CHAPTER I

INTRODUCTION

1.1 COMPUTERS IN EDUCATION :

Computers have become an important and versatile tool of instruction for teachers in the classrooms. Use of blackboard is now being augmented with lessons, prepared with the help of computers. Computer aided instructions add action to the information which students receive through one way process and help students to see the unseen, to test the theoretical concepts and to comprehend abstract ideas. When a teacher in the classroom applies his creative ability to use computers, enormous possibilities do exist for maximizing learning. Thus, the use of computers is no more limited to complex calculations and information storage and retrieval alone. It is now possible for teachers to interact with students without their physical presence, bindings of a fixed time-table and communication even from long distance. Computers are also used in educational management, drilling and practicing and in tutorials by the students. The computers in educational institutions can be used for many allied jobs which are carried on everyday. It helps to maintain the attendance registers, cumulative records, library management and maintaining accounts. Thus, it reduces the work load of the subject teachers and helps them to concentrate in a better way on their teaching.

The use of computers for teaching a particular subject affects the process of education in two ways :

(1) time taken in absorption of information, and

(2) one-to-one interaction and removal of barriers of distance and physical presence of students (Shrivastava and Singh 1991).

As the modern society is becoming more & more dependent on information technology, there is a need to develop self instructional devices which can supplement the classroom teaching. In this process, students can acquire more knowledge within limited time. Until recently, usage of computers in schools was relatively limited to their function as tutor in Computer Assisted Instruction (CAI). They also served as tutees, when students learned to program mainly in the languages of BASIC or LOGO. Serving in these capacities, computers were treated as separate and independent tutors and tutees - segregated from all other activities of the schools.

The pace of computer evolution has been rapid in the 1980's, for the advent of the microcomputer has elevated the computers from having only a marginal role for education to become a major educational media. This has paralleled the evolution of the computers in the world at large - from its former limited role in big business and administration to it's new status as a "primary work tool" (Pogrow 1983). Computerized instructions have proved to be effective for learning complex concepts. According to Maggery (1983), the challenges and problems faced by the modern educational

system can be removed with the help of computers. Knezek and others (1988) described a taxonomy for educational computing. Educational computing applications are classified into three groups : (1) Knowledge generation, (2) Knowledge dissemination, and (3) Information management.

Knowledge generation is classified into (a) Data acquisition, (b) Data analysis, and (c) Modelling. Dissemination is classified into (a) Computer as a topic, (b) Computer as a tool, (c) Computer as a tutee, and (d) Computer as a tutor. Information management is classified into (a) Students' records (b) Financial records (c) Personnel records, and (d) Project records. Further, Caral (1992) reported that computerized instructions are more effective than the traditional instruction in increasing reading as well as mathematics and language achievement. Computerized Instructions had positive effects on student motivation, attitude, instructional tasks and in improving students' writing.

From the above mentioned research evidences, one can say that computers are necessary for any educational system. The reasons for computers to be of necessity in education are :

(1) help to improve learning process.

(2) help in certain administrative tasks such as maintainance of students' record, preparing time table, preparing admission list, developing question banks, preparing results and taking managerial decisions.

(3) future citizens of the country should be aware about the nature and use of computers so that they can cope up with the present and future technological challenges.

Thus, with the advancements in the field of computer technology and it's application in various fields, it becomes essential to know about the progressive developments in the field of Computer Education.

1.2 DEVELOPMENT OF COMPUTER EDUCATION

In the history of computer technology, it can be noted that the first teaching machine of Pressey came to the education scenario in 1920 which did not achieve popularity till 1959. The whole movement dropped by 1932 because of two reasons. Firstly, no provision was made in the machine to use programmed instructional material and secondly, the social conditions and education system did not offer a favourable environment (Sharma 1981). Later on in 1954, B.F. Skinner attempted to apply the principles of learning to education and to the use of teaching machines. He found that Operant Conditioning is of more significance for human learning. But there is a great difference between Pressey and Skinner's contributions. Pressey had developed Hardware approach and testing strategy whereas Skinner had contributed to software approach and instructional strategy. Afterwards Crowder (1954) developed another learning strategy called branching programming wherein he gave more emphasis on task analysis

rather than learning conditions. Crowder combined the study assignment and testing of Pressey. The Crowder's intrinsic programming is based on human training in which emphasis is given on the structure of the task whereas Skinner's Linear Programming is based on psychology of learning in which more stress is given on structure of learning. Ryle (1962) gave the concept of content analysis for facilitating the transfer of learning. Further, Robert Mager (1962) developed an approach for writing objectives in behavioural forms for having learner controlled instructions and task analysis. Thus, the concept of programmed instruction developed to full extent by 1970. The evaluation approach or Mastery Validation was also introduced by 1970, Glacer (1965); Snelbecker (1974); Smith (1978); Sharma (1982). So it can be concluded that programmed materials supplemented the machine of Pressey and theories of learning developed during 1950's and 1960's. The emergence of Computer Assisted Instruction (CAI) in the late 1960's was heralded as a break through. Although the first electronic computer was built in 1946, the personal computer did not begin until 1975 (Defleur, 1989). In 1985, there were on an average only 0.9 micro computers per 100 pupils in primary schols and 1.7 per 100 secondary schools in U.K. Computer studies was only the twelfth most popular ordinary level examination subject in 1984 in England and high quality softwares are almost non-existant in elementary and secondary schools. It is difficult to find many teachers who believe that the software suport is adequate. Further,

number of studies have shown that students were not always interested in learning through softwares or motivated by positive reinforces or even verbal feedback on the screen and the use of extrinsic reinforcement undermines the students' own intrinsic interest (Harris, 1988). Further, Harris (1988) interacted with 33 CAI packages developed for children and found that children learn faster by CAI but the retention of what was learned through CAI was lower in comparison to normal instruction.

Since long, the western countries have been using computers in the area of education. In a developing country like India, it is essential to adopt emerging areas of technology to inform, to provide skills, and to educate the people, to make them aware of their potential and contribute towards national development. It was felt necessary to use this technology in education to keep pace with the technological developments.

Recognising the importance, the Sixth Five Year Plan document also stated that :

"The importance of educational technology has to be adequately provided for greater efficiency, effectiveness and wider reach of the educational programmes".

The importance of computer education is also very well reflected in the report of the National workshop on Computer Literacy Curriculum held at the National Council of Educational Research and Training (NCERT) in 1984. It

mentioned the following :

(a) Computer education should be introduced at senior secondary level and may gradually be introduced at middle and primary levels.

(b) Computer education would be a part of the curriculum for every student, irrespective of the area selected for specialization.

(c) Computer literacy programme would familiarise students with the computer as a versatile tool - with immense application potential in all aspects of human development. After the workshop, the CLASS project (Computer Literacy Studies in Schools) was started.

With due emphasis on computer education, the Department of Electronics, Government of India, in close cooperation with the Department of Education, Ministry of Human Resource Development, Govt. of India launched the pilot project in 250 schools. In this regard, National Council of Educational Research and Training (NCERT) New Delhi, took up the executive responsibility and Indian Institute of Technology (IIT), New Delhi provided initial inputs for the implementation of CLASS project in terms of designing teachers' and students' training programme. CMC Limited (Computer Maintenance Corporation Limited) had the responsibility to install and maintain the computers of the project.

For this CLASS project, 42 Regional Resource Centers had taken up the responsibility for implementing the project. The class project introduced computer education in schools in a phased manner with the following objectives.

1) To provide students with broad understanding of computers and their use.
2) To familiarise students with the range of computer applications in all walks of human life and the computers' potential as a controlling and information processing tool.
3) Computer education should be introduced at the secondary and higher secondary level at the outset, to be followed by the computer literacy at middle and primary school levels.
4) Computer education would be a part of the school curriculum, and for every student, irrespective of eventual branching into science, humanities and commerce.
5) Computer literacy programme would enable students to become familiar with the computers and its potential as a versatile tool with application in all aspects of human endeavour.

The important functions of the Resource Centres were as follows :

i) Provide support and consultancy to the teachers of selected schools.

ii) Monitoring the implementation of the programme with a view to particularly identifying problems and their solutions.

iii) Training of teachers of schools covered in experimental phase and the wider expansion phase.

iv) Maintainance of computers and attending to some urgent replacement of parts.

v) Interaction among institutions and also with other educational institutions.

vi) Development of curriculum and teaching strategies.

Maintenance and service support for the project was organised through Computer Maintenance Corporation of Government of India undertaking.

Microcomputers were selected for this project because of their low cost and availability of the suitable software packages for school children such as word processor, data based systems and computer based learning packages.

The most crucial element of the programme was the generation of an adequate number of trained teachers for running the computer education programme. Seven hundred and fifty teachers (3 each from 250 schools) were trained through the intensive 3 week training courses conducted by the Resource Centres during June-July, 1984.

The curriculum followed for computer education was divided into three phases. The first phase was designed to prepare the students to be able to make use of the existing

educational programmes. The second phase was designed to provide training in BASIC languages and third phase was meant for vocational training of the students with special aptitude for computers.

Later on, the National Policy on Education (1986) emphasised for the computer literacy. During the Seventh Five Year Plan, a huge sum of Rs. 700 crores was alloted for computer literacy and expansion of computer programmes at all levels of education. The following measures were suggested for expansion of various programmes of computer literacy.

(a) To expand existing or initiating new programmes for computer manpower by 1995.

(b) Integration of computer education modules in professional and general education courses at first degree level and provision of computer facilities in these institutions.

(c) Introduction of effective computer science courses at higher secondary level.

(d) Extension of computer literacy programmes for all higher secondary schools by 1995 and elementary schools in the long term.

In order to extend computer literacy programme and to prepare a background for instruction of elective computer courses at higher level in various states, many secondary schools were equipped with computer sets with the active assistance of Government of India, N.C.E.R.T., Engineering

colleges and with other agencies viz., TTTI's (Technical Teacher Training Institute). Facilities were provided for necessary training of the selected teachers, who will provide computer training to the students in their respective schools.

THE PRIORITY MEASURES DURING VIIth & VIIIth FIVE YEAR PLAN

(1) To expand existing/initiate new programmes for computer manpower development during the VIIth plan to reach desired levels by 1995.

(2) Integration of computer education in professional and general education courses at first degree level and provision of computer facilities in these institutions - in the VIIth plan to be completed by 1995.

(3) Introduction of elective computer science courses at higher secondary level during the VIIth plan. Extension of computer literacy programme to cover all higher secondary schools by 1991, secondary schools by 1995 and elementary schools in the long term. Further the plan document also mentioned that recent advances in information and communication technology will need to be used to reach out to cover large numbers at minimum costs.

The VIII Five Year Plan document Vol. I has also mentioned about the importance of information technology. It has stressed that all steps would be taken to move in to the age of information.

Ramamurthy Committee (1990) laid emphasis on computer education and recommended that :

1) Computer education is important because computerisation has become a part and parcel of technologies contributing in development of all the sectors.
2) Computer learning should be made an integral part of the school time-table. Emergent and meaningful steps for the production of the computer softwares in regional languages should be taken up. The Resource Centres which are expected to train teachers and provide necessary support should be streamlined.

It can be noted here that the emphasis is given on computers, specially in the field of education due to the versatile facilities of computers.

NATIONAL POLICY ON EDUCATION & PROGRAMME OF ACTION (1992)

National Policy on Education (1992) stated that :

As computers have become important and ubiquitous tools, a minimal exposure to computers and a training in their use will form a part of professional education. Programmes of computer literacy will be organised on a wider scale from the school stage. Keeping in mind the recomendations of NPE (1992), following strategies and programmes were suggested by Programme of Action (1992) :

1. The class project would be expanded subject to resource availability.

2. The coverage of 2000 senior secondary schools was envisaged in the 8th five year plan.
3. The management system for implementation of class project would be strengthened and made more effective.
4. Computer Applications with adequate facilities of computers in schools would be encouraged on operational basis at secondary and higher secondary level.

Thus, it can be concluded that over last few years the NPE (1986), NPE (1992) and POA (1992) have highlighted not only the importance of computers in education but has also suggested different strategies to implement the recommendations at school level. Even Rammurthy committee report also laid emphasis on making computer education as an integral part of school time-table. Thus, it is beyond doubt that computers are going to play a very crucial role in education system in India in near future.

1.3 COMPUTER IN EDUCATION

The computer by now has been accepted as an effective medium of instruction. Now, it has been entrusted upon, even the task of teaching different subject contents. The computers are even used in place of the subject teachers for performing the task of teaching. Recent innovations in information technology have revolutionized the means of instruction - within and outside institutions. Local Area Network (LAN) has brought in the concept of integrated learning systems - whereby a central file server can provide

random access and interactivity in learning. Networking in the context of local area interconnections ranging from a few meters to a few kilometers is called Local Area Network. If the interconnection ranges from a few km to about a thousand kms, the networking is called Wide Area Network (WAN). In comparison to LAN, WAN offers much lower reliability.

Educational uses of LAN and WAN are as follows :

* faster delivery of instruction and communication.
* sharing of data, programmes and other information.
* greater reliability by keeping copies of work on more than one system and eliminating the need for preparing hard copy.
* students could use resources like processor, printer facility or storage of the distant systems.
* saving of duplication of equipments and other items by different departments of an institute.
* scheduling meetings, collaborations and arranging students' conferences.

1.3.a EDUCATION ON THE INTERNET AND INTRANETS

Internet is a network of computers which offers access to people and information. Over 60 million people are using the internet & are likely to multiply very soon. No one group or organization owns this vast global network. There is no centralized management for it. Each network cooperates with other networks to direct internet traffic so that information can be passed on among them.

ADVANTAGES OF INTERNET :

* Students can take credit - bearing courses without ever entering a classroom. The course can be taken and followed by a test via internet.
* Library facilities are available on the internet. Many libraries nowadays make their card catalogues available via telnet so that a person on Internet can search through the catalogues. Reservation of books is also possible for a card holder, and copies of their special historical collections are made available by the libraries.
* Scientists can also share information by sending files back and forth. They can also use the resources of a supercomputer from their own desktop.
* News groups allow teachers and students to ask questions, request, advice and share information. Virtual reality can be used to do things such as students can experience what is likely to steer the space shuttle or create 3-dimentional models of molecules.

Intranets usually belong to corporate organisations, universities and large institutions. Thus, the processes of information dissemination and education may be radically changed over the years. With ever increasing popularity of the internet, local area networks and wide area networks may merge into it as a subset or intranets. Distinctions of reaching out a few meters or across continents may vanish.

The focus in the institutions may shift from teaching to learning. Learners will have to plan and learn for themselves. They would develop metacognition strategies. Course packages would be organised to provide a variety of alternative learning experiences, from which, the students could pick and choose at will. One can hardly locate five or six studies on CAL/CAI and a couple of efforts in developing CAI softwares. The researchers in all cases found greater learning gains through CAI than the conventional method. Although, for understanding and higher cognitive levels, it was not very effective. But these findings are not adequately corroborated with CAI formats that can have differential impact on cognitive gains at higher levels (Mukhopadhyay, 1980).

1.3.b CAI AND USE OF COMPUTERS IN EDUCATION

The term CAI refers to the system of providing on-line direct interactive instruction, testing and prescription in the process of learning. Students can be presented with assignments, problems, exercises, reading materials and references by a computer for learning. After the students complete these assignments, they can be tested through computers. If required, remedial exercise can be presented in the next set of assignments. To motivate the students, immediate feedback is an important ingredient of CAI. Computer Aided Instruction is a set of programming instructions which is used in instructional process to

develop certain predecided skills for the students' mastery over the subject content. In this way, CAI is a use of computers to present drill, practice, exercise and tutorial sequence to the students, and sometimes to engage the students in a dialogue about the substance of the instruction. It means that computer is used as teaching aid and proxy for a teacher. So, CAI is a type of instructions which is used to achieve the objectives of the instructions. The computers are the means and have potentials to contribute to the instructional system. As the knowledge is exploding at a very fast rate, an individual teacher cannot handle the enormous amount of information in a limited time period. For this purpose, computerized instructions can very well be used due to it's following characteristics.

(1) ACTIVE INVOLVEMENT OF THE LEARNERS :

The pioneer of programmed instruction, B.F. Skinner of Harvard University has given five steps which are based on his theory of learning Operant Conditioning. Out of these five steps, one is active responding. He has stated that learners learn well when they remain active in the process. The active involvement of the learners, help them to think about the problems in depth. As, their heart and head both are involved in the instructional process. Power of critical thinking is developed among them which establishes proper relations between the different attributes of the problems. Intermittent slabs of human active interaction in any instructional situation are likely to maximize it's

effectiveness. CAI is the instructional material which has full scope for interaction.

(2) DEVELOPMENT OF COGNITIVE DOMAIN :

Every function of the human body is being controlled by the brain. Acts like grasping the problems, adjustment with the situation, solving the problems etc. are done by the mental processes. Therefore, development of mental abilities of the learners should be the main goal in our instructional process. The instruction should be designed in such a way that there should be full scope for developing critical thinking and cognitive functions. Generally, it is observed that the day-to-day activities of the classrooms aim at development of the abilities related to knowledge and comprehension to a large extent. In other words, higher level of cognition remains undeveloped. For solving problems, giving precise solutions, analysing different ideas, evaluating the critical solutions, establishing relationships among different premises and drawing conclusion is needed to develop the higher cognitive domain.

(3) SELF-PACING AS AN ESSENTIAL FEATURE OF INSTRUCTION :

At secondary stage, learners have more potentials to comprehend the language. They also have the other mental abilities and can learn in their own ways, if suitable instructions are made available to them through the instructional techniques such as Modular form of Instruction,

Programmed Learning Material, Computer Assisted Instruction, etc. Learning through these instructional techniques/methods/ approaches need motivation for the learners. This can be provided through proper arrangement of feedbacks in the instructional material.

(4) INDIVIDUAL INSTRUCTION :

No two individuals are identitical with each other. Even identical twins differ from each other in some aspects. Pupils do their jobs as per their physical and mental abilities. Classrooms are heterogeneous in nature. It is not possible for one teacher to effectively tackle this heterogeneity. Homogeneous way of teaching can not satisfy the slow and fast learners equally. So, there is a basic need to individualize instruction in learning process. Hence, computer is one of the better medias which has the potential to do so.

Educators have been faced by an optimist vision in the use of computers in education for more than 20 years. Computers are rapidly being installed in schools for teaching computer literacy, teaching subjects through Computer Assisted Instruction and for specific computer programming courses. The increasing use of computers in schools is based on a vision of improving pupils' school performance, preparing young ones for changing the structure and nature of job market and altering the way of learning. Some developments in teaching-learning process and in the field of

educational technology has given the new vision towards educational processes. The principle of learning and educational design, cybernetics and instructional technology, mechanical teaching machine developed by B.F. Skinner (Theory of Operant Conditioning) and programmed learning have supported this vision. Enhancing cognitive development and problem solving skills was the second expected area of working with computers. These visions prompted the continuous use and demand of computers in education. For making an effective use of computers in education, one should plan curriculum for the same.

Curriculum can be a programme of studies, a collection of courses at a specific educational level, or it can be more broadly viewed as all the experiences a child or youth has in the educational institutions. It is difficult to generalise about various curricular applications of computers. There are two things which a teacher can do with computers : one is teaching through computers. Teaching through computer depends upon the available software. Software is the computer programme that instructs the computer about what to do; what information to display on the screen and what type of responses to make on command. Available software can be placed under the following categories; drill and practice, tutorial and simulation, modelling, interactive knowledge based system, information seeking and calculation (Eraut Michael, 1989).

1.3.C DRILL AND PRACTICE

The simplest form of CAI uses the computer to present the learner with a series of exercises which he or she must complete by giving some response or answer. The computer processes that response (according to the rules embodied in its program) to determine whether or not it is "correct". It may then provide the learner with some feedback about the answer in the form of a congratulatory message if it was right, or a corrective comment if it was wrong and a noncommital message if the computer was unable to recognize the response. The exercises are specified in advance in their complete form or as templates which can be filled out according to a set of rules.

Computer assisted learning offers a means of providing endless drill and practice without repetition, at a pace that can be controlled by the learners. The nature of the exercises depends on the learner's progress. Thus, as he or she learns and his or her accuracy and speed improves, the exercises can become more difficult or reverse. If a learner makes too many mistakes, they can be made easier. Mistakes can be systematically detected and computer can adapt the pattern of exercises to rectify this weakness.

1.3.D TUTORIAL

The lay image of CAI is of serried ranks of students, each seated in front of a computer keyboard and screen, all learning in their own way and at their own pace. There is an

assumption that each student is participating in some sort of tutorial where he or she is taken on a journey through the learning material via a dialogue, in which information is presented and feedback is elicited through a process of question, answer and challenge.

In its simplest form, this tutorial dialogue bears a close resemblance to the programmed learning sequences found in print and on teaching machines in the 1960s. It is reasonable to ask what the computer can add to the material apart from illuminating the text. If that were all, then there could be little benefit in using the computer, a book would be better. However, programmed texts present a number of problems, particularly in determining whether the student has really mastered the current steps and also for deciding about how to branch to the next step. Self-assessment may require a student to make difficult judgements and the routing may involve complex decisions based on his or her performance and progress through the material. This responsibility may make the student's work more difficult.

In order to construct the CAL tutorial, the teacher (as a part of the production team) must set out a dialogue which they themselves might have with learners under various conditions and decide upon the criteria which determine how they would adapt the pace and direction of their students' learning. These rules are then embodied in the computer programme so that the computer can deliver an analogue of the

real tutorial. However, in topics where it is reasonable to assume that most of the students will follow a few well-trodden routes through the material, this mode can be an effective way of learning.

1.3.E SIMULATION

Both the tutorial, and drill and practice modes of CAL operate by providing information in a structured way according to rules specified by the author / tutor. Another facet of learning involves the student studying real-life systems or phenomena. Sometimes this is quite feasible, but there are some learning experiences which are too time consuming, too expensive, too difficult or too dangerous. The simulation may be supported by a laboratory system, which must be constructed before hand and may require expensive equipment.

Computer can be used to emulate a real-life system by following a set of rules (a programme) which approximates the behaviour of the real system. The quality of the approximation is governed by the author of the simulation who can specify the rules as being simple or complex. It may be educationally desirable to provide various levels of approximation within the same simulation package so that it can be used to show the effects of increasing experimental error or to give a feeling for the accuracy of the simulation.

The advantage of a CAL simulation over the use of the equipment and media is in the flexibility and control which the computer can bring. The computer is a general purpose information processing machine which is transformed into a machine to carry out a specific task by the programme within it. Thus, with different programmes the same computer can simulate different systems. As it runs the simulation, it can also mediate between the student and the analogue of the real-life system, guiding him or her towards experiences which are likely to be helpful and providing some tutorial assistance where necessary.

1.3.F MODELLING

This mode of CAL is similar to the simulation mode.It helps the student to learn by working with an analogue of a real-life system or phenomena expressed as a set of rules within the computer. However, whereas in a simulation, the analogue as specified by the tutor in modelling, it is the student who must construct the analogue. In effect, the student must "teach" the computer the rules, so that it can emulate the real-life system in given circumstances and correctly predict the behavior of the real-life system in new circumstances. The student learns through this process and demonstrates his or her mastery of the learning through the final model.

As with simulations, the technique of learning by modelling is not unique to CAL. It is possible to devise

systems of rules or equations which describe the behaviour of the system to be studied and to test these models in new circumstances, without using a computer. However, the computer provides a convenient way of checking the model, performing the calculations, and following through the set of rules as an impartial referee.

1.3.G INTERACTIVE KNOWLEDGE-BASED SYSTEMS

The preceeding distinction between simulation and modelling for imperative analogues of real-world systems has a parallel in interactive knowledge-based systems (IKBS). These two modes may thus take an alternative approach. The imperative analogue comprises a set of (often mathematical) rules or equations which are used as instructions to the computer to govern the behaviour of the system. The IKBS comprises a descriptive model of the knowledge relating to a particular topic,system or situation.

This can be explored by the learner, perhaps with an expert system providing tutorial guidance and explanation, or by means of asking questions which will lead to an understanding and assimilation of the knowledge. Alternatively, the learner may use the IKBS to model his or her own knowledge of the topic, building and testing his or her own knowledge base. The best way to learn a subject is to teach it and this use of an IKBS provides an opportunity for the student to "teach" the computer about the topic.

1.3.H INFORMATION SEEKING

The last of the six major modes of CAL uses the computer as a mentor and guide through a range of learning resources which might, but need not be, themselves based on the computer. The power of the computer to store, retrieve and process information is used to help the student as he or she browses through the material, responding to questions about related information and retrieving items which are needed, summarizing statistical data and suggesting possible lines of investigation that may be of interest.

This is also the least well-developed mode since it requires very substantial computing resources to cope up with the large quantity of information which people are accustomed to use in libraries, resource centres and finding out from other people. Further, if it is to act as an effective mentor, it must have some artificial "intelligence" at a higher level than is currently feasible in classroom systems. In its unintelligent form, where all the routes through the materials are prespecified and selected according to what is known about the student, the mode degenerates to the computer-managed learning (CML) routing function.

1.3.I CALCULATION

In the early days of computers, before their full potential for general information processing was realized, they were regarded principally as calculating engines. It was natural to use them as sophisticated calculators to relieve

some of the numerical labour involved in learning in the numerical sciences and in statistics. It was noted earlier that, in practice, most CAL packages use components of several modes (for example simulation may be supported by some tutorial material) and calculation facilities are often to be found in packages which are predominantly drill and practice, tutorial or simulations. A number of the larger general purpose CAL systems provide the student with a "calculation mode" which he or she can select in the middle of a tutorial sequence to help work out some numerical results.

The mode could sensibly be widened to include other ways in which the computer can process information so as to relieve the student's work load and help him or her to reach through to the underlying ideas. Thus, the computer might be used to retrieve data from a large database and to prepare, analyse and summary.

As with the use of simulations, care must be taken to ensure that the computer does not replace too much of the activity. Although the calculation and other information processing is often an unnecessary nuisance as it takes time and can obscure the underlying facts and ideas, it may be that the student must understand the processing and be able to carry it out without the computer. If the calculation is always carried out by the computer, then the student will lose out on valuable practice in circumstances where he or

she is motivated by seeing it as a part of a larger process leading to a desired result. However, once he or she has had adequate practice, further repetition is tedious and demotivating and could sensibly be undertaken by the computer.

Thus, computer can do a wide range of things for the learners in different ways. It can involve the learners in an active manner through interactive mode and learners can be engaged in the learning process. The learner becomes intellectually involved and has the opportunity to grow without a great deal of teacher simulation. In a definite sense, this interaction becomes a personal experience. The computer is versatile with regard to videotape players, electronic musical equipments, physical education monitoring equipments and so on. It becomes an invaluable teaching tool on both -a personal and a collective scale. It has also the potential for abstract thinking because the learners can compare relationships with reference to computer games as well as concepts involving many academic areas such as Biology, Economics and Physics. By creating models and utilizing logic, the learner is put into thought process which might have remained unused if they are to read only (Decker, 1983). Computer may be used in analysing and evaluating the standards of teaching in the schools. It is also used in analysing and interpreting the examination results from various educational viewpoints. Computer is also adaptable as a tool for teachers. It helps the teacher in

teaching as well as analysing students' tests. Such programmes could find ready application in most teaching situations. An incredibly versatile tool like computer can be used across different subjects. Thus, computers can greatly facilitate the search for and the retrieval of information and the learners are relieved for more productive learning tasks. This, in turn suggests the need for re-examination of all aspects of the curriculum.

1.4 IMPLICATIONS OF COMPUTER FOR CURRICULAR PRACTICE : SOME ISSUES

The implementation of computers in school curriculum is not free from obstacles. The Experts do not see the adaptation of computers to some curricular areas such as humanities and fine arts because computer depends on a systematic body of rules and procedures. So the implication of computers in these subject areas is not yet possible. Academic fields depend heavily on creativity, intuition, judgement etc. do not lend themselves easily to formal rules which are a base for computer programming. Computers cannot solve fundamental questions regarding public education such as finance, equality of educational opportunity or for that matter, public confidence in the schools. Furthermore, education is not only an individual process. Thinking and social functions are closely related to engagement in action and operations which are both individually and socially organised (Piaget, 1950).

The social development of child is not isolated but is a part of the child's general cognitive development. The investigation concerning the effect of Computer Assisted Instruction related to social behaviour revealed that children who received CAI, exhibited less social behaviour compared to children who were given normal instructions (Feldman and Sears, 1970).

Technological advances tend to isolate individuals from one another and emphasis solitary activities. What happens in essence is that, information collection, storage and use increases while human interaction decreases. **In the final analysis, one may know more but would understand less.** This can decrease human relation skills. Schools are not solely occupied with teaching and instruction work but have an important social purpose. If education is changed into a private act carried out by the computers at homes, some important social dimensions in education could possibly be lost. This is an important caution that the teachers and educationists must be aware of regarding the use and further development of the computer technology in schools. Certainly, the learner must be exposed to the computers in a sequential programme that begins with computer awareness, then using the machine as an instructional aid and finally learning how to programme computers. In order to balance involvement in the computers, the teachers must become more humanistic in their outlook.

1.5 RATIONALE OF THE STUDY :

As mentioned earlier, computers are used in a variety of ways for providing instructions in the classrooms. The various ways are, drill and practice, tutorial and simulation mode. The computers with their variety of programmes, simulate a playful work for learning e.g., the exploration of computer based simulations (such as simulations of scientific experiments) may encourage creative thinking and assist learners to experiment with the hypothesis in the ways which can enhance their creativity rather than confining them to the linearity which mostly characterises the formal education.

Hardly any study has been found in India related to the application of CAI simulation for the teaching of Chemistry at higher secondary level. Studies conducted abroad in the area of teaching of Chemistry through CAI have been found to be scattered over different subject area. No study has been found by the researcher which would help to understand the area of teaching of Chemistry through CAI and in particular, the organic part of Chemistry which deals with variety of three dimensional structural formulas. Computer simulation with graphics would be the most appropriate instructional media (Copolo 1992, and Williamson 1992) for teaching of topics such as stereoisomers, optical isomers, chemical equilibrium, redox reactions etc.

Computer simulation programmes could be used effectively as these topics require much of an imagination for students. In addition, as the students are exposed to these topics for the first time in the standard XI, they definitely need clarity and understanding of concepts as well as more practice for attaining mastery over these concepts. Further, Swetman (1972) and Knotas (1985) have concluded from their studies that computer enhances learning process among children and as Taylor & Conniff (1988) have also found that it helps learner to comprehend some concepts faster and more accurately than when presented textually. The computer softwares have been found to produce a significant difference in the students' achievement between the experimental and control group (Raghavan and Dharmaraja, 1991). In the studies conducted by Patadia (1993) and Sahasrabuddhe (1993) regarding computer education in the secondary schools of Baroda city, it was found that many computer teachers felt that there was a need to develop educational softwares for teaching school subjects but subject teachers were not trained in producing softwares. Hence, there is a need for developing software in school subjects like Physics, Chemistry etc. Further, the studies conducted by Desai (1970), Mehta (1971), Choksi (1972), Abrol (1977), Nagalakshmi (1982), Chauhan (1982), Bharati (1984) and Ahluwalia (1985) have shown that there exists significant positive correlation between academic motivation and scholastic achievement. Studies conducted by Al Rami (1991);

Wison (1995); Kinde (1995) have shown positive relation between IQ and scholastic achievement.

From the above studies, it is clear that the usefulness of computer based instructional packages largely depend upon the quality of softwares. Even Raghavan and Dharmaraja (1991) emphasised the need to test CAI packages in schools before releasing them for publication.

The questions which still remain unanswered are :

1) How does computer based packages help students in bringing conceptal clarity in different topics of Chemistry ?
2) If it helps in bringing the conceptual clarity then how does; (a) IQ level, (b) Motivation level and (c) Attitude of students affect their learning in Chemistry through computer based packages ?
3) Whether CAI is time effective or not ?

To answer above mentioned questions, the present study has been undertaken by the investigator.

1.6 STATEMENT OF THE PROBLEM :

"DEVELOPMENT OF COMPUTER SOFTWARE FOR LEARNING CHEMISTRY AT STANDARD XI"

1.7 OBJECTIVES OF THE STUDY :

The following are the objectives of the present study :

1. To develop CAI package in subject of Chemistry for standard XI Science students, studying GSTB syllabus.

2. To study the effectiveness of the software package in terms of instructional time and achievement of students.
3. To study the effect of the software package on students' achievement in relation to students' (a) Intelligence level, (b) Motivation level and (c) Attitude towards the package.
4. To study the attitude of the students and teacher regarding the effectiveness of the CAI package with regard to aspects of the software such as content of the software, presentation of the software, examples and illustrations, graphs and figures, evaluation items, utility of the software and instructions given in the instructional manual that are provided with the software.

1.8 OPERATIONAL DEFINITIONS OF THE TERMS :

The terms which have been used in the study have been operationalised as follows :

1. **Motivation** : In this study, motivation means academic motivation. According to Jack Frymier (1970), motivation towards school is assumed to represent an internalised state of being which manifests itself outwardly in particular ways of behaviour. Here in this study motivation to learn in the school i.e. the one which gives direction and intensity to students' behaviour in a school has been taken as motivation. It is a construct inferred from behaviour manifested by students.

2. **Attitude** : Attitude is generally used to denote the sum total of one's inclinations, feelings, prejudices bias, preconceived notions, ideas, feelings, and threats of an object. Therefore attitudes are individual in nature having feelings about the psychological object in terms of favourable and unfavourable i.e., positive or negative feelings. Here in this study, students' feelings about the package are measured with the help of three point attitude scale. Through it, dimensions like presentation of topic with the help of software package, comprehensiveness of the package, logical sequencing of the topics, examples and illustrations, figures and graphs, evaluation items and instructions given in the manual are measured.

Achievement : Here, achievement means the marks obtained by the standard XI Sciennce students in the achievement tests constructed by the investigator for three chapters of standard XI Chemistry textbook published by GSTB (1994).

Intelligence : Here intelligence of a student corresponds to his IQ score as per Madhookar Patel's Intelligence Test (1970). It measures students' power of abstract reasoning and space perception regardless of their cultural background.

1.9 HYPOTHESES :

1. There will be no significant difference in the mean achievement of control group and experimental group students.

2. There will be no difference in time taken for learning three chapters by the students in the experimental and control group.

3. There will be no significant difference in the achievement of the students in the experimental group with positive and negative attitude.

4. There will be no significant difference in the achievement of high intelligent and low intelligent students of experimental group.

5. There will be no significant difference in the achievement of high and low motivation level of students of experimental group.

6. There will be no interaction effect of motivation and IQ level on student's achievement in the experimental group.

7. There will be no interaction effect of motivation level and attitude on students' achievement in the experimental group.

8. There will be no interaction effect of IQ level and attitude on students' achievement in the experimental group.

9. There will be no interaction effect of motivation level, IQ level and attitude on students' achievement in the experimental group.

1.10 DELIMITATIONS OF THE STUDY :

This study was confined to only three chapters of standard XI Chemistry textbook of Gujarat State Textbook Board (GSTB, 1994). Further, it was limited to standard XI Science of only English medium schools.