thus turning the ideological principle into personal connections and habits of everyday behaviour.

Education is a reorganizing or reconstructing of experience. It has all the time an immediate end, and so far as an activity is educative, it reaches that end, the direct transformation of the quality of experience.

Education should be an individual activity to a much greater extent. Not all children should be forced to go through the same steps of learning at the same speed. The high achievers will move faster in their learning whereas the under achievers will need more time. Children have their own ways of learning. Some children may learn better through the use of different learning materials than by merely listening to an inspirational talk by the student. The style of learning may also change according to age. Children learn best if they use their senses in acquiring knowledge.
An important feature of education is its use of physical and intellectual tools. Education must reflect the influence of technology. This new technology demands new interpretations of the instructional process and those charged with educating the next generation must engage in a continual cycle of evaluation and revaluation in the light of technological influence at all levels. Learning through CAI offers an interactive environment for all subjects and skills. Young children respond quickly and naturally to appropriate technologies, which frequently offer a high level of physical control and quick feedback in a variety of forms. The use of technology enhances the effectiveness of a learning experience. Learning must be assessed towards more flexible and student-centred environment. A technology-rich learning environment is characterized by collaborative and investigative approaches to learning. Increasing integration of content across the curriculum and a significant emphasis upon concept development and understanding can help students and students become co-learners through the use of technology tools.

Today’s education for students and learning involves numerous other complex patterns directly or indirectly associated and the strategies for learning and learning necessitate newer approaches and continual orientations to suit the changing patterns and priorities in education. School children are well exposed to T.V shows, computer programs, video games, e-mail based information exchange, internet browsing and many other interesting forms of educative entertainment. Each one of them has a learning regaining significance. Using the experiences of the children as the base to provide further learning experience is a challenging task. Traditional class room techniques will not do justice to the learners of this generation. They require techniques that will stimulate them to explore, discover and learn by themselves as much as possible and the role of the student is to be an effective facilitator. Students should have the freedom to innovate, to devise appropriate methods of communication and activities relevant to the needs and capabilities of and the concerns of the community, says the National Education Policy (1986). So we need an education to facilitate effective instruction and evaluation through science and technology.
1.4 TEACHING OF SCIENCE

Sharma (1991) in his book “Modern science Teaching” has mentioned, “Pandit Jawaharlal Nehru is one of his famous addresses has remarked that the progress of any nation depends upon science knowledge and a population that knows not to apply it in life. This is very true because science and its application have pervaded every sphere of our life.

Kothari (1966) observed that teaching of science is an integral part of school education.

The quality of science teaching has also to be raised considerably so as to achieve its proper objective and purposes, namely to promote an ever deepening understanding of basic principle, to develop problem solving, analytical skills and the ability to apply them to promote the spirit of enquiry and experimentation. Only then can a scientific outlook become part of our way of life and culture.

Teaching of science is always helpful to develop commitment of man to free enquiry and to the quest for truth as his highest duty and obligation.

Although it is largely occupied with the understanding of nature at present its development is tending more and more to help man to understand himself and his place in the universe.

All these point out the values of science not only as an educational subject but also as an important cultural and social factor with great impact on the life of people. It touches all the dimensions of human personality, namely the cognitive, psyche motor and affective aspects. The fourth dimensions as pointed out by Dr. Sood namely the social implication are actually the result of the interaction of the individual with and in the society.

In this connection a brief statement of three major goals of teaching science to all the students are studying from schools.
(i) They are the development of functional understanding of scientific information which comprises of facts, concepts, generalizations, principles and theories.

(ii) Development of inquiry skill which include both abstract, problem solving and associated psychomotor concrete skills.

(iii) Development of values and attitudes which involves interest appreciation, habits, etc, (Sood, 1989)

These goals which are common for all discipline can be achieved synchronously in the teaching learning experiences of science in general and Chemistry in particular. This is because of the nature of science. Nature of science is a cumulative and endless series of empirical observation which result in the formulation of concepts and theories. Science is both a body of knowledge and the process of acquiring and refining knowledge. The former in identified as the substantive structure of science. Knowledge is the static view of science and the process of inquiry is the dynamic view of science. The static view places in the center of the stage, the structure and context of science, whereas dynamic, is related to the process of science and progress of science.

Thus science is at one and the same time a body of knowledge and an on-going self-testing process of inquiry. Through this science inquiry science grows and finds it application in life.

The changing trends in school science teaching during 1980 also pointed out by Dr. Sood in his new direction in science teaching gives a clear picture related to the nature of science it influence on goals of science teaching should enrich the personal life of the students so that they can help in solving science related social issues (Sood. 1989).

Teaching of science has four main branches from higher secondary level. The branches are chemistry, physics, botany and zoology. Out of which
Chemistry plays an important role for our day today life. With knowing chemical reactions we could live long. For that teaching of Chemistry at the higher secondary level is the basic for understanding all chemical reactions.

1.5 TEACHING CHEMISTRY AT THE HIGHER SECONDARY LEVEL

Throughout the history of the human race, people have struggled to make sense of the world around them. We have gained an understanding of the matter which makes up our world and of the interactions between particles on which it depends. The ancient Greek philosophers had their own ideas of the nature of matter, proposing atoms as the smallest indivisible particles.

Towards the end of the eighteenth century, pioneering work by Antoine and Marie Lavoisier and by John Dalton on the chemistry of air and the atomic nature of matter paved the way for teaching of modern chemistry. During the nineteenth century teaching of chemistry worked steadily towards an understanding of the relationships between the different chemical elements and the way they react together. A great body of work was built up from careful observation and experimentation until the relationship which we now represent as the periodic table emerged. This brought order to the chemical world, and from then on chemists have never looked back.

Teaching Chemistry looks for an academic understanding of how matter works and how the environment might be protected from the source of pollutants. Fortunately, chemistry holds many of the answers. Following the progressing trend in chemistry, it enters into other branches of teaching chemistry and answers for all those miracles that are found in all living organisms.

The practical aim of teaching chemistry would be to acquaint the student with the rudiments of its day to day activities of knowing to use chemicals give him a grasp of its teaching and learning by doing; Chemistry, being a well-developed science, its importance among other sciences is a mirror of the day to day life of the people living and experiencing that chemical reactions in their daily life. The need and importance of teaching
Chemistry in schools are to inculcate the student ability to express his / her every day to day activity in enjoying and experience without any difficulty in simple easy and correct way of understanding chemical compositions. In short the aim of teaching Chemistry is to give pupils a basic all round happenings of understanding the surroundings.

Chemistry, a branch of science concerned with the properties, structures and composition of substances and their reactions with one another. Inorganic Chemistry studies the preparation, properties and reactions of all chemical elements and their compounds, except those of carbon. Organic Chemistry studies the reactions of carbon compounds, which are 100 times more numerous than nonorganic ones. It also studies an immense variety of molecules, including those of industrial compounds such as plastics, rubber, dyes, drugs and solvents. Physical Chemistry deals with the Physical properties of substances, such as their boiling and melting points.

Teaching of Chemistry will provide an “inverted pyramid” model to gain knowledge in all branches of chemistry. The topics such as Atomic Structure - II, Periodic Classification - II, Solid State - II, Thermodynamics - II, Chemical equilibrium -II, Chemical Kinetics - II, Electrochemistry - I and II are designed in such a way that students should have a continuous access to these topics. Hence, the knowledge gained in higher secondary first year will help the students to have a continuous access to these topics. The knowledge gained in +1 will help the students to achieve excellence in the path of quest for chemical knowledge. Many problems are introduced in inorganic, physical and organic chemistry to enhance the quantitative aptitude of students. The quantitative aptitude will enable the students to understand the concepts well.

The importance of chemistry is well known. Knowledge of chemistry will help anybody to understand biology, natural processes, geochemical concepts, pharmaceutical and biochemical concepts. Hence this teaching of Chemistry at higher secondary level will enhance the image of the students in such a way that they can face any competitive examination in future. The problems in all branches of chemistry and many more mechanisms of organic chemical reactions will help the students to understand the chemical principles.
An important recent development for the methodology of teaching Chemistry has been the shift from teacher to the learner. The teacher is asked to experience and evaluate techniques from the learner’s point of view and to be aware of their role as helpers in the learning process. Chemistry students/teachers should familiarize themselves with not only the wide range of techniques and strategies but also the general needs of the learners and their existing level of chemical competence.

Teaching Chemistry should pay greater attention to know about the chemical reactions and compositions of using chemicals in our day today life. The investigator working as a teacher had a thirst to make use of technological method of teaching Chemistry through CAI is helpful to score high marks in higher secondary school.

1.6 EDUCATIONAL TECHNOLOGY IN TEACHING CHEMISTRY

Educational Technology of teaching Chemistry is a systematic way of designing, implementing and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning with communication and employing a combination of human and non human resources to bring about more effective instruction. The way of using technology results an increased effectiveness of educational process. Each new physical device prescribes a new set of procedures and techniques. Educational technology consists of all modern media, methods, materials and needs to be used in a well integrated manner for maximizing the learning experience of students at various levels. The pace of change brought about by new technologies has a significant effect on the way people live, work and play worldwide. New and emerging technologies challenge the traditional process of teaching, learning and the way education is managed. Information technology, while an important area of study in its own right is having a major impact across all curriculum areas. Easy worldwide communication provides instant access to a vast array of data, challenging assimilation and assessment skills. Repaid communication, plus increased access to it in the home, at work and in educational establishments could mean that learning becomes a truly
lifelong activity an activity in which the pace of technological change forces constant evaluation of the learning process itself.

In India there is growing interest for a switch over of education from the conventional method to modern teaching method. Here the word modern refers to any technique we are using while teaching where the learning will be more. These modern teaching techniques lead to educational technology, which is one of the crucial developments in the field of education. Educational technology is the newly evolved emerging branch of education and it plays a vital role in enhancing the efficiency of the teaching – learning process.

Technology is the action end of knowledge. It is the application of scientific discoveries to life and scientific situations. In the case of education, the findings or studies in linguistics, education, psychology, sociology and communication need to be transformed by “specialists” into processes which can be handled by “persons” in the field for the purpose of solving problems or fulfilling needs of specific groups of learners. A few of the types of instructional technology available to use in our schools and colleges in our country are as follows: Materials prepared using gadgets like OHP, LCD, computer, television and video cassettes.

Using technology would help us to develop the education results in the educational process. Each new physical device prescribes a new set of procedures and techniques. The use of technology increases productivity too by enhancing the human capability.

The teacher is thus required to restructure his / her environment for promoting effective teaching by utilizing educational technology in an integrated manner. It has to be realized that students are not always born, they are often made. For “making” students, various media, methods and materials should be utilized appropriately in the right place, at right lime and in the right manner. Educational technology should be rightly regarded as the handmaid of the teaching profession.

Effective teaching in any subject depends largely upon the introduction of newer methods. The investigator thought creatively for the growing need to
use technology through newer methods of using computer in teaching Chemistry.

1.7 COMPUTER ASSISTED INSTRUCTION (CAI)

CAI – Computer Assisted Instruction may be defined as the use of a computer as an integral part of an instructional system, the learner generally engaging in two-way interaction with the computer via terminal. CAI in education is being with aim not only making education more widely available but also of improving the quality of education. CAI is the effective tool to enlighten the humanity. Investment in CAI is urged upon policy-makers as the path to educational quality. In fact, enthusiasts for CAI argue that quality has and will continue to increase rapidly, creating a “new educational culture”. The purpose of CAI is to improve the effectiveness of teaching and learning process in formal or informal setting and utilizing scientific principles. Thus CAI is the newly evolved emerging branch of education and it plays a vital role in emerging the efficiency of the teaching-learning process in all the subjects. Effectiveness refers to produce a successful result by the CAI in teaching chemistry. Effective teaching in any subject depends largely upon the introduction to newer methods. The investigator aware about the growing need to make use of CAI is the new method or approaches highlight the impact of CAI in teaching Chemistry.

We live in a world of computers. We have a visual culture and we live in an environment influenced by computer messages of every kind. The conditions under which computer can be made to influence teaching and learning optimally are being explored from five perspectives (a) computer as technology or machines (b) computer as tutors or students (c) computer as socialising agents (d) computer as motivators for learning (e) computer as mental tools for thinking and problem solving.

The various technological computers are used to teach the needed information to pupils than the traditional method of teaching. So today pupils acquire knowledge through the various computers. Another trend is creation of CAI to teach subjects in a simplified manner for the learning environments in
the classroom, which involve the use of a variety of interrelated learning experiences. This implies “the selection and use of appropriate sequences of computer teaching creates experiences which reinforce and strengthen one another in furthering the progress of the learner.

The teacher and student can make use of various computers like micro and macro computers and lap tops for making them very effective towards teaching and learning. The investigator has intended to create CAI to teach Chemistry in the classroom, which helps the teacher to teach Chemistry effectively and makes the learner to learn the subject thoroughly for scoring high marks in the classroom.

CAI has a high motivational value since the learner is exposed to both visual and aural aspects of science simultaneously. The visual presentation of science in use will involve the students more actively in the learning task. By the skilful use of the various techniques that modern technology makes available, the science students can choose to present CAI materials to learners in the most suitable way facilitating successful science acquisition. CAI materials made for the classroom can have all the advantages that the medium of instruction brings, as well as being designed especially for the purpose of educational use. It may well be that the special nature of computer, with their powerful communicative content, influences the style of students and learners.

The recent and the most striking innovation in the field of educational technology is the application of CAI. The main objective of CAI is to provide flexibility for individualizing learning in the educational process. CAI meets the specific needs of the student in a way in which it is almost impossible to do so in a face-to face teacher-student relationship. The greatest asset of the computer is its instant response and its flexibility to suit the learner’s needs and requirements. There are number of ways by which computers can be used for instruction. CAI refers to situations in which a computer system is utilized in the learning process. It can be used as a record keeper, retriever, laboratory-computing device, as a tutor, as simulation device and in a number of other ways.
Computer can be used as part of a CAI in teaching and learning, where the computer is just another learning resource available to student and instructor. In CAI the computer programme is likely to be only one component in a package that may also contain print, audio, video, people and non-computer based activities.

CAI environments provide a further and more powerful dimension to communication when the control and manipulation of meaningful information is passed into the hands of the learner. The ability to interact with these communication elements via interactive CAI allows science learners to explore discover, ponder, search, question answer and receive feedback.

Science learners differ from each other in terms of their needs, interests, strengths and weakness, motivations and learning styles. The ability of CAI to be used as a flexible self-study resource may be useful in accommodating these learner differences. Learners can focus on science areas in which they decide they need help in and ignore others. They can take as much time as they like and exploit to use CAI for learning chemistry. They can work at whatever pace they choose and use or not use any off-line media that they so wish. The vast repositories of CAI make it more likely that material of topic interest to different learners will be available.

CAI really helps the teacher to teach his subject more effectively as well as make the learner to learn the concept voluntarily. They can deliver authentic input, provide meaningful science learning tasks, deliver feedback on those tasks and can be manipulated according to the learning agenda of the user. Therefore they may have great potential in facilitating autonomous science learning. Autonomous science learning refers to situations in which learners become self-achieving these, and evaluate their own progress.

Typically, CAI plays two roles in school reform models. Students learn to make use of CAI as an aid to retrieving information from multiple sources. Teacher teaches and makes the students to learn the subject with self-interest with the help of CAI based computer assisted learning environments. Students learn to develop CAI materials, especially as a component of project based
learning that is rooted in constructivism and in co-operative learning. Many school reform models focus on a significant restructuring of the class room. They propose a shift from a student centred didactic model to a learner – centred constructivist model. Most types of school reform models recognise that CAI brings a new dimension to reading and writing, and that student need to develop basic skills in information retrieval in CAI environment.

The use of CAI in Chemistry teaching as an innovative technique would become fruitless unless it is evaluated properly by the students.

1.8 CHEMISTRY TEACHING THROUGH CAI

In fact, a relatively small number of teacher and chemistry students know the way of using computers for teaching and learning of Chemistry. CAI gives an opportunity to teach Chemistry and make the students to learn all laboratory applications in simplified form. Using the appropriate CAI allows the computers to measure, record, graph, and analyze a variety of physical quantities: temperature, light, pH, pressure, and electrical and magnetic parameters, to list the most common. The topics such as Atomic Structure – II & Periodic Classification - II, P, D Blocks of Elements, D,F Blocks of Elements, Coordination Compounds & Nuclear Chemistry, Electro Chemistry I & II, Solid and Surface Chemistry, Chemical Equilibrium, Kinetics and Thermodynamics, Chemistry in Action, Isomerism of Organic & Nitrogen Compounds and Biomolecules has been developed by the investigator to understand the concepts with the help of CAI.

An ideal computer learning environment, possible with current technology, might be an arrangement where each student has access to a "friendly" computer station consisting of high quality CAI with the help of Computer. At such a station each student could proceed at his or her own rate of learning. An important feature of the CAI would be the learner's ability to choose whether to proceed or to review when attempting to master course objectives. In addition, students would be encouraged to repeat the doubtful topics with the help of CAI. CAI would also play a major role in the Chemistry labs of the future. Students in the ideal computer environment
would also be encouraged to participate in cooperative activities as part of the chemistry course, perhaps in the form of problem solving activities that would not require that all students in a group be at the same level of instruction. Indeed, it might be very beneficial to create cooperative problem solving groups composed of students currently studying topics in different areas (i.e. physical chemistry, inorganic chemistry, organic chemistry and pharmaceutical chemistry) or at differing levels of an integrated Chemistry curriculum with the help of CAI. When teaching is done through CAI proper evaluation techniques must be used to find its effectiveness.

1.9 EVALUATION OF CHEMISTRY LEARNING

As evaluation plays an integral part of this experimental study, the investigator highlights the need and importance of evaluation and Achievement. Evaluation is defined as the making of judgements about the value, for some purpose, of ideas, works, solutions, methods and materials. It involves the use of criteria as well as standards for appraising the extent to which particulars are accurate, effective, economical or satisfying. The judgements may be either quantitative or qualitative and the criteria may be either those determined by the student or those which are given to him.

Evaluation is a process of collecting evidences about students’ attainment or growth on the basis of which judgements are formed which in turn are used for making decisions. Therefore, information gathering, judgement forming and decision making are the three components of evaluation.

Evaluation may be defined as a systematic process of determining the extent to which instructional objectives are achieved by pupils. There are two aspects of this definition. First evaluation implies a systematic process which omits casual, uncontrolled observation of pupils. Second, evaluation always assumes that instructional objectives have been previously identified. Without previously determined objectives, it is impossible to judge the nature and extent of learning. This definition indicates that evaluation is a much more comprehensive and inclusive term than measurement. Evaluation includes
both qualitative and quantitative descriptive of pupil behaviour plus value
judgements concerning the desirability of that behaviour. But measurement is
limited to quantitative descriptive of pupil behaviour. It does not include
qualitative description nor does it imply judgement concerning the worth or
value of the behaviour measured. The following shows the relationship
between measurement and evaluation.

Evaluation – Quantitative description of pupils (measurement) + value
judgement Evaluation – Qualitative description of pupils (non-measurement) +
value judgement. As noted above evaluation may or may not be based on
measurement. When it is, it goes beyond the simple qualitative description.

Evaluation has a broader connotation than the term measurement. The
utilization of any measuring instrument can be regarded as one of the
techniques employed to evaluate status or extent of progress. Hence any
device that it utilised with an individual or a group of individuals to gain
added insights concerning personal characteristics can be called a tool of
evaluation.

In addition to providing information about individual pupil, a good
evaluation programme will provide data enabling a student to determine the
effectiveness of his learning and to what degree have the ideas, concepts,
processes, skills, understandings, and attitudes, which have been the objectives
of his learning, been learnt by his pupils.

Evaluation is a diagnostic process before it is a judicial one. Its
ultimate purpose is to determine our success in the task. We have accepted
fostering the best growth of children. To the degree that we help it serve that
purpose it is a dynamic and valuable function and will contribute to the
liveliness and value of the school’s learning programme.

A science learning programme that achieves its objectives is valid.
Evaluation is that phase of science program development that monitors the
learning process in order to ensure that the system works, and determines
which phases of the system need adjustment when problems are detected.
Evaluation is concerned not only with the product or results of science learning, but also the processes by which science learning is accomplished. Its procedures include:

- Analysis of the system through which the program is delivered, to determine if it represents the optimal structuring of time, resources, learners, students and materials.

- Analysis of the goals and objectives of the programme to see if they are relevant and attainable.

- Evaluation of the results of the program to see if the levels of performance attained are compatible with the programme objectives.

- Evaluation of results obtained to ascertain if these were achieved as a result of the program, or despite it. The fact that students make progress during a period of instruction, for example, does not enable one to conclude that this resulted from the program or methodology adopted. Students may learn independently without any method. To determine the degree to which the program is responsible for the results observed, research using a true experimental design may be needed, where the effects of a particular technique or method can be studied systematically.

Analysis of the process by which the program is implemented.

This may involve gathering data on the actual behaviour of students and learners within classrooms during the course of instruction. This will provide a more detailed profile of learning and learning behaviours, one from which it is possible to determine the degree of fit between the theory underlying a particular instructional philosophy and the actual learning and learning behaviours that result from its implementation.

1.9.1 ACHIEVEMENT IN CHEMISTRY

The investigator in order to find out the effectiveness of CAI approach for teaching Chemistry and to compare the performance of the students in different groups of achieving high scores in Chemistry.

The term ‘achievement’ refers to the performance or experience relative to a given subject. It is concerned with learning outcomes rather than native capacity or ability to learn the subject.
Among the many aspects of the evaluation procedure that have been developed, achievement has a significant place. Thorndike and Hagen, while dealing with different aspects of evaluation observe that ‘Achievements are performance based to show what a pupil has already learnt to do.

Achievement is defined as the accomplishment or proficiency of performance in a given skill or body of knowledge. Achievement objective is commonly a measure of the students’ ability in terms of standardised test results. Achievement refers to accomplishment, success in bringing about a desired end or the degree or level of success attained in scholastic or academic work.

Achievement tests are intended to measure the student’s knowledge of specific facts. In recent times they attempt to measure the students understanding and mastering of basic principles. A major problem in developing achievement test is to select content sufficiently common to the curricula of most school systems so that the test will have a satisfactory level of content validity. Another aspect of content validity that one should consider when framing the test is the degree to which the test is up to date. When the research conditions call for measures of very specific knowledge, it is often necessary for the research worker to develop an achievement test for use in the research project.

Achievement test consists of objective type, short essay type and essay type. Among these, objective type has more validity than others. Objective tests can cover more content because each response is short and can be given quickly. Therefore assessment of quite a number of learning outcomes and a good coverage of the content is possible by giving an objective test. Items in this type of test generally have only one acceptable response and hence possess high objectivity. That is, the possibility of scores differing from one scorer to another, for the same scorer is limited to a minimum. Correcting the responses is very easy requiring little technical skill. A key listing correct response can be used for objective and easy scoring. The researcher developed Entry behaviour test, Pre/Post-tests which had appropriate content coverage to
suit their level of learning could be evaluated by using the multiple choice type of objective questions.

1.9.2 COMPETENCY BASED LEARNING CHEMISTRY

Competency based learning is an approach to teaching and learning more often used in learning concrete skills than abstract learning. It differs from other non-related approaches in that the unit of learning is extremely fine grained. Rather than a course or a module every individual skill/learning outcome, known as a competency, is one single unit. Learners work on one competency at a time, which is likely a small component of a larger learning goal. The student is evaluated on the individual competency, and only once they have mastered it do they move on to others. After that, higher or more complex competencies are learned to a degree of mastery and isolated from other topics. Another common component of Competency-based learning is the ability to skip learning modules entirely if the learner can demonstrate they already have mastery. That can be done either through prior learning assessment or formative testing.

Competency based learning is learner focused and works naturally with independent study and with the instructor in the role of facilitator. Learners often find different individual skills more difficult than others. This learning method allows a student to learn those individual skills they find challenging at their own pace, practicing and refining as much as they like. Then, they can move rapidly through other skills to which they are more adept.

Most other learning methods use summative testing; competency-based learning requires mastery of every individual learning outcome making it very well suited to learning credentials in which safety is an issue. With summative testing a student who has 80% in an evaluation may have an 80% mastery of all learning outcomes or may have no mastery what-so-ever of 20% of the learning outcomes. Further this student may be permitted to move on to higher learning and still be missing some abilities that are crucial to that
higher learning. What it means to have mastered a competency depends on the learning domain (subject matter). In subject matter that could affect safety, it would be usual to expect complete learning that can be repeated every time. It is important to understand that this learning methodology is common in many kinetic and/or skills based learning, but is also sometime applied to abstract and/or academic learning for students who find themselves out-of-step with their grade, course or program of study. The competence based learning is well exhibited in the way in which he learns in the class. The teacher should assess their student’s ability by the way of their knowledge, understanding, application and skill of learning chemistry in their day to day life.

Terry D. Johnson (1973) observes, “Learning involves consideration of the nature of the child, the goals to be attained, and finally the methods and materials required to attain those goals”. Learning is a fairly complex process. It involves the use of clear and identifiable framework for conceptualizing how people learn. Effective learning involves more than knowing one’s subject, being a nice person, and answering questions politely. Generally learning competence refers to the learning performance of the student taking into account the various skills he will be displaying in the class room. The student’s competence with respect to each skill will be measured on a seven point scale and the total score will indicate his / her competence. The gain scores of the teacher on student’s assessment battery (TAB) are considered as the scores on the critical variable.

Michael, I Junkin observes that learning competency refers to specific behaviours that are considered to be particularly effective in facilitating desired learning in students. Webster’s New Twentieth Century Dictionary (1955) defines it as the “Capacity equal to requirement adequate fitness or ability, the state of being competent”. Learning competency of a student is defined as the average success of all his behaviours in achieving their intended effects. Learning competency is those skills, concepts and attitudes needed by students for the act of instruction in an educational institution.
A competent student is able to adjust his learning procedures and the tempo of his learning to bring in a good effect in the learners. He will prove himself an effective student. While assessing the learning competence of a student, when a higher degree of competence index is perceived then the student will definitely bring out efficient learning in the learners as the student will directly or indirectly transform his abilities to the learners.

Unlike other subjects of study, Chemistry is an important science subject as well as knowledge subject. The teacher who teaches Chemistry should teach the knowledge, understanding, application and skills. Apart from this he has to develop the student’s skills of acquiring knowledge of using chemicals in the day today life. To make this learning effective, the Chemistry student must develop certain abilities of learning science through active based learning. To be a competent student of learning Chemistry, a student must have a “ability to identify the chemical composition in their day today life.

In Chemistry class, the student should exhibit his competence at various stages Knowledge, Understanding, Application and Skill. The teacher has to be time conscious of using CAI package to develop their students competency in learning Chemistry.

1.9.3 APTITUDE IN LEARNING CHEMISTRY

An individual’s aptitude plays a vital role in his performance, so the investigator had used it as one of the variables. An aptitude is a combination of characteristics indicative of an individual’s capacity to acquire (with training) some specific knowledge, skill or set of organised responses, such as the ability to speak a science, to become a musician, to do mechanical work. An aptitude test, therefore, is one designed to measure a person’s potential ability in an activity of a specialized kind and within a restricted range.

When we speak of an individual’s aptitude for a given type of activity, we mean the capacity to acquire proficiency under appropriate conditions: that is, his potentialities at present, as revealed by his performance on selected tests that have predicative value. The various types of aptitude tests largely possess, in common, the characteristics of testing the individual’s potentialities in
terms of specific abilities resulting from the inheritance and general experience but of disregarding the abilities resulting from specific training or education.

In Traxler’s opinion, “Aptitude is a condition, a quality or a set of qualities in an individual which is indicative of the probable extent to which he will be able to acquire under suitable training some knowledge, skill or composite of knowledge, understanding and skill, such as ability to contribute to art or music, mechanical ability or mathematical ability or ability to read and speak a foreign science. In simple way we could define aptitude considered as special ability of an individual to acquire a required degree of proficiency”.

An aptitude test is a device designed to indicate a person’s potential ability for performance of a certain type of activity of a specialised kind. It measures present performance, which is symptomatic of future accomplishment. These tests should be given at any time when a teacher requires evidence concerning the aptitudes of his pupils. Since evaluating aptitude is a technical task, mostly standardised aptitude tests are employed to estimate aptitudes. Hence, the investigator has intended to construct an aptitude scale to find out their level of aptitude in learning Chemistry.

1.9.4 ATTITUDE TOWARDS LEARNING CHEMISTRY

A person’s attitude towards his/her subject brings out changes in his performance, so the investigator has made use of this variable in this study. One aspect of an individual’s personality is his/her attitude. According to Thurstone, “An attitude is the sum total of a man’s inclination and feelings, prejudices or bias, preconceived notions, ideas, fears, threats and convictions about any specific topic”. Attitude in the first instance is the way in which the body is set or made ready for an out-coming situation. The psychology of attitude begins with the psychology of set, the readiness to move in one direction or another.

Thurstone defines attitude as the degree of positive and negative affect associated with some psychological object. An attitude is a dispositional
readiness to respond to certain situations, persons or objects in a consistent manner which has been learned and has become one’s typical mode of response. An attitude has a well defined object of reference.

Tests of attitudes are based upon several assumptions (a) the scale should deal with a controversial question; (b) an individual’s feelings and insights in regard to the question will determine his responses to the various statements that are made pro and con; and (c) the statements can be scaled regarding the degree to which they favour or are opposed to, the question under consideration.

Attitude tests are aimed at predicting the students’ later performance in a specific type of behaviour. Attitude scales are frequently developed to measure the individuals’ attitude toward a particular group, institution, or institutional practice. An attitude is usually thought of having three components; an affective component, which consists of the individual’s feelings about the attitude object, a cognitive component, which is the individual’s beliefs or knowledge about the attitude object, and a behavioural component, which is the individual’s pre-disposition to act toward the attitude object in a particular way.

Several different procedures have been used to develop measures of attitude. Attitudes are often measured in educational research because of their possible predictive value. A very large number of attitude scales are listed in Measures for Psychological Assessment which purports to measure attitude toward such things as authority, change, death, health, job, mental illness, school and so on. Satisfactory attitude scales can be developed by the research worker to measure the attitude of the students towards learning of Chemistry.

One’s perception towards his/her profession would also bring desirable changes in one’s behaviour. Hence the investigator has inclined to develop an attitude scale towards Chemistry learning.
1.9.5 PERCEPTION ON LEARNING CHEMISTRY

The Oxford Universal Dictionary (1974) defines perception as the action of the mind by which it refers its sensations to an external object as their cause.

Perception is in a limited sense, an awareness of external objects, conditions and a continuous process of integration of present and past sensory impressions and in a broader sense, awareness of whatever sort, how and brought about.

The term perception implies knowledge of the world of material things in which we live. Perception is explained as the acquisition of information about the environment through the senses. Perceptions are closely related to learning and thinking since they deal with the problem of knowledge. Each individual gains knowledge about the environment through perceptions. They also deal with the way in which one forms impressions about other persons. Further, they depend on the type of climate / atmosphere which the student sets in the classroom.

Lynch (1973) explains learning profession perception as an understanding of the social process of becoming a student to investigate how perceptions of learning are successfully transmitted to students in making so as to ascertain the societal significance of such perceptions. This process can be thought of as the adjustment by individuals to the expectations held for them as students by others, whether directly or through institutionalized values.

The investigator feels to employ Patted’s, Perception on Learning Chemistry (PLC) as one of the variables of the study, to find out students’ perception on learning Chemistry.
1.9.6 PERSONALITY

Personality is that which permits a prediction of what a person will do in a given situation. Personality is concerned with all the behaviour of the individual both over and under the skin. Personality is the entire organisation of human being at any stage of his development. It embraces every phase of human character, intellect, temperament, skill, morality and every attitude that has been built up in the course of one’s life. Personality is the sum total of the effect made by an individual upon society, habits or action which successfully influence other people.

Warren’s Dictionary (1984) defines personality as the integrative organisation of all the cognitive, affective, conative and physical characteristics of an individual as it manifests itself in focal distinction from others. Personality is a concept which is commonly used both in every day science and in psychological research and practice to epitomize other person’s observable behaviours in terms of the differential ways they relate to interact with and adjust to their social and physical surroundings. The emphasis is most often on cognitive, emotional and behavioural styles which are apt to change across the life span. Personality is thus a hypothetical construct that has no existence of its own. It is inferred from behaviour and used to characterise individuals. Personality is described in terms of an individual’s behaviour – his actions, postures, words, and attitudes and opinions regarding his external world. But personality may be more basically described in terms of the individual’s covert feelings about his external world; feelings that may not be apparent or discernible in his behaviour. It is described also in terms of one’s feelings about oneself. Psychologists use the term dynamic organization, by which they mean that personality traits do not exist independently or act in isolation. They are interrelated, interacting in an organised and coherent manner. They may, like any other organised system, be in a process of change and evolution.

Allport (1961) defines Personality as the dynamic organisation within the individual of those psychophysical systems that determine his characteristic behaviour and thought.
Other psychologists call it “Psycho Physical” as Personality is neither exclusively mental nor exclusively neural (physical). Its organisation entails the functioning of both “mind” and “body” is some inextricable unity. Personality is something and does something. The latent psychophysical systems when called into action either motivate or direct specific activity and thought. All systems that comprise personality are to be regarded as determining tendencies. They exert a directive influence upon all the adjective and expressive acts by which the personality comes to be known. A trait is a constant directing psychic force, which determines the active and reactive behaviour of the individual. Traits are the ultimate relatives of psychological organisation. They are the mental structures that account for consistency in behaviour. Traits are pre dispositions to respond and they serve to respond, and they serve to integrate what would otherwise be dissimilar stimuli and responses. Traits are relatively general and enduring, although they may range in generality from highly generalised cardinal through central to secondary traits or more specific ‘attitudes’. An individual’s personality structure is his pattern of dispositions or traits. Allport emphasised this structure, rather than the environment or stimulus conditions, in his analysis of human behaviour. He stressed individual differences and the uniqueness of each person. Although he recognised some roughly common traits on which individuals can be compared, he urged an intensive study of the individual. The investigator has made use of Cattell’s 16 PF questionnaires to assess the personality traits of the student and to find out how far it is related to their achievement in Chemistry.

1.10 SIGNIFICANCE OF THE STUDY

Today the various nations across the globe are networked more closely than even before. This has had a deep and profound effect upon the functioning of high secondary sector and has literally transformed the way we look at all aspects of quality in higher secondary schools because with the help of that only students life have been decided by them and their parents. Through suitable interventions like institutional structures for quality we need
to enhance awareness about creating a quality education system. In this age of competition, quality has to be managed strategically. The demand for scoring high marks in the higher secondary exam is very important for all the students to choose right studies for their life. For that all the students try to score centum in Chemistry. This approach embraces the learner and the learning in a more complete way than traditional way of studying from the schools. The problem chosen for the study plays a significant role in the field of higher secondary school in Government of Tamilnadu XII standard Chemistry revised syllabus of First Edition was published in the year of 2005, Second Edition was published in the year of 2006 and revised edition was published in the year of 2007. But the students are showing huge gap of scoring marks in Chemistry from higher secondary exams. Our State government has given free laptops to all the students but how far this computer is helpful for the development of their studies is a question mark! So the researcher would like to overcome from the huge gap of scoring marks in Chemistry. For filling the gap the researcher find the way of teaching Chemistry through computer for his study.

1.11 NEED OF THE STUDY

The investigator has been serving as the Principal form Sri Ram Nallamani Yadava and JP College of Education from Tenkasi Taluk of Tirunelveli District., teaching physical science to his student teachers for the last 10 years, observed that whenever his student teachers went for teaching practice most of the Chemistry teachers are teaching chemistry through traditional methods. The investigator being a teacher educator decided to venture into an innovative CAI in order to teach Chemistry to higher secondary students. The investigator started CAI for theoretical with practical background of teaching chemistry which has been a good source of information and inspiration to carry out this study. But these trends of traditional methods are suitable only for the fast learners and give little effect to average and less effect to slow learners. To overcome the gaps between the average and slow learners researcher has instructed to develop Computer
Assisted Instruction to teach Chemistry for the revised syllabus of XII standard Chemistry 2007 to the higher secondary students. The investigator felt that the conventional method of classroom instructions does not cater to the learners’ need in the presentation of the content in an effective way. Till date no attempt has been made to study the effectiveness of CAI approach for the revised syllabus in learning of Chemistry at the higher secondary level in the presentation of content. The above information provoked the investigator to develop ten computer assisted instruction packages to present the content through CAI and to compare the effectiveness of CAI with that of the conventional lecture method. Hence this study of CAI is very useful to learn Chemistry at the higher secondary level by the investigator through experiment.

1.12 DELIMITATION OF THE STUDY

1. The experimental study is limited to 120 students from Matric and Montessori schools from Tenkasi Taluk in Tirunelveli District.

2. The sample is restricted only to the higher secondary students pursuing XII standard.

3. The sample of the study is restricted to only 40 students from each school.

4. The study is limited to collect information about independent variables which are follows: Groups (Control, Experimental-I and Experimental-II), Subject (Computer science and Biology groups of students studying Chemistry is an important subject to decide their future) and Locality (Rural and Urban).

1.13 LIMITATIONS OF THE STUDY

The sample of the study comprises for XII standard higher secondary students studying Chemistry from Bharath Montessori, MKVK and Hilton Matric higher secondary schools from Tenkasi Taluk in Tirunelveli District in
the year 2011-2012. The investigator works as Principal incharge from JP College of Education and the study being experimental in nature, he had limited his sample for the Experimental groups in the same taluk. Besides, the investigator had easy accessibility to visit the nearby schools which are under the jurisdiction of Manonmanium Sundaranar University for the purpose of carrying out his research. Hence, the investigator has limited his study written the schools of Tirunelveli District. The investigator studied the effectiveness of CAI for teaching ten Units of Chemistry for the English medium students only. The study is limited only with 8 tools and with the following dimensions.

1. Entry Behaviour Test
2. Pre/Post and Criterion Tests
3. Suresh John Kennedy A & Denisia S.P Aptitude in Learning Chemistry Scale (SDALCS)
4. Suresh John Kennedy A & Denisia S.P Perception on Learning Chemistry Scale (SDPLCS)
5. Suresh John Kennedy A & Denisia S.P Attitude towards Learning Chemistry Scale (SDATLCS)
6. Suresh John Kennedy A & Denisia S.P Competency Based Learning Chemistry Scale (SDCBLCS)
7. Identification of Personality Factors (Cattell’s 16 PF)
8. Suresh John Kennedy A & Denisia S.P CAI Reaction Scale (SDCAIRS)

1.14 CONCLUSION

This chapter ‘Introduction and Conceptual framework has elaborately presented the various factors that has led to undergo this study, the concepts related to the problem of the study has been given in detail by explaining the theoretical aspects of effectiveness of CAI in teaching Chemistry for higher secondary students through experiment. It has also provided the need and significance of this study. The ensuing chapter deals with the related literature which has served as the base of this study.