CHAPTER 2

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2.1 FIVE GENERATIONS OF AIDS AND MEDIA

I. A good teacher, like a good mother, always uses real objects and real experiences. But on these he has less control. Hence materials including symbols and models like charts, maps, pictures, chalkboard, posters, came in as educational aids. This generation requires no machines or electronic devices.

II. The second-generation media include printed book, printed workbooks, printed posters etc. This generation requires machines to produce them but one produces, a learner does not need a machine to use them. A learner at his own pace and time can use these media. The teacher can use them in the classroom and also assign them for homework.

III. The third generation media include slides, phonograph recording, tape recording, motion pictures (films), radio and television. Here, both in production and reception (e.g. a transistor radio, TV tube) a machine or several machines are involved. Based on advances in electrical and the communication function much more efficiently than a human lecturer. They can also serve simultaneously a large number of learners spread over in many faraway locations.

IV. Mass media like radio and television in their fourth generation are combined with other media to make possible an "University of the Air" and "Open University", or an "Open School", or classrooms without walls. Combined with books, postal system and particularly with telephone system they introduced some form of "two-way communication". The zenith of this generation was reached with cable television on the one hand and satellite television on the other.

V. The fifth generation electronic technology, and now with the magic "chip". Computer technology goes far beyond. Not only does it allow for audio-visual stimulation or two-way communication, it actually performs most of the activities a teacher can normally perform for a much larger number of students, with much more efficiency than any human teacher is capable of.¹
2.2 INTRODUCTION TO COMPUTERS

Let have a brief introduction of computer system.

2.2.1 Introduction

The first computer came into existence in the late 1940s. Rapid advances in technology have changed the computer greatly over the past years. It has become smaller, faster and more efficient. Today computers are used in research to carry complicated calculations; in industries for intricate assembly and automatic testing of finished goods. In simulation of real life events and thereby analysing large quantities of data; in management through MIS and Decision Support Systems; in preparation of statements of accounts and payrolls in business applications; in meteorology to predict weather. In instrumentation and numerous other applications. These days they are being used in almost every facet of everyday life. This trend has been greatly facilitated with the advent of microcomputer or the microprocessor, as it is commonly called. Small in size yet very powerful in processing capability, microprocessors are being used in not only home appliances like washing machines and cooking ranges but also in heavy industrial applications such as control panels of Nuclear Power Reactors. BASIC, one of the many programming languages is growing in popularity with the use of microcomputers.

2.2.2 Computer Architecture

A computer is an electronic device that processes data. It can record, manipulate and retrieve data. It is a machine capable of carrying out a sequence of logical and arithmetical operations, called for in a program. The basic functions of a computer can be classified as:

a) Storing a set of instructions, namely the program that might include decision-making instruction.

b) Storing data that included numbers and/or words for use by the program.
c) Carrying out a set of instructions in a logical sequence.
d) Displaying on an output device or storing for future use on storage the results of step (c).

Broadly, computers can be classified into three categories viz., large systems, mini computers and microcomputers. This classification of computers is not based on any one criterion but on the collective effect of a number of parameters. These parameters are the size of the memory, processing speed, the number of different tasks that the computer can perform simultaneously and the variety and number of peripheral devices supported by it.

2.2.3 Components of a Computer System

A computer system is basically made up of four hardware components: the Central Processing Unit (CPU), the Input unit, the Output unit and the External Storage unit. The input and output units are called peripheral devices and these together with the CPU are called the Computer Hardware. The below figure shows the general block schematic of a computer system. Its various components are dealt with in the following sections.
2.2.3.1 The Central Processing Unit:

The central processing unit (CPU) of the computer Conceptual understanding is a base of science education. Changes are very fast and in that Science & Technology has put the world at the bank of reversal computer is made up of three components: the main storage, the processing unit and the control unit. The CPU handles the internal control of the system, the processing of instructions, the flow of information and the mutual linkages of the peripheral equipment connected to the computer. In effect, CPU controls all the activities occurring in the system.

2.2.3.2 Arithmetic/Logic Unit:

The processing unit consists of two operating units: the arithmetic unit and the logic unit. It is known by the combined name of arithmetic/logic unit (ALU). One can think of the ALU as the computer's calculator; it performs many of the same jobs for a computer that a pocket calculator performs for a person. ALU does the mathematical functions of addition, subtraction, multiplication and division together with the logical operations such as comparison. The logical operations from evaluating a string of logical statements to doing simple operations like comparison are done here.

The control unit controls the operation of ALU. It has to interact with the main memory to perform its task. The operands for various mathematical operations are brought here from the memory and the result is again stored in some memory location. For performing the operations themselves, it has a set of registers that hold the operands temporarily during execution.
2.2.3.3 Control Unit:

The control unit fetches instructions from the memory and executes them. It controls the activities of the ALU and the flow of information between input, output and the CPU.

The control unit operates in a fetch-execute cycle. Instructions are fetched from the memory and executed one after another. No matter how complex the task a computer is carrying out, the control unit is always fetching and executing instructions, all the time.

The control unit oversees the movement of data back and forth between the ALU and the main storage. It also supervises the movement of data between the ALU and the input/output. A number of registers like program counter, memory address register, instruction register and memory buffer register aid in its task of supervision.

The control unit resides in a processor that is driven by an electronic timing circuit called the clock. The clock produces electrical impulses, a series of low and high voltages, of frequencies 20 MHz or more. Normally, a fetch-execute cycle requires more than one clock cycle (five-to-ten clock cycles are typical). These clock-cycles or fetch-execute cycles are the basic commodities of computation. The number of cycles required to execute an operation determine the speed as well as cost of computation.

2.2.3.4 Main Memory:

It is also sometimes called core memory because in older computers main memory was made up of a large number of tiny magnetic rings called cores. A computer's main memory is divided into a number of individual memory locations, each of which can hold a certain amount of data. Typically a memory location may
store an 8,16,32 or more bit word. Each location has an address, which other parts of the computer can use to refer to that location. One can think of main memory as a series of lockers in a bank. Each locker has an address and a place to hold/store things. With the help of the address, a particular locker can be accessed and its contents 'handled'.

Main memory is random access and very fast. The speed at which the computer can obtain access to individual memory locations does not depend on the order in which the locations are referred to. A series of locations can be accessed in some random number just as rapidly as if they were accessed in order of increasing or decreasing addresses.

Main memory is interfaced by Memory Address Register and Memory Buffer Register. Memory Address Register holds the address of the program instruction and Memory Buffer Register holds the data and instructions going back and forth from memory.

2.2.3.5 Input Unit:

The input device provides a means of feeding instructions and data into the computer. It accepts the user programs and the user programs and data in one of the many specialised languages and converts it into the machine code suitable for use by the computer. In this way, it provides a link between the outside world and the world inside the computer. Popular input devices are Card Readers, Cathode Ray, Tubes, Optical Scanners and Magnetic Ink Character Readers.

2.2.3.6 Output Unit:

The output unit provides the results of the computation to the user in a format and language easily understood by him/her. In this way, it performs a function that is opposite of the input unit.
Popular output devices are Line Printers (hard copy output), Cathode Ray Terminals (soft copy), X-Y plotters etc.

2.2.4 External Storage Unit

External memory or the auxiliary memory is required because of the limited capacity of the main storage in the CPU. This part of the storage, since it stores large amounts of data, is sometimes, called as Bulk storage. The external memory is used for large permanent files such as those holding the accounts of a corporation. Program libraries stored in auxiliary storage allow a person to use the computer without having the need to write a program.

Magnetic Tape, Magnetic Disks, Paper Taps and Punched Cards are some of the external storage devices.

Computers are surrounded by their jargon, much of which is not essential to the level of understanding. The machine itself, with its various accessories, makes up the hardware. The rules or commands for the computer to follow are the software, written in one of a large number of programming languages. A set of commands is called a program and kept in electronic or other forms either in the computer itself or elsewhere. Programs can be printed out on paper, but untrained people cannot understand them, because first they must learn the appropriate language. If we want to use one of the programs to process information, we make sure that the program is in the computer or at least accessible to it electronically. We then put in one way or another, the information to be processed. Processing takes place very quickly, and our processed information can then be stored or displayed, or both. The display is the computers' output and can take a variety of forms, not all of them visual displays, as we shall see.
What does the computer actually do with coded information during processing? The programs, converted into binary code and stored in one part of the computer, act upon the information to be processed, which is coded and held in another part of the computer ready for processing. We cannot see what is happening in the circuits, but we can imagine switches changing from off to on and from on to off. These changes represent complex changes in the patterns of states among all the switches in the set of circuits being used. The patterns of states, in turn, represent changes in the information coded into them.

The computer is immensely powerful as an information-processing machine, better even than our brains in some respects. It remembers everything it is told and works very quickly indeed: the most advanced models carry out as many as a hundred million instructions per second (Ince, 1982).

2.3 COMPUTERS IN EDUCATION

The use of computer in education is bringing some exciting innovations to education. The teachers are being helped by the computers in the following areas:

1. Classification of pupils: Computers are used to do classification of children according to their abilities and evaluating their performance.
2. Preparing timetable: Computers are used in preparing timetable, schedules etc.
3. Allocation of learning resources: Computers are able to allocate learning resources and materials according to individual needs and interests.
4. Maintenance of progress cards: Computers are able to maintain progress cards and preserve them efficiently and confidentially.
5. Easy access: Computers are able to provide easy access to files of information for reference and guidance.
6. Direct interaction: Computers are used to provide direct interaction between student and the subject matter to be analysed.

7. Tutorial and dialogue. Computers can play an efficient role of a tutor. It makes the teacher in engaging students in tutorial work. There is tutorial interaction and dialogue.

8. Immediate feedback: Computers are helpful to the teacher in providing immediate feedback to students for carrying out better interaction and motivation.

9. Problem solving and creativity: Computers are usually used to develop problem solving ability and creativity among the students.

2.4 THE NEW INFORMATION TECHNOLOGY

It is vital for us to arrive at some understanding of new information technology and of what benefits it can bring to many fields, including education. We must bear in mind, of course, Scriven's (1981) dictum that information is not education. Nor is information necessarily knowledge, although knowledge is based on information. Bell (1980) suggests that knowledge is 'an organised set of statements of facts or ideas, presenting a reasoned judgment or an experimental result', and distinguishes knowledge from news or entertainment, though all contain information.²

Institutions that produce or distribute information in some form are, however, classed by Machlup³ (1980) as belonging to the 'knowledge industry' sector. Knowledge industries, producing and distributing knowledge and other information, rather than goods and services, are increasing steadily their share of the national product in Western countries. It is a fact that information is accumulating in many fields at rates far exceeding a worker's capacity to absorb it.

New information technology is new technology applied to the creation, storage, selection, transformation and distribution of many kinds. That is more than one line and does not say very much. We need a more comprehensive approach,
which takes up more space and is, unfortunately, less suitable for casual use. The
definition adopted by UNESCO is 'the scientific, technological and engineering
disciplines and the management techniques used in information handling and
processing. Their applications; computers and their interaction with men and
machines. And associated social, economic and cultural matters'. Perhaps that says
too much and certainly it explains very little.

One-way of defining a new technology is to say what it can be used for, what
functions it can perform, and to describe the symbols, codes and languages that
support these functions. Another way is to survey the devices and systems that have
so far grown out of the technology.

2.5 TESTING TECHNOLOGY

Technology affects all aspects of testing: construction, administration, scoring,
and reporting and analysing test data. It can also improve the experience of taking a
test. Special purpose equipment can be used to score and to administer certain tests.
Computers can be used to provide easy access to files of items for inclusion in tests,
and administering tests by computer has many advantages. Use of computers to
tailor tests to the abilities of the examinees, makes testing much more efficient than
the conventional method but requires many complex steps. In some arenas,
computers are even providing interpretations of test results.

2.6 COMPUTER AIDS TO TEST CONSTRUCTION

An interactive computer with a large storage capacity can store a file of items
that might be used in preparing a test. A file of items, with some associated
characteristics, is called an item bank. Items may be coded by the topic they test the
level of difficulty, and perhaps the type of understanding required. Many textbooks
now include a computer diskette for the instructor, containing test items. Psychometric information may be stored for each item difficulty and discrimination. More elaborate item analysis results may be stored for each item, including the popularity of the various distracters. The statistical results should be adjusted to refer to a standard distribution of ability.

Test construction involves matching a more or less detailed specification of test content with an item bank. Specialized computer programs can facilitate the matching process by offering options for each selection. Because a well-designed test specification has a variety of requirements, the item bank has to be crossing classified in various ways to satisfy the requirements. Baker (1989) provides a thorough treatment of the topic.

Some testing agencies sell computer diskettes containing practice tests that examinees may use to prepare for the actual test, which may be conventionally administered.

2.7 COMPUTER DELIVERY OF TESTS

A multiple-choice test can easily be adapted to computer presentation. Typically, only one item, together with the various response alternatives, is presented at a time on the computer screen. When the test-taker has selected an answer, the choice is indicated in some way on the display screen; when the test-taker verifies that the answer shown is the one desired, it is entered into the computer record. The screen is cleared, and the next item appears. Which item is next presented depends on the testing system. There are two different modes of computer-based testing: computer-based ordinary testing (COT), in which all examinees receive the same sequence of items, and computer-based adaptive testing (CAT)- also known as tailored testing- in which the choice of item depends on the ability of the examinee,
as indicated by responses to earlier items. Many aspects of computer delivery are
common to both types of testing. Some issues arise mainly in COT, others only in
CAT.

One minor advantage of the computer format is that items with different
numbers of alternatives can be intermixed, because different response alternatives
can be programmed for each item. On paper-and-pencil tests, such intermixing is felt
to be confusing, requiring hard-to-follow special-purpose answer sheets. A minor
disadvantage of the computer is that both the item and the alternative responses
should all fit on the computer screen. This requirement can be a problem with some
items, such as paragraphs comprehension items of items needing complex graphic
diagrams.

The possibility of immediate feedback exists on the computer. In an
instructional environment, feedback would be desirable; in an evaluation
environment, providing feedback might be unwise, because it could differentially
affect motivation. One item format that is readily used on the computer is the
answer-until-correct method already described.

A fill-in-the-blank test could be put on a computer, with the test-taker required
to construct a response using the keyboard, or related devices. Any such system
raises the problem of computer familiarity. However, the computer could have a list
of acceptable responses and so could score the response with little difficulty. In
principle, an open-ended test could also be given, with the examinee expected to type
a paragraph in answer. In principle, the constructed responses could be evaluated
automatically by the computer, but except in very special circumstances, the needed
computer programs are difficult to develop.
2.8 COMPUTER - ASSISTED INSTRUCTION

Instruction in which a computer is used to present substantial amounts of learning material to the student. It often represents an auto instructional technique enabling students to progress at their own individual rates.

Computer-assisted instruction (CAI) means those programs where the computer is used to interact tutorially with the student as he or she moves through a self-laced program or course of instruction.

The student and computer ordinarily communicate through a teletypewriter; the computer types instructions, diagnostic questions, and feedback messages, and the student responds via the keyboard. The "messages" from the computer, however, need to be limited to words or simple concepts. Some systems, for example, use slide projectors or closed circuit television or recording of foreign languages. In like manner, student responses can be fairly complex; and electronic stylus, for example, can be used for pointing to places on graphs or maps. There are even systems where computers can detect the placement of objects such as blocks on a "manipulation board". The possibilities for variety in the communication modes between computer and student seem almost endless. Goodlad\(^5\) (1971) describes the potential of computers for flexibility and variety: "The computer is a tireless, relentless, evaluating teacher which has several modes of instruction at its disposal. Sound, sight, and touch. A properly programmed computer is able to present words to be spelled, sounds to be made, instructions to be followed, and so on. It is able to evaluate pupil performance and to direct the student backwards, forwards, for appropriate learning activity."

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The potential of the computer for individualizing instruction is enormous. Its patience, memory, and its endless capacity for detail are assets that defy competition from ordinary human teachers.

As with the programmed instruction, CAI seems to have its greatest advantage in the reduction of the time required for learning. The research to date shows that students who participate in CAI generally do at least as well as Conceptual understanding is a base of science education. Changes are very fast and in that Science & Technology has put the world at the bank of reversal which drill is required. CAI is at its efficient best. As Ornstein discussing the teaching of foreign languages, points out: "While in an ordinary fifty-minute class a student is lucky to recite for five minutes, in CAI he must be almost constantly active. Massive amounts of drill, the lifeblood of language acquisition, are possible, so that live session of students and teacher can be devoted to liberated conversation, problem solving, and a salutary airing of complaints."

Students using CAI for drill express particular pleasure with the patience of CAI. There is no feeling of delaying the teacher or other students, no awareness of being "slow" in accomplishing the task. While the computer has been charged with being impersonal, there is no evidence that students feel depersonalized by their practice sessions with the computer. In fact, in one study junior high school students considered the computer "fairer", "easier", "clearer", "bigger", more "likeable" and "better" than the teacher.

Rappaport (1974) reports that CAI resulted in significant changes in attitude toward subject matter on the part of low achievers. It has also been observed that the use of CAI in the college physics truncates the distribution of lower grades; that is not as many people make poor grades when CAI is used.
Clearly, there is some real strength in CAI; however, it is not a panacea that will solve all learning problems. Like programmed instruction, CAI should be combined with other learning activities. It should not replace them. Atkinson (1974) suggests that CAI should supplement classroom teaching by concentrating on those tasks in which individualization is critically important. The computer's great strength is individualization, and it makes good sense from an efficiency standpoint to utilize the tools of education where they do the most good. Ignoring this generally good advice has led to most of the features described as limitations of CAI.

Even the advantages of CAI can turn into limitations when they are overused and abused. While the use of CAI for drill and practice seems thoroughly desirable, there is some concern lest the mere convenience of CAI encourage "drill" for subjects in which drill and memory work are not appropriate to the mastery of the subject matter.

Education as content versus education as process is perhaps the most serious educational issue raised by CAI. Many of the new technologies assume that the goal is to make present education more efficient. Education that simply transfers information from one receptacle to another is sterile, and the danger of adding only efficiency to education through CAI is a real danger especially for New Students. De Leon (1971) puts it well: "Computer-assisted instruction becomes the one plus ultra of remedial education. And remedial education, too often, can be defined as an effort to pour into a student in concentrate what he has already rejected in diluted form. Most efforts at programmed learning, and their refinement into CAI, seem to adopt wholesale this pernicious assumption."

Another example of strength turning into a limitation through unwise application is the extent to which the learning task is defined for the learner. One of the strength of CAI id presumably the active involvement of the learner, but many
people are beginning to question how "active" the mind really is when the learner simply responds to whatever appears on the screen in front of him. There is a distinction between machine-controlled programs and learner-controlled programs. A major trend in the use of computers for instruction is the shift from machine to learner control. More attention is being given now to providing more options and more interactions between learner and computer. The goal is to make the computer more responsive to the commands and questions typed by the student, so that student can derive their own diagnoses and take more responsibility for directing their own learning.

Some learning tasks are clearly inefficient, and nothing will be accomplished through trying to "program" such learning. "Much learning takes place on the hoof or in conversation with a more capricious responder than the computer. If we are to encourage the spirit of inquiry, we want students to go to the library, to putter about the shop. To prepare them for responsibility we want them to meet together to make plans for group activity, to take part in plays and in team games. That is, learning by doing is not dead, and there are some 'doings' that the terminal is unsuited for". Changes are gradually being made as teachers and students gain experience with the use of CAI, but there are still some difficult problems deterring widespread use of CAI.

2.8.1 Origin

Computer-assisted instruction (CAI) is a natural outgrowth of the application of the principles of programmed instruction. As we know the main objective of programmed instruction is to provide individualised instruction to meet the special needs of individual learners. To accomplish this objective, it needs some efficient and flexible device that can store gigantic amount of organised information and use selected portion meet the needs of individual learner. A computer is such a device,
which can cater to the needs of individual learner. A computer is such a device, which can cater to the needs of individual learners by storing huge amount of information. It can process the information suiting to the needs of individual learner. It can serve to a great variety of educational levels, subject matter, style of instruction and level of learning from simple drill and practice to problem solving. In short, we can say that CAI covers the whole educational spectrum and is gaining more recognition as an important and useful tool in the teaching of various subjects.

The origin of CAI was, probably, an attempt by some technicians to see if a machine could be programmed to interact with a human. In the beginning, very simple programmes were tried out on machines such as printing of prestored questions accepting multiple-choice answers and judging answers for correctness. The first commercial computer began operation in the Census Bureau in 1951. The first major pioneering attempt in CAI occurred after a decade around 1961 when the University of Illinois produced Programmed Logic for Automatic Teaching Operations (PLATO). Thus, historically, the use of computer in general education is under development from early sixties. Though there are controversial and conflicting interpretations as regards the use of computers in education and training but even then CAI has become a valuable educational recourse.

The second landmark in CAI is the development of computerised tutorials in arithmetic and reading for elementary school children by Patrick Suppes of Stanford University in the year 1996. After the successful use of these programmes, a number of efforts have been made to develop programmes for CAI and great improvement has been made in the technical aspects of computer.
2.8.2 Basic Assumptions of CAI

The system of CAI has been developed on some sound assumptions, which have made it popular and acceptable in education and training at different levels of the future, if properly and effectively used. Following are some of the basic assumptions of CAI.

The first assumption is that the computer-assisted instruction (CAI) can be arranged for 4000 students simultaneously. It can cope with the problem of quality and quantity in education. In CAI more flexible kind of branching is possible because the computer can make complex branching decision based on the students' performance. One can learn at his own pace, receive immediate personalised feedback and freely choose the content, sequencing and degree of difficulty of instruction. It has completely individualised instruction.

The second assumption is that in CAI each learners' performance during the course and on the test is automatically recorded and can be fed back to the teacher so that he may promptly evaluate the learners' performance and use the data in designing the best teaching strategy for the learner in future. The teacher can be relieved from much of the daily routine redundancies.

The third assumption is regarding the presentation of variety of subject materials. It can be used in all types of teaching – learning programmes. It has been experimentally proved in several studies conducted on CAI that any subject can be programmed for CAI provided that the lesson strategy can be explicitly defined and lesson material represented in words, pictures and experiment to be presented to the students. It is the general opinion of educationists in the West. CAI is emerging as a widely used, versatile and effective educational tool to meet the educational problems of highly industrialised society.
2.8.3 Role of the teacher in CAI

The role of the teacher has changed from his conventional assignment of delivering lectures to a guide and a problem solver. The CAI directly interacts with the students individually and with the teacher. Human teachers have to play their role in CAI. They cannot be eliminated from instructional process. Lacks of teachers working in schools and colleges constitute a large educational resource. CAI if ever introduced in general education in this country, it should be brought in such a way that it increases the scope and quality of teachers' contribution to teaching-learning process.

In CAI the teacher has the chance to use new tools, which will enhance his individual satisfaction and will increase his efficiency. The teacher will be liberated from his routine duty. The CAI will prove a powerful device in the sense that it can compute accurately and rapidly huge data. It can produce elaborate graphs and drawing and can perform sophisticated retrieval of information from large data bank.

CAI is compatible with live teaching. It can be used side by side. It is flexible system of instruction. It can very promptly evaluate the performance of individual student. The teacher can devote his time for more creative work.

2.8.4 Limitations of CAI

CAI is becoming a great tool for education and training. It must overcome many handicaps, which are inherent in its functioning. The following are the limitations of CAI as pointed out by research workers in the field:

1. The peripheral equipment puts constraints in the ways on which a student can interact with the computer. At present he has to make a physical or mechanical
response by typing on a Teletype or by touching appropriate spots on a screen with a light pen. Speech or writing analysis by computer, in a useful form, seems to be many years away.

2. Most applications require the computer to recognise students’ responses by matching them in some way to set of prestored exemplars. At its simplest this becomes multiple choice questioning, but more sophisticated systems are now in general use and these rely on character string matching and so allows responses in natural language.

3. It is alleged that the warmth and emotional climate, which is created by teacher in direct classroom interaction with the students, is absent in CAI. The computer fails to appreciate the emotions of students.

4. Commenting upon the limitations of computer, Longuit-Higgins put it “the human student is a rather rich information source. Reducing him to a short of morse code consisting of a string of multiple choice answers we lose a lot of this information and so reduce the possibility of understanding his difficulties.” Computer programmes of conventional type do not work like human beings at all. One has to have an idea of what human beings do before tackling the difficult task of making a computer behave like one. CAI programmes do not in themselves solve psychological or educational problems. They just demonstrate that the problem has or has not been solved.

5. Computer –assisted instruction fails to develop essential features of language competency where the ability to generate or construct meaningful sentences is essential. The ability to perform a complex task depends on hierarchical structure rather like a computer programes with its stored sub-routines and an executive, which brings them into play when needed. Performing a complex task is a constructive process guided by a set of rules rather than a minutely controlled sequence of stimuli and responses.

6. One of the major problems in the CAI study is fatigue. As a result of experimental studies conducted in Japan for the purpose of comparing effects of the CAI study
with those by lecture, it was found that the CAI study was superior than conventional one and that the study hours were reduced to almost half of those of lecture.

From an analysis made on a questionnaire survey conducted after completion of study, it was also found that the CAI study was more pleasant than conventional one by lecture and easier to understand.

However, as negative opinions for the CAI study, it was pointed out that some students got more tired (38 per cent) than conventional study or felt like quitting the study halfway. (64 per cent).

7. Another limitation of CAI is that it cannot appreciate the students' artistic endeavour and cannot strengthen his friendship and deepen his perception of those around him. In CAI children may sit still for as long as possible, open their cerebrums wide and receive regular and rapid spoonfuls of what someone else has deemed best for them to know. This kind of forced feeding is the antithesis of the thinking of such prominent educators as Dewey, Piaget and Bruner etc., and it is understandable why this mechanical approach to education is under criticism.

Needless to mention that computer Assisted-Instruction purports to make an unprecedented impact on education in near future. The time is not far when India will have to introduce the computer-assisted instruction to cope with the challenges of problems of education. We should use CAI keeping into consideration a number of variables, which will affect its use. It will affect the total organisation and administration of education. It will also affect the role of the teacher community and the responsibilities of the students. As the field of CAI is still in embryonic stage of development, so it should be very cautiously introduced in education and training. We should take the lesson from the experiences of other countries. We will have to see the cost of CAI and advantages accruing from it.
2.9 COMPUTER-MANAGED INSTRUCTION

Although both computer-assisted instruction (CAI) and computer-managed instruction (CMI) assign heavy educational responsibilities to the computer, the two systems are very different. In CMI, students do not interact on line with the computer. Rather, the computer is used to manage individualization largely through diagnostic testing and prescriptive assignments tailored to individual needs. There is some agreement that CMI has greater promise for widespread adoption in the near future than CAI. Not the least of its advantages is that it costs less than CAI.

Sophisticated systems of CMI are capable of performing a number of functions to assist in instruction: (1) they can present to the student alternate goals and sub goals, making it possible for individuals to follow different learning paths. (2) They can diagnose and store information about the characteristics of the learner- long-term characteristics such as abilities, interest, and learning styles or short-term characteristics such as recent performance on a related study unit. (3) They can assign or suggest an appropriate method of study, even to the point of grouping students together for a discussion. (4) They can conduct continuous monitoring and assessment, including information about how much practice the student requires, how well she retains information, and what kinds of instructional alternatives she chooses or does well with. (5) They can provide the instructor with group and individual statistics to help in the revision and constant improvement of courses and materials.

2.10 CONCLUSIONS

The individualization of learning lies at the heart of the instructional revolution. The movement is young, but it is accelerating rapidly now, so that almost every college in the country has been affected in some way by the phenomenon of self-paced learning. Programmed instruction, although still very popular in
community, in on the wane and is now more interesting for its historical contribution to knowledge about the learning process than for its use as a teaching technique. The principles demonstrated by PI have now found their way into a great variety of new applications. The newest applications tend to be systems of learning rather than techniques.

The use of computers to help in the task of individualizing learning is a significant technological extension of PI. Computer-assisted instruction, is best understood as a sophisticated application of the learning process introduced by PI, but CMI is a technological tool that has considerable potential for managing the complexities of individualized instruction. If the instructional revolution is to have the dramatic impact then the capacity of computers to "remember" highly individualistic learning needs may be a virtual necessity in managing the thousands of individual learners that will complicate the existence of educators in the 1980s.
REFERENCES


3. Ibid., p.54-68

