CHAPTER II

COMPUTERS IN EDUCATION
| 2.1   | The Relevance of Computers                  | 18  |
| 2.2   | Capabilities of Computers                   | 20  |
| 2.3   | Applications of Computers                   | 22  |
| 2.4   | Role of Computers in Education              | 24  |
| 2.5   | Instructional Uses of Computers             | 24  |
| 2.6   | Computer Assisted Instruction               | 27  |
| 2.7   | Types of Computer Assisted Instruction      | 31  |
| 2.8   | Advantages of Computer Assisted Instruction | 34  |
| 2.9   | Conclusion                                  | 38  |
2.1 THE RELEVANCE OF COMPUTERS

For a very long time, it was thought that mere information was tantamount to knowledge. Traditional education operated on the assumption that the time-consuming steps of learning could be by-passed; that the final knowledge could be transmitted to the learner by a sort of intellectual intravenous feeding process. Schools were considered knowledge shops and teachers, information mongers. Subjects were taught according to logical method of presentation and little attention was paid to eagerness, curiosity and capability of the pupils.

As a result of the impact of educational technology, a few ideas have acquired currency in education.

Now education is at least partly about information. Sometimes the learning of this information is regarded as an end in itself. At other times it is regarded as the means to more general educational objectives. The amount of information processed in any educational system, taking into account the needs of all students at all times in all subjects, is enormous and at its best the processing of this information must be fast and accurate.
This is where the usefulness of the Computer becomes apparent, since a Computer is a device for storing large amount of information and for handling this information in specified ways in short period of time. In fact the Computer is the information processing machine for excellence. Indeed it has been said that it represents the most important invention by mankind since the invention of printing.

A computer is a power-driven machine equipped with keyboards, electronic circuits, storage compartments and recording devices for the high speed performance of mathematical operations. In simple terms, a computer is a 'glorified calculator' with a difference. It has in addition, a capacity for storing or 'memorizing' a large amount of information and producing or retrieving any of them when called for. As a tape recorder stores the information in audio-tape, a computer stores information. The computer is a box loaded with information. Information and problems are translated into computer language so that it can understand. The procedures and formulae necessary to process the information are also fed into the computer. When related information is given to it, it interacts and manipulates the information, translates the answer and types it out in a teletypewriter.

The development of computer technology has been most rapid, passing within a period of two to three decades from the bulky, complicated and costly hardware stage to the present one of compact, efficient and
comparatively cheap stage. The history of the modern electronic computer is categorized into periods, on the basis of the types of technology used. The first generation computers used thermionic valves, and the second generation computers made use of transistor technology. The third generation computers relied upon the electronic chips of integrated circuits capable of hundreds of function in a single bite. Large scale integration and microprocessing are now used in the present fourth generation computers. The impending fifth generation computers are being designed to replicate human intelligence activities making way for artificial intelligence, including speech recognition and robot technology. The data for input in a computer are stored in discs and tapes. The data is coded in language understandable by computers and a variety of computer languages to suit different purposes (like BASIC, COBOL, FORTRAN etc.,) have been evolved. Computer training is emphasized in our New Educational Policy.

2.2 CAPABILITIES OF COMPUTERS

Computers have come to be used in all walks of life for the following reasons:

Data Storage: It can store tremendous amount of information, i.e., text, numerical tables, graphs, etc.
High Speed: It can perform thousands of operations in a fraction of a second. Results of calculations are thus more or less instantaneous.

Little Space: It occupies less space than any other medium storage of data, retrieval system etc.

Linkages: Computers can be linked together to share the same data, to perform different computations at the same time, Parallel processing and Networking are in progress.

Interactivity: Computers can promote interactive learning by responding to and by seeking responses from the learner.

Processing and Monitoring: Computers can be programmed to process the responses and to monitor the progress of a learner during the process of interaction.

Sequential and Random Display: Of the vast amount of data, graphs and other visuals stored in the memory, it is possible to display any number of them in a desired order or by the press of a button to identify its location.

Portability: Computers may be transported easily. Lap-held computers and 'Notebooks' are collapsed into a briefcase format.
Individualisation: One may learn individually by having access to a computer.

Consistency and Accuracy: Computers can compute and display the same information with a high degree of accuracy any number of times and anywhere.

2.3 APPLICATIONS OF COMPUTERS

Computers have been employed in almost all spheres of human activity. They have taken over the repetitive work in storage of data, processing and retrieval of information from different fields. They have been identified as follows: In Industry, Computers have taken over the tasks of designing and manufacture. This is referred to as Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM). Numerically controlled machines and computed-managed systems have brought in a virtual revolution in automation.

In Banks and Post Offices, computer are employed to process cheques, account notes, handle bills and maintain records of all withdrawals, deposits, transfers etc.,
In Railways and Airways, computers are used to make seat reservations and also cancellations, alterations, etc. Up-to-date status of reservations is instantly displayed.

In Schools and Colleges, computers keep student records of attendance, performance in tests, fees, scholarships, etc. Computers are being used for instruction.

In Warehouse and Stores, Computer maintain constant record of all supplies and consumptions, indicate shortfalls and monitors procurement etc.

In Medicine and Health Care, Computers maintain records of patients and medicines and also help to diagnose. For example, computerised blood test can provide all the desired information within minutes.

In Science and Technology, computers are used to analyze problems and also to design systems with any degree of complexity. Most systems are designed and simulation studies are conducted either on computers or in laboratories before their large-scale fabrication.

In Art and Culture, computers play a role of creating color graphics, patterns, pictures and also create a range of music to simulate musical instruments.
In Architecture, newer designs of buildings and other structures are prepared and different views are examined before selecting a design.

2.4 ROLE OF COMPUTERS IN EDUCATION

The use of computers in education is in its infancy. However, the computer is bringing some exciting innovations to education. The following are the areas in which computers are helping the educators:

(i) Computers take over the most of the drudgery of schooling like classifying children according to the abilities, preparing time table schedules etc..

(ii) Computers allocate learning resources to individuals and groups.

(iii) Computers maintain progress cards and preserve them confidentially.

(iv) They provide easy access to files of information for reference and guidance.

(v) They provide direct interaction between student and the subject-matter to be learned.

(vi) They engage the students in tutorial interaction and dialogue.

2.5 INSTRUCTIONAL USES OF COMPUTERS

Although a computer can be used in many ways in the educational programmes, the following are some of the areas where it proves to be effective in the instructional process.
(i) Drill and Practice:

The student sits at a specially designed electric typewriter which is connected to a computer by telephone lines. He identifies himself by a code number and his name. The machine types out the first question and the student responds. Soon the lesson is under way. The computer keeps track of each student’s performance and can 'read-back' to the teacher a summation of each student's work whenever the teacher wants it. Depending upon the programme, the student might be referred to a branching type of remedial exercise. As on programmed instruction, the student moves at his own pace, gets immediate feedback and receives individual tutoring.

(ii) Tutoring and Dialogue:

The subject-matter is literally taught by the computer programme. Explanations are given orally through audio tape and needed visuals presented in cathode ray tube as in television. The student responds on a typewriter keyboard or by pointing on the screen with a light pen. The computer reacts to the student's response by 'talking' to him. Student makes further responses. A kind of dialogue takes place between student and machine. The Talking Typewriter developed in 1966 by O.K. More also serves a similar purpose.
(iii) Simulation and Games:

These have come into effective use in education during the past decade. Simulations are condensed learning exercises specifically designed to represent vital real life activities by providing learners with the essence or essential elements of the real situations without its hazards, costs or time constraints. Simulations are realistic imitations. Simulations are frequently planned in the form of competitive games to increase motivation and interest. Organised social simulation is called gaming, as for example, historical games. Simulated learning came into prominence during the Second world war when extensive use of this was made to train recruits in psychomotor skill such as aircraft flying, weapon system operation, etc. Now simulation is used in teaching various subjects as well as in areas like teacher training. Simulation may involve simulator trainees or mock-ups which are really 3-dimensional teaching aids eg., an aircraft flight simulator. Role playing is also a type of simulation, ranging from simple make-believe to play acting and drama. Educational simulation and games like all other well organised learning experiences must be carefully designed and clearly specified objectives. The most obvious use of simulation is in extending the experience of pupils and in simulating their interests. Simulation and gaming increases motivation and self-confidence and can accommodate students of different ages and levels of maturity. They approximate reality far more closely than conventional class methods. But some of these take considerable time and demand too much from the teacher.
(iv) Information Handling:

One area where processing and information handling capacity of the computer is profitably used in counselling and guidance. Computers store complete cumulative records and match them against employment needs and potentialities.

2.6 COMPUTER-ASSISTED INSTRUCTION

The most exciting innovation in the educational technology is Computer-Assisted Instruction. Though it is still in the experimental stage in India the day is not far off when it will revolutionise the whole process of instruction.

Before discussing in detail about Computer Assisted Instruction, which appeals most to the teacher practitioner, it is relevant to refer to two other models of Computer-Based Instruction. One is Computer-Managed Instruction and another is Computer-Based Instructional Simulation. Each of these techniques makes use of the computer in a different role in instruction to the learner. This type of instruction 'helps to assess the learner's present level of knowledge, weakness or gaps in his learning and remedial action possible'. Computer-Assisted Instruction is directly involved in tutorial work, drill and practice and is of greater help in instruction. In the use of Computer-Assisted Instruction, different programmes, one for new instruction and another for drill and practice may be needed. Computer-Based Instructional
Simulation is the most powerful application of computers in instruction as it provides realistic substitutes for real life experience that might be otherwise impractical, time-consuming or even dangerous. Computer-Based Instructional Simulation creates a model situation which imitates some aspect of reality and the simulation model may be static or dynamic, in which conditions are changed as a result of feedback of pupils' actions and responses. Now a more detailed look at the characteristic of Computer Assisted Instruction, which has distinct possibilities in the classrooms.

A computer is programmed with linear or branching programmes. It acts like a super teaching machine catering to the needs of a number of students at the same time. The characteristics aspect of Computer-Assisted Instruction is its capacity to initiate flexible interactions with the same student which is not possible in the teaching machine. There are a number of ways in which this can be brought about. The computer is able to record and store all the responses of all the students. It can branch not just in terms of one answer but also in terms of a whole series of previous answers. It can also record the time taken to answer a question and degree of correctness of the student's response. It uses the information in planning to determine which branch to take.

A typical Computer-Assisted Instruction consists of individual learning booths, each with a console. The student is seated. Facing him on the
console is a television screen for displaying information. Before he starts a
programme, the student checks in with the computer by displaying his identity
number. This connects him with his part of the learning programme. A
complete package of information stored in the system is presented
sequentially. This information could take the form of video-tape recording,
slides, motion picture films, film scripts etc. The student may question the
computer and feed answers into it by means of a typewriter keyboard. The
computer responds by printing out comments, answers and questions.
Sometimes, the student may write directly on the cathode ray tube display
screen with a 'light pen'. His answer will be picked up by the computer and
the next programme, records his progress and prints out a report for his
teacher.

The Computer-Assisted Instruction starts by identifying the way a
student seems to learn best. It reviews his past history of learning and then
presents a programme built on his strength. Sometimes the computer stores
all the information gained from all the students who have taken the computer
course previously. The information may be re-analyzed and much of the
teaching strategies which have succeeded may be continued.

Computer-Assisted Instruction is therefore not merely a sophisticated
type of programmed instruction but a different kind of instruction altogether.
No doubt, it uses programmed instruction but it also uses electronic data
processing, communicating theory, systems theory and learning theory. In contrast to Computer-Assisted Instruction, computer managed instruction (CMI) analyses the relationship between various factors pertaining to a pupil and suggests activities appropriate to individual students.

Characteristics Of Computer Assisted Instruction:

There are two basic characteristics of Computer-Assisted Instruction. The first is that the computer can evaluate a student's (Learner's) responses instantly and indicates whether the response is correct or incorrect on the basis of predetermined key words identified within it. Where the student's answers (responses) corresponds to the anticipated incorrect answers, then the computer gives corrective hints or offers general hints when the answer does not relate to any of the anticipated incorrect answers. It would also call for a modified or a new answer. In this way, every student is involved in the learning process as it is different from a conventional classroom where only a small percentage of students respond to the teacher's questions. Each student responding and receiving necessary feedback through Computer-Assisted Instruction is led towards the goal of effective learning. Secondly, the computer can individualise instruction in a number of specified ways. Instruction can be individualised according to differential aptitude, achievement and interest. The computer makes note of the learner's performance and progress in learning unit and on the basis of the evaluation of his ongoing achievement and as per his needs, it can modify his
programme for further learning. The great asset of computer is its instant response and its flexibility to suit the learners' needs and requirements through tutorial interaction and dialogue.

Computer Assisted Instruction and Programmed Learning:

Computer-Assisted Instruction is one example where programmed instruction has been combined with powerful media and technology to produce expensive and impressive learning systems. In this case, the monitoring and feedback functions of a teacher are handled by the computer. Computer-Assisted Instruction is based on the same principles as the ordinary programmed instruction but students work from computer terminals. They observe displays shown on monitors or typed on a computer output, instead of programmed textbooks or workbooks. Students type information into the computer or respond to it by pressing the related (buttons) keys. In addition to manipulating and interesting, sophisticated and responding equipment, the student find that they cannot cheat, as answers are given (or appear on the screen) only to the student's responses. It also permits the student to proceed according to their abilities and pace of learning.

2.7 TYPES OF COMPUTER-ASSISTED INSTRUCTION

There are a number of ways by which computers can be used for instruction. Computer-Assisted Instruction or Computer-Aided Learning (CAL) refers to situations in which a computer system is utilised in the learning
process. The first application involves utilisation of the Computer as a record keeper and retriever. Teachers and administrators programme the computer for processing data of the students for instructional purposes such as printing report cards, storing and retrieving test and examination results, pertinent details about students (age, sex, community, family background etc.,) and scheduling students for classes in the case of streaming students ability-wise or due to strength of college or shift system. For the purpose of guidance and counselling, cumulative records, counsellors records, file and details about vocational interest, aptitude and information and psychological test results can be stored in the computer and retrieved as and when needed.

The computer is used as a laboratory computing device, which is one of the most frequently used educational application. A single terminal, teletype or electric typewriter is installed in the classroom with a direct access to an externally placed computer. Students are encouraged to develop their own computer programmes relating to their regular classroom assignments. Talented and over-achieving students can be encouraged to develop their own software or help the peer group in preparing software to suit the different abilities of the learners. At the tertiary level, this will be a very stimulating experience.

The third form of Computer-Assisted Instruction uses the computer as tutor. One form of a tutorial is to provide drill and practice to the student at a
computer terminal. In this form, a complete lesson/course is also presented in the computer to the student and the computer keeps track of his performance to the teacher whenever asked for. In drill and practice, branching type of remedial programme is also provided for those learners who are in need of such remedial teaching.

The fourth application is simulation which is effective when presented in Computer-Assisted Instruction. Through specific inputs, computers develop models of processes or structures. Simulated conditions are shown on the computer screen such as working of the circulatory system of the human body or the effect of interactions on the operation of a system or the other models from company management, biology, mathematics or ecosystem. Such simulations have tremendous potentials for instructional purpose. Simulations are also planned as competitive games to motivate and increase the interest of the learners.

**Computer-Managed Learning:**

Computer-Managed Learning (CML) as different from Computer Assisted instruction or Computer Assisted Learning, involves decision-making. On the basis of the initial interaction with the student, the computer suggests the type of models of instruction for him. The computer notes down the attainment as well as the drawbacks of the learner in order to construct his profile. This profile is used to plan the learning unit for the student,
whether it should be modified, enriched or remedial module should be added. This decision is taken on the basis of the measurement and assessment it makes on the learner's performance. Student's achievement is measured in relation to criterion attainment with reference to the syllabus of the module and assessed in relation to the course requirement. Following the computer's decision, there could be discussions with the student and the teacher (tutor) and the instruction of the student is so managed that efficient personalised learning takes place.

2.8 ADVANTAGE OF COMPUTER ASSISTED INSTRUCTION

In describing undergraduate Computer Assisted Learning in biology, chemistry and physics McKenzie (1977) cites eight advantages and three criticisms of the method. The advantages of Computer Assisted Instruction are:

(i) The immediate feedback provided by interactive terminals keeps students interacting and eager to keep trying.

(ii) Weaker students are obliged to participate actively. They often remain passive in lectures.

(iii) The computer will wait patiently for an answer and will not express annoyance with wrong response.

(iv) The graphics facility is a powerful aid in enhancing intuition, especially in giving insight, into mathematical formulae.
(v) Interactive graphics make it possible to sample many more illustrations that could easily be shown in a textbook.

(iv) Mathematical calculations can be done as readily for realistic examples as for artificially simple case that can be solved analytically.

(vii) Large volumes of data can be handled with accuracy and without drudgery.

(viii) The novel technique provide enrichment of a course through added variety.

The Limitations and Disadvantages of Computer Assisted Learning are:

(i) A programmer cannot cater for every possible response and may give unexpected and unhelpful responses to unusual input.

(ii) A few students are intimidated by the strangeness of a computer terminal (less likely for physics and chemistry students).

(iii) A package will not be appreciated unless it has a perceived goal and will not be considered important unless it is integrated into a course to the extent of being assessed by a teacher.

Computer Assisted Instruction provides for individualised instruction, motivates students to go through a unit or a course through its varied presentations modes and by instant feed-back, encourages learners to proceed with the lesson. There is a tremendous saving of student's and
teacher's time. Computers are adaptive to students potential. However, computer can never replace a teacher as the 'human aspect' is vital for learning and behaviours of the effective domain can only be developed by a teacher.

Other Modes of Presentations:

Computer Aided Evaluation (CAE) is another recent innovation whereby computers are employed to evaluate the learning of student in a comprehensive manner.

Evaluation of learning is a multistage process. It commences with the formulation of instructional objectives and it proceeds beyond the announcement of results. The chronological stages of the process are as follows:

(i) Identification of domains of learning and taxonomic levels of instructional objectives for all topics in a subject.
(ii) Preparation of test items and questions of different types on all topics vis-a-vis objectives.
(iii) Classification and storing of test items and questions by type, topic, domain, level, optimum time, marks, etc.
(iv) Preparation of a table of specification for the relative weightages assigned to different topics, domains, levels, etc.
(v) Selection of test items and questions in accordance with the table of specifications in order to prepare a question paper,

(vi) Implementation of the test to get student responses.

(vii) Scoring the student's responses sheets and tabulating the raw scores.

(viii) Obtaining the statistical parameters such as mean, mode, median and standard deviation and fixing the cut-off point etc.

(ix) Analysing the performance of individuals, groups achievements, strengths and weakness of the course.

(x) Conducting test analysis and taking decision vis-a-vis evaluation.

Computers are ideally suitable to take over the difficult, time consuming and mechanical tasks. Teachers would then be able to concentrate more on the basic educational aspects of evaluation. Development of experts system is another alternative.

There are thus three levels of needs for computer in evaluation.

(i) Question Bank Retrieval

It refers to storing of classified questions, selection of items and printing out of question papers according to the table of specifications. Any number of question papers may be printed with the same table specifications.
(ii) Scoring and Analysis of Scores

It includes facilitation of student's responses, scoring and analysing the responses as also analysing the performance of individuals, test analysis and item analysis.

(iii). Creating Knowledge Base

It endeavours to operate with computers through artificial intelligence, large database and diagnostic retrieval system.

2.9 CONCLUSION

Thus, Computer is found to be an impressive one as it facilitates a user to extend his mental activity. More emphasis is given to the participation of students in classroom learning. Teacher now is the facilitator of learning not a lecturer in the classroom.

In order to improve students performance in learning, multimedia approach is also emphasised.

If the interactive nature of the machine is utilised suitably, it makes the learner play an active role. The learner learns by doing, corrects himself and moves forward to the next stage of learning using his reasoning abilities. What is not possible in a classroom situation - the one to one interaction can be made possible in Computer Assisted Learning. For eg., an individual can
interact with a computer by making it repeat the instructions which it does accurately, tirelessly and impartially. Also Computer Assisted Instruction cater to individual learning.

No one can deny the following merits of Computer Assisted Instruction which are not available in Conventional classroom teaching that is
(i) Individualised pace of learning
(ii) One to one interaction
(iii) Learner autonomy and learner's involvement.