UNIT 1 COMPUTER AS AN EDUCATIONAL AID

Structure

1.0 INTRODUCTION

Computers have revolutionized the way we collect, process, store and disseminate information. Every document on the achievements of the 20th century mentions devices capable of storing an unimaginable quantity of information, but the invention that made all these possible was the computer. In the 1960's the four major means of dissemination of information i.e. television, print, telecommunication and computers were all independent. Today all are supported partly or wholly by computer technology. This convergence has been made possible by the developments in microelectronics, transistors and computer technology. The latest development in this area is the emergence of multimedia programmes. Multimedia programmes, normally stored on a Compact Disk –Read Only Memory (CD-ROM) provide the facility to move quickly from one point to another without the time involved in physically viewing each page. This allows the freedom to read only the portions in which one is interested and

skip the others, and it is therefore appropriate for all learners since it caters to different learning styles. This unit covers the capabilities of the computer for education and training.

1.1 OBJECTIVES

After having read this unit, you should be able to:

- describe what a computer is and state its capabilities;
- explain three specific uses of computers, viz. pedagogy, training, and life long education;
- list the major features of CAL and CML;
- distinguish between various applications of computers in education;
- state the advantages of CBT;
- define multimedia;
- explain design issues and application of multimedia teaching-learning (MTL) materials;
- identify the factors that affect the use of computers in education;
- elaborate on the status of computers in Indian education; and
- enumerate the application and pedagogic utility of computers as a media in distance education.

1.2 COMPUTERS: AN INTRODUCTION

Computers are extremely fast information processing machines. They take a given input, process it and deliver a certain output. The developments in microelectronics and transistors have gone so far much ahead that computers are classified in terms of different generations. The first computer ENIAC (Electronics Numerical Integrator and Calculator) was invented in 1946. From that point we have moved into the age of the 5^{th} generation super computer (based on artificial intelligence) though in day to day life 4^{th} generation personal computers are predominantly used. Though it is not necessary to go into the details of the generations of the computer technology to understand the usage of the computer in education, to do so would give you an insight into the growth and development of the power of computers. We will not discuss these aspects here, but if you are interested you could pick up a basic text on computers from your library for details. Computers are basically classified as micro-computers, mini-computers mainframes and supercomputers. What we are concerned here is the use of micro-computers in education. These are machines with high speed, accuracy and versatility, which characteristics are a byproduct of the interaction between the *hardware* and *software* components of a computer. The hardware consists of physical components of a computer (like the keyboard, the monitor) and other related devices (like printers). The software is a set of programmes that allows the hardware to operate. It is

particularly important that users of the computer should understand its software — not necessarily how it has been developed, but how to use it. The Central Processing Unit (CPU) is one of the most important aspects of hardware. It is the increase in the capability of this component that has resulted into new products in the market. The number of transistors in the CPU decides the speed of a computer. Table –1 provides a glimpse of different personal computers available today along with their transistor capacity.

Table – 1: Transistor capacity of different PCs

Year	Intel		AMD	
	Product	No. Transistors in millions	Product	No. of Transistors in million.
1985	PCAT 386	0.275	-	-
1989	PCAT 486	1.2		
1991	-	-	PCAT 386	0.2
1993	-	-	PCAT 486	1.0
1994	Pentium	3.1	-	-
1995	Pentium Pro	5.5	K5	4.3
1997	Pentium II	≈7.5	K6	8.8

Note : Intel and AMD are microprocessor companies

Source : World Communication Report (1997)

1.2.1 Capabilities of computers

Present day computers have the following capabilities:

- They perform operations at high speed.
- They store huge amounts of information in formats such as text, sound, picture, film, etc.
- They take up very little space, usually, that of one table, but you could also have just a 'notebook' type computer on your palm.
- They are portable. One can work on a 'notebook' or 'laptop' computer even while making a trip from Amsterdam to New York.
- They are highly interactive and also enable communication from one place to another.
- They are user-friendly and easy to operate.

All these qualities make computers highly suitable for use in education and training.

1.3 SPECIFIC USES OF THE COMPUTER

We know that the computer is a versatile device of modern information technology and it can be used in a variety of situations for storing, processing and retrieving data. Hence, its uses are almost as endless as are situations in human life, which includes those under which educational transaction take place. However, the reactions of teachers to the computer as a teaching-learning tool have been far from uniform. For some of the

developing countries, the computer is still very much like a disease that is best avoided, because it threatens the traditional well-tried educational system. But this is only one side of the story. An increasing number of teachers, on the other hand, are fascinated by the opportunities that it offers to them as well as to their students; they feel encouraged to try out its usefulness in almost every subject area. According to Moore (1986) "Teachers who do not use the computer in their teaching are not only doing a disservice to their pupils, but are rejecting a teaching tool which is limited in its use by the imagination of the teacher".

Rural Informatics: The Udang Experiment[1]

Udang is a small rural village in west Bengal, India. This village demonstrates the capability of rural people to use computers for development of an information system of 20 village cluster around it. In 1984, the All India Association for Educational Technology organised its annual conference in Udang. As a part of the conference demonstrations about the capability of computer were organised with the help of two private computer hardware manufacturers. Villagers were informed about these demonstrations through folk-media of drum beating followed by announcement. In three days about 2000 rural youth and the old received their first glimpse of a computer. This sensitisation activity gathered momentum and a computer was purchased by collecting money from the local people. The computer was installed in a mud hut with tin roof. The inside wall of the room was plastered with mud-cow dung and paddy husk. The plaster was given distemper and the floor was done up with cement. A false ceiling was also made with bamboo pieces to make the room suitable for use of the computer and protect it from heat and dust. Local teachers were trained on the use of computer for word processing, database management and spreadsheet applications in the near by engineering college. These local teachers daily trained few villagers on how to develop an information system. The result of the rural informatics experiment was manifold-(i) Computer can be used by all and at all places; (ii) all categories of people take interest and learn from the use of computer; and (iii) computer is not the monopoly of elite urban, and developed class.

It is not necessary to list or to describe each situation in which the computer can be used as an educational medium. Nevertheless, it may be pointed out that the computer lends itself to a variety of uses and is capable of teaching various types of curricula at almost all levels in both face-to-face and distance modes of instruction. It is in view of this variety of applicability that specific uses of the computer have been grouped here under three broad categories, viz., pedagogy, training and life-long education.

1.3.1 Pedagogy

Pedagogic uses of the computer are concerned with more effective learning with the help of the computer. In fact, the computer should be regarded as an add-on rather than a replacing device. It is a technological tool that deserves to be used at the right time, to the right extent and in the right way to improve what has been learnt using other media and source material. Obviously, the choice of when, how and how much to use the computer for promoting learning should be ideally left to the teacher to make. The following three questions should engage the serious attention of the teachers who want to put the computer to pedagogic use:

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[1] *The Udang Experiment was the brain sail of Prof. M. Mukhopadhyay, Senior Fellow NIEPA, New Delhi.*

- How can learners use the computer in order to express themselves?
- How to adopt the computer systems to the needs of the individual users?
- How to evaluate the quality of the instructional software?

The last question assumes more importance, in view of the general feeling that the increase in the number and use of the computers in education is matched only by a decline in the quality of the instructional software available in the market. This, however, need not be the case if the software is selected with proper quality consciousness.

So far as the range of the pedagogic applicability of the computer is concerned, almost all subjects, ranging from Mathematics (the most structured) to Music (one of the least structured), can be learnt with the help of the computer. The National Institute of Pedagogic Research (NIPR) in France amply demonstrated this during 1971-1976. For these five years the NIPR trained about 600 teachers representing all disciplines, including Mathematics, Biology, History, Geography, Literature, Physics, Foreign Languages and Music. More than 500 programmes in all disciplines constituted the teaching packages. In 1980, more than 7000 copies of these programmes were in use through over 700 terminals on a time-sharing basis and the mean use of each terminal was about 200 hours a week.

The pedagogic uses of the computer necessitate the development, among teachers and students, of skills related to the effective use of the computer. 'Computer awareness' means becoming aware of the importance of the role of the computer in our lives and in the society in which we live. "Computer literacy", on the other hand, refers to the ability to use the computer as a tool to seek answers to one's problems, to enhance and extend one's learning and to increase one's effectiveness and develop into a rational being. Obviously, computer literacy is the more desirable goal of these, since it is not only more demanding but it also requires much more equipment and longer practice sessions.

Besides computer literacy, the pedagogic uses of the computer include learning to programme, learning in subject areas and learning at home on one's own, and these necessitate the use of new methods like modelling, simulation, use of data-bases, guided discovery, closed-word exploration, etc. The implications in terms of changes in the teaching strategy, instructional content, role of the teacher and the context of the curricula are obvious as well as inevitable. It is being increasingly realized that if a society can afford it, the pedagogic uses of the computer should be based on the 'bottom-up' rather than the 'top-down' approach. Learning to use the computer is now as basic as the ability to use printed language. The children of today are bonafide citizens of the information-based world in which most adults find themselves hopelessly handicapped, and so they deserve an early start to developing their abilities to handle and react to new modes of organising and processing information.

The pedagogic uses of the computer are not only spreads over various levels of education (elementary through university) but have now also been extended to handicapped students with disabilities. CYCLOPS, for example, is a tele-writing system currently being used to advantage by visually

handicapped students in many open universities, because it utilizes conventional television and telephone technologies, which are easily available. MERLIN is a computer tutorial with a telephone facility that enables a single tutor in one location to monitor a number of students simultaneously, and to conduct a telephone tutorial depending upon the students' progress or requests.

The pedagogic uses of the computer have special significance for distance education because of economic reasons. The computer enables a large number of students in distance education to develop new skills at a much lower cost than is possible through the formal learning system. In distance education the computer can function as a surrogate for the human tutor even though it lacks the latter's intelligence and flexibility. The interactive computer system can make the learners more autonomous and help them assume greater responsibility for their learning by providing individual adaptive instruction supported by graphics, synthesised speech and modelling software.

Thus we find that the pedagogic uses of the computer may relate to

- heightening the learners' motivation;
- helping recall previous learning;
- providing new instructional stimuli;
- activating the learner's response;
- providing systematic and steady feedback;
- facilitating appropriate practice;
- sequencing learning appropriately; and
- providing a viable source of information for enhanced learning.

The computer can help distance education in offering more open as well as more flexible learning patterns. Open learning, as you know, refers to any form of learning that is adapted to the varying needs of the individual learners in terms of time, place and choice of study. The computer can surely meet these changing needs because its patience and capacity to adjust to the needs of its users are in a way inexhaustible. Flexible learning systems emphasize the needs and convenience of the students, and are therefore essentially learner-centered. The computer network can take care of the student's isolation from the tutors as well as from other learners and, thereby, help the students feel that even in distance education, they belong to a system that makes provision for human and interpersonal interaction without being impersonal or alienating. These are, surely, worthwhile assets in distance education that will benefit the system, if the computer is used intelligently.

We have so far seen the pedagogic uses of the computer. Let us now turn to how the computer can be helpful in imparting more effective training.

1.3.2 Training

We know that the concept of training refers to the development of skills, and a skill as we know, is a well co-ordinated psychomotor activity. Any training programme is thus concerned with improved ways of doing things, of carrying out various activities in a professional manner.

Let us examine a few examples from different areas and illustrate how the computer can be helpful in imparting effective training.

a) In order to bridge the large gap that exists between the knowledge acquired during university education and the knowledge most useful in professional life, CAIL (computer aided laboratory instruction) was developed to provide real-time applications of physics in the computer science department of the University of Karlsruhe in Germany. As a result of participation in CAIL, some students, later on, computerized instruments and experiments in various institutions.

b) Shortliffe, another university in Germany developed MYCIN, an artificial intelligence programme in 1976 to train the students of medicine in the diagnosis of bacterial infections in blood, and to suggest appropriate treatment.

c) ERICA (Effective Reading in Content Areas) was developed in 1976 by Morris and Stewart-Dore at Brisbane College of Advanced Education in Australia for providing training in reading. ERICA presents reading as a continuous linguistic, cognitive and affective interaction with the response to the text; its focus is on the process strategies in four stages, viz., preparing for reading, thinking through information in the text, extracting and organising information, and translating information into one's own words.

d) SPACEX appears to be an adventure game, but in reality it provides a comprehensive training programme in language skills, including reading, listening comprehension, oral expression, writing, art activities (e.g. drawing, colouring, painting etc.), dramatization, etc. The children who use SPACEX have to collect various parts of a spaceship, which have been hidden on the planet, Persephone, by its inhabitants. The game format motivates the students very effectively and various language skills are practised while playing the game.

These examples are illustrative rather than exhaustive, but they reveal that the computer can be a very useful tool for the development of skills. In fact, the contribution of the computer in providing effective training programmes can be attributed to its capacity for stimulation, model-building and interactive adaptation. Use of the computer for training purposes applies not only to subjects like sciences and languages but also to various aspects of professional courses like engineering and teacher training. Computers could assist in development of administrative skills related to student management, tutoring, course writing and pedagogic skills in distance education. Industry and the defence forces have shown the way to education in making use of the computer for training purposes. Though computer-

based industrial and military training can also be broadly classified as educational, distance education as such has not lagged behind in recognising and harnessing the computer to its advantage.

1.3.3 Lifelong education

The concept of lifelong education is associated with a learning society. In the present day world, the end of formal education does not mean the end of one's learning. The pace at which new knowledge is being generated and old knowledge is becoming outdated, demands that an individual should continue to learn all through life. Open learning systems, including distance education institutions, have to provide facilities for lifelong education. The computer can render excellent service in this, both as a tutor and as a tool. The concept of lifelong education is based on post-formal education and it assumes learners to be adults or near adults who can manage their learning on their own. The computer-tutor spares the adult learners of the psychological disadvantage or inhibition that he/she may experience while learning from a human tutor. The availability of various types of software can help a learner choose instructional material, which meets his/her specific needs. Distance education institutions can provide computer-based learning facilities that make lifelong education a reality for most learners. The development of the Internet (to be discussed in the last unit of this block) provides a real opportunity for lifelong learning through the use of the computer.

We do not have the scope for entering into a philosophical discussion on this subject here. However, certain key issues relating to the role of computer applications in education have been touched upon. We will be satisfied, if this section has triggered some thought in this area. Now, before we move on to the next section, let us pause for a moment. Do work out this exercise before you proceed.

Check Your Progress 1

Notes: *a) Write your answers in the space given below.*

b) Compare your answers with those given at the end of the unit.

i) List the three basic issues related to the pedagogic uses of the computer.

ii) Justify the use of the computer as an 'add-on' device instead of a 'replacing device'.

iii) How does the use of the computer make distance education more open as well as more flexible?

iv) Name two functions of the computer which justify its use as a training device.

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1.4 COMPUTERS IN EDUCATION

The 1930s saw the development of 'teaching machines' for effective learning. Then followed the use of computers in education. However, there are a number of terms such as computer-assisted learning (CAL), computer-assisted instruction (CAI), computer-managed learning (CML), etc., which are used to connote the use of computers in education. These terms are many a time used interchangeably. However, there are certain differences, that we would like you to remember while using them. Romiszowski (1986) provided a framework for understanding computer in education (Fig 1), where he divides the field into two main sectors — 'informatics as content of education and informatics as an instrument of education'. We are concerned with the latter, which includes computer as an administrative, teaching and learning tool.

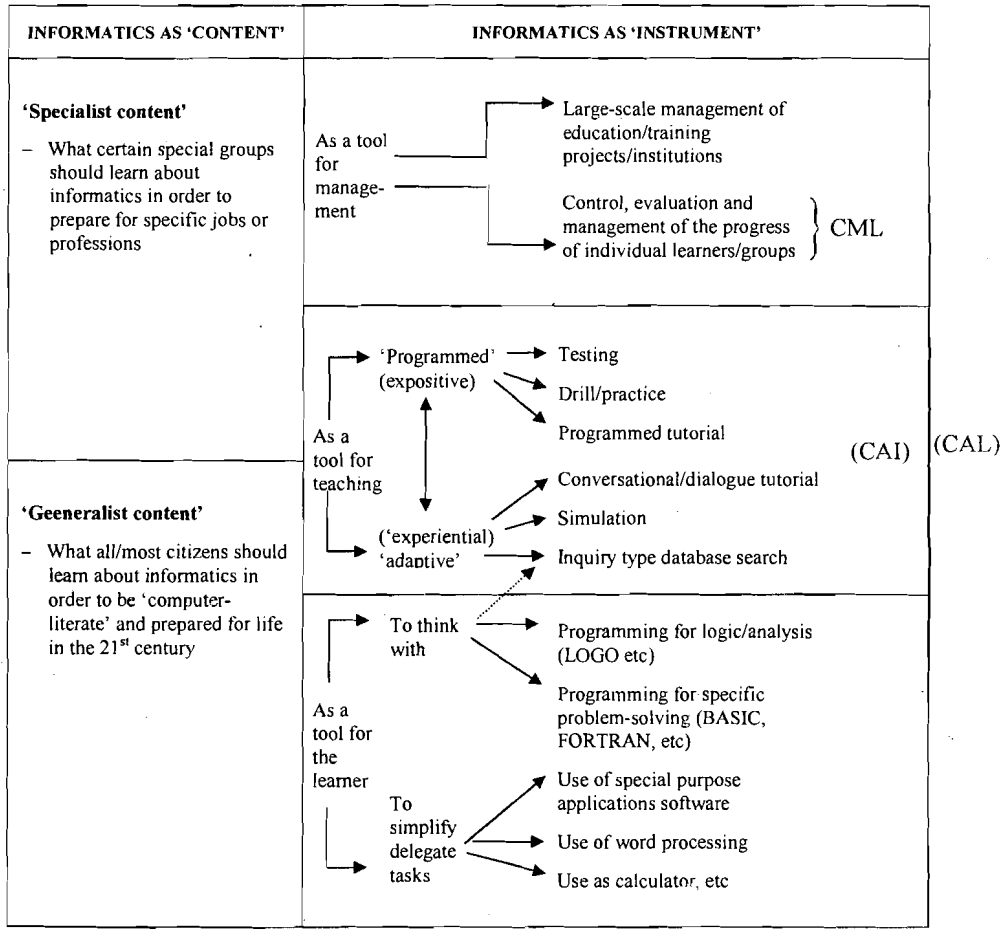

Fig. 1: The 'field' of 'computers in education'

Source: Romiszowski(1986)

1.4.1 Computer-assisted learning (CAL)

In CAL, the learner operates as an autonomous individual and as far as the content of instruction is concerned he/she seeks assistance, or it is given according to his needs. CAL deals with flexible, rapidly changing and detailed information, and is essentially more than a means of administering programmed instructional material, even though the computer can function as a tutor with unlimited patience. Stephen Kemmis et al (1977) advocated four paradigms for CAL. They are: i) Instructional paradigm, ii) Revelatory paradigm, iii) Conjectural paradigm, and iv) Emancipatory paradigm. ***The instructional paradigm*** deals with tutorials and drill-and-practice. According to Kemmis, instructional paradigm is based on the assumption that the knowledge and the students' need to acquire it can be specified in language and learnt by the transmission and reception of verbal messages. Thus, under the instructional paradigm, the subject-matter largely determines how it is to be taught.

The revelatory paradigm deals with learning through discovery and vicarious experience though computer simulation and data handling. Under the revelatory paradigm, the key concepts related to discipline are gradually revealed to the learner in a manner that makes the structure of the learner's knowledge similar to that of the discipline being learnt.

The conjectural paradigm stresses active knowledge, manipulation and hypothesis testing. The conjectural paradigm assumes that knowledge is created through experience and evolves as a psychological and social process.

The fourth paradigm, that is, ***the emancipatory paradigm,*** distinguishes between knowledge that is authentic and is valued in itself and knowledge that is valued because of its instrumental function. The emancipatory paradigm stresses the learning of authentic knowledge and de-emphasises learning that has mere instrumental value.

Johnes (1984) categories CAL under two modes:viz., the **Tutorial CAL** and **Simulation CAL.**

The tutorial CAL simulates the dialogue that may take place between the student and the tutor. The Open University uses three systems of Tutorial CAL and these are Cicero, Merlin and Calchem.

In simulation CAL, the computer serves as a laboratory or a field situation, and it enables students to perform risky, difficult and/or expensive experiments. Simulation CAL provides greater freedom to the students to plan their experiments and to enrich their understanding.

CAL subsumes the use of the computer for the whole class, a group of students as well as for the individual learner. Drills, demonstrations, games, and programmed learning are some of the frequently used instructional activities under CAL. A generative approach to CAL encourages the use of the computer-created instructional material.

Meeting the learner's needs

The learner's need should be the central factor in the design criteria. In this connection let us take a look at an example from the case of CALL

(Computer Assisted Language Learning). Hubbard (1988) has come up with a set of items for courseware evaluation. This was arrived at by merging the developer's views of the language teaching approach with the inherent strengths and limitations of the computer as an interactive delivery system. The highlights of this list would be:

i) to give meaningful rather than mechanical practice, contextualised in a coherent discourse larger than a single sentence.

ii) to provide hints of various types to lead students to the correct answers.

iii) to accept alternative correct answers within the given context.

iv) to offer the option of explaining why certain answers are considered correct.

v) to anticipate incorrect answers and offer explanations concerning them.

As you can see, this type of criteria ensures that course development and evaluation in computer assisted instruction position the learner at the centre of the matrix.

The notion of intelligence in CAL

Typically, intelligence in CAL is thought of as synonymous with the implementation of highly complex programmes which simulate human intelligence or which perform tasks that would require intelligence if performed by human beings. In other words, these sorts of programmes are based on techniques of Artificial Intelligence.

Our main point of interest here is the emergence of the increasingly sophisticated interface between 'artificial' and 'real' intelligence. Again, let us elaborate with an example from CALL. The kind of ideal programme in CALL that language teachers visualise today is one, which understands spoken natural language. And is capable of responding appropriately through a voice synthesizer with an impeccable accent in a variety of registers and at the same time contains the distilled essence of all the best language teachers in the world.

A tall order, indeed. But such devices are close to reality today, at least in the U.S.A. and Europe. One of the significant developments of these systems is the expert system based computer-aided learning (EXCAL). The aim here is to provide learners and course designers/authors with an environment for managing learning activity in a multitude of new ways. A specific example here is the EXCALIBUR project in Australia. This is intended to be an intelligent, general-purpose computer environment that will provide a favourable development and delivery framework for computer-aided learning. Briefly, the EXCALIBUR project consists of

i) a domain expert system consisting of a knowledge base and an appropriate reasoning system.

ii) a student model for each student i.e. a representational map or network diagram, of their cognitive abilities together with a map of their subject knowledge.

iii) a teaching expert which contains both general and subject-specific pedagogical knowledge.

iv) a natural language interface to analyse user input and synthesise system output into natural language.

v) a reasoning system capable of operating not just from knowledge, in one of the above knowledge bases but also from the student's knowledge, in order to construct a dialogue with him/her.

To reiterate a point made earlier, these examples repeatedly tell us that the main focus in the use of the computer as an educational aid is to cater to varying learner needs.

1.4.2 Computer managed learning (CML)

In CML the learner is more at the receiving end, and much less initiative is expected of him, than in CAL. CML deals with less detailed and less changing information, and has of late been increasingly associated with individualised learning in which the computer makes information stored in it available to the learners in order to provide various learning experiences. These include administering tests for assessing achievement as well as diagnosing the areas of weakness and their follow-up remedial instruction.

A review of literature on CML reveals that a lot more has been written on CAL than on CML. CAL is more flexible than CML, and it provides greater scope for innovations. Another significant innovation of the 1980s is the computer-based interactive video in education. The interactive video system has three essential components viz., i) the end-user who could be a learner or trainee; ii) the computer system which includes a knowledge elicitation system; and iii) the video disc system. An intelligent interactive video system theoretically performs the interactive function of the human teacher, though the system is still in its infancy.

The description given above of the computer as a medium of education, should not lead you to conclude that the computer (or CAL, to be more precise) is equally effective in teaching all subjects. Two important facts have to be kept in mind while assessing CAL. Firstly, many more studies have been done on CAL in more structured subjects, like mathematics and physics than in the less structured one, like languages and music. Secondly, almost all these studies have been conducted in the developed countries. Various CAL studies reveal that

i) the effectiveness of CAL is far from absolute: it depends upon a number of factors, the chief among which are the curricular subject, the achievement level of the learners and the instructional setting;

ii) CAL is more effective in teaching subjects which are relatively better organised and structured;

ii) elementary level students gain more from CAL than college students do;

iii) CAL becomes more effective when it is integrated with the curriculum than when it is used as a mere complement to classroom teaching; and

v) CAL can be profitably introduced at the lower grades, i.e. be used in primary education.

In short, the significant impact of the micro-computer in the educational scene is the central point of discussion in section 1.5. The various aspects of CAL and CML illustrate this point amply. Before you proceed, do pause and work on this exercise.

Check Your Progress 2

Notes: *a) Write your answers in the space given below one question.*

b) Compare your answers with those given at the end of the unit.

i) Distinguish between CAL and CML.

ii) List any two distinguishing features of Instructional CAL and Revelatory CAL

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ii) .....

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1.4.3 Computer based training (CBT)

The success of the use of the computer in the school and educational set up has resulted in its use for industrial and military training. In fact this is now more predominant and is often referred to as computer–based training (CBT). CBT is an approach to solve performance problems through training, which is essentially individualised. A typical CBT enables the learners to acquire the knowledge and skills that comprise competence in task performance. However, it is similar to CAI in its design. Some call it Technology Based Training (TBT) as well. CBT provides the following advantages:

- Tutorial: Activity based tutorials of shorter duration that provide information for understanding and allows higher retention of knowledge.
- Drill and Practice: It allows mastery learning through drill and practice.
- Learning by closing: CBT can provide complete experiential learning and a learner can develop skills by working on models and simulated projects.

Using the UK based National Vocational Qualification (NVQs) framework Ravet and Layte (1997) suggest six levels of computer activity that can be used for developing computer-based training packages. These are depicted in table –2.

Table –2: Six levels of computer activity

Level	User Activity	Computers reaction to user activity	Analogy
1.	Select, read, listen, watch static data	The state of the system does not change significantly. It is possible to add basic information like a page mark, annotation or users name.	Reading a manual about a car
2.	Modify, input static data	The state of the system can change significantly. Evolution of the system depends mostly on user's actions. Other people can collaborate in this process (work group)	Filling in a registration form. Writing a manual about a car.
3.	Set and change parameters to collect dynamic data or pilot a process	The state of the system can change significantly. The system presents some degree of autonomy and ultimately could evolve independently Other people can collaborate in this process (distributed interactive simulation.	Driving a car Adjusting the carburator to reduce pollution.
4.	Build a model assembling pre existing discrete components	The state of the system depends on a model constructed (or modified) by the user, manipulating existing objects and relations between objects.	Creating a road transport system and testing different options.
5.	Create an entire original model	The state of the system depends on a model constructed by the user creating objects, i. e. concepts and laws of physics, mathematics, economics, etc.	Creating a model to study the importance of a new transport policy.
6.	Practising soft skills like management, negotiation, counselling	The system contains intelligent agents evolving in a complex digital world which can be briefed and debriefed using the full spectrum of communication: body language, tone of voice, etc.	Negotiating during a conflict with a lorry driver.

Source : Ravet and Layte (1997).

This indicates that the computer can be used for a variety of purposes, from teaching basic computation to managerial skills. In recent years, the computer based training materials are available in multimedia formats. In the next section we will discuss multimedia teaching learning (MTL) materials in detail.

1.5 MULTIMEDIA TEACHING LEARNING MATERIALS

We have already discussed in the block-2, the role of the media in education,where it was suggested that the appropriate use of the media can offer enormous potential for increasing learning. As such, the use of multiple media was an alternative strategy for effective teaching and learning. However, the advent of greater computing power has underpinned the emergence of multimedia as a potential teaching and learning tool in higher education, since it delivers a combination of media via the computer. Before we go further let us understand more fully what 'multimedia' is.

1.5.1 What is multimedia?

Multimedia has become one of the biggest buzzwords in educational computing today. It's a technology that combines print, with art like painting, photo, animation, graph, chart and other forms of illustration and radio and television as well. All these could reach your desktop computer, providing the freedom to interact with and handle moving pictures, stereo sound and animation as well as text and graphics. As such multimedia is defined as the integration of multiple media such as visual imagery, text, sound, video, and animation — which together can multiply the impact of any message. Another term quite often used is interactive multimedia, which refers to the ability of the user to control these components and interact with them as required.

The information in multimedia programmes is broken into smaller units and embedded at the appropriate points where the user might require it. This enables the user to switch over (navigate is the technical term) from one medium to another and benefit from understanding through different communicative media. Sitting at a desktop computer a learner can read a text, view a supporting picture to visualise the setting, listen to the dialogues or see a play enacted. Unlike a real life situation the machine will replay the action as many times as the user wants it to. Good multimedia programmes will provide answers to all the users' enquiries and 'interact' with them to facilitate their viewing exactly the desired information. This is known as interactive quality.

In the 'multimedia' jargon there are two more terms 'hypertext' and 'hypermedia' which are used quite often. Now let us explain them.

What is hypertext?

The concept of 'hypertext' was introduced by Theodor Nelson in 1965, but became popular only in the late eighties. However the idea of hypertext may be credited to Vannevar Bush's article 'As We May Think in the *Atlantic Monthly* of 1945, where he wrote: 'Consider a future device for individual use, which is a sort of mechanised private file and library. It needs a name, and to coin one at random, "Memex" will do. A memex is a device in which an individual stores all his/her books, records and communication and which is mechanised so that it may be consulted with exceeding speed and flexibility. It is an enlarged supplement to his/her memory'. With the advent of the Macintosh software HyperCard most people started using the term 'hypertext' interchangeably with multimedia though it only permitted texts to be joined together. Today hypertext, to most people, means electronically linked data (text and graphics) that run on computing devices and planned software. Hypertext is defined as the non-sequential arrangement of texts that allows authors to bind information together through a variety of links.

What is hypermedia?

For some time now hypertext programmes have made possible the inclusion of sound, graphics, pictures and video. As this is a step beyond the text-only approach, it has been named 'hypermedia'. The term is normally used of a hypertext system, which incorporates a variety of media including text, graphics, animation, sound, and video. This word is often used

synonymously with 'multimedia', but there are other multimedia systems which do not function on the principles of hypertext e.g. a video disk based multimedia program like the Doomsday Project (UK). The concept of *hypertext* denotes a system of 'electronically linked texts' and the cognate *hypermedia* is an extension of the term hypertext, to differentiate between the new kinds of technology which include other non-textual materials in different media forms.

1.5.2 Multimedia design issues

Multimedia programmes are developed using sophisticated software called authoring softwares or authoring tools. Some of the commonly used authoring tools in courseware development are: Authorware Professional, Director, Studiomax, Hyper Card, Toolbook, Apple Media Toolkit, etc. Our intention here is not to turn you into multimedia designers, but the following issues should be considered while looking at any multimedia teaching-learning material development.

- Adopt a user centred approach. How is the multimedia programme going to improve student learning ?
- Take user feedback. Are learners satisfied with the courseware? Incorporate learner feedback in the development process.
- Maintain consistency. Develop a consistent style and design, especially for the front-end screens.
- Make it interactive. Design facilities for interaction: for errors, for setting pace, for choice of module etc.
- Present information in small chunks. The information in multimedia programmes should also be thought provoking, in order to maintain the learners' interest.
- Documentation. Provide help facilities and clear documentation for usage.

1.5.3 Applications of multimedia

Multimedia programmes can be used for a variety of purposes. They are used:

- for providing information in information kiosks;
- for delivering reference works, such as encyclopaedias;
- for distributing games;
- for education and entertainment.

Here we will focus our discussion on the educational applications of multimedia. These are, by definition, a mixture of various kinds of media, and hence offer a clear advantage over single media resources. The user can to a certain extent control his/her learning process through multimedia courseware, as they are designed to suit different learning styles. Phillips (1997) has identified the following examples where multimedia could be a suitable technology to use:

- Material which is difficult to visualize, such as microscopic processes.
- Material which is three-dimensional, which is difficult to visualize using traditional two-dimensional media such as books and whiteboards.
- Dynamic processes, which require understanding of the relationships between moving objects.
- Material which covers broad contexts, where a number of ideas need to be linked to form an understanding of the whole, not just the parts.
- Simulations of expensive or complex processes, where understanding may be hindered by the mechanical details of performing the process, or when there is no possibility of using the real equipments.

Check Your Progress 3

Notes: *(a) Write your answers in the space given below.*

(b) Compare your answers with those given at the end of the unit

(i) Give three advantages of CBT.

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(ii) Define multimedia.

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(iii) Identify at least three issues in multimedia design.

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1.6 EFFECTIVENESS OF COMPUTER USE

We have so far discussed the theoretical aspects of the computer as an educational medium. We shall now deal with two practical aspects of the use of computers in education, viz., administration and cost consideration.

1.6.1 Administration

Administrative aspects of using the computer in education pertain to installation of the computer, student management, staff training and software evaluation. Much can be written on these aspects but the scope of this unit necessitates only a brief description of each.

We know that individuals differ from each other, and at times in a unique manner so as to make each of them unique. Therefore, the suggestions on the administrative aspect of using the computer should be treated as

guidelines based on the experience of most teachers. Besides, using the computer as an educational medium should not be a 'hit-or-miss' affair. Hence the need to evolve a policy and a working plan for it. Ideally, a team of teachers should participate in evolving the policy on 'when', 'how' and 'how much' the computer is to be used.

i) Installation of the computer: No doubt, the computer is a costly device and its safe custody should be properly ensured. However, the safety of the computer should not be at the cost of accessibility. After all, the computer should be available to its users. Computers should preferably be attached with uniterrupted power supply.

ii) Pupil management: The teacher or the counsellor usually mediates between the user students and the computer. If the institution has more than one teacher capable of using the computer, then an arrangement for booking the computer room should be made. This allows greater utilisation of the computer and fair distribution of the computer-based teaching load.

So far as the pupil management is concerned, the pupils may use the computer as a whole group, in small groups or as individual users. Whole group organisation has its justification in spite of its limitations, since it can be used for demonstrating what the programme is about and can, therefore, be a good starting point. Secondly, whole group organisation promotes discussion. If possible, whole group organisation should be followed by small group organisation. Four to six pupils are the right numbers for a small group. Studies on computer-based learning have established that "computer-enhanced-collaborative-learning" (CECL) using small groups is more effective than individual CAL because CECL is based on co-operation and discussion.

iii) Staff training: All teachers may not be computer literate when they join the institution, and even if they are so, they may not be proficient in using the computer as an educational medium. The institution can, however, ensure systematic computer literacy and skills for one teacher to begin with, and this teacher may then train others. However, provision for imparting computer literacy and computer based teaching skills is more a matter of institutional policy. The greater the number of teachers who are computer literate and proficient in computer-based teaching, the greater the possibility of the best use of the computer facilities available at the institution.

iv) Software evaluation: If an institution has facilities for computer-based learning, then some provision has to be made for procuring appropriate and adequate software. Even if an institution gets its software supply through a centralised agency, the need for the teacher to evaluate the software package in terms of its suitability for the students does remain. A good software package, when put to use, must engage the pupils' attention and motivate them, provide additional relevant information, encourage practice, sequence learning and provide a worthwhile additional learning resource in itself. A software package may often fall quite short of its advertised merits. Hence, software should be assessed on technical aspects, presentation and documentation. Of these three criteria, the effects of good presentation have already been listed above. A good programme should be easy for the learners to use, since it should make as few demands on them as possible

and they should be able to use it without running into difficulties. Software evaluation skills, however, cannot be developed overnight or even in a short period — they develop with practice over a period of time and there are no short cuts.

1.6.2 Cost

Decisions regarding educational innovations and the use of the various educational media are very frequently based on cost considerations. This is especially true of the developing countries where education is just among many priorities, quite a few of that often rank higher than education. We shall not deal here with technical considerations of the various brands and models of computers. The cost of a computer system includes the cost of peripherals and, at times, of the additional visual display unit or monitor. As such the cost is related to the capability of the computer, i.e. whether it is multimedia or networked or just stand-alone. Though the costs are prohibitive for most developing countries, there has been a consistent decline in the price of computers. According to an estimate the power of computers doubles in every 18 months and the cost reduces to half during the same period. Today, the average cost of a multimedia PC along with fax-modem capability costs around Rs.40, 000 in the Indian market (ie about US$1000).

Check Your Progress 4

Notes: *a) Write your answers in the space given below.*

b) Compare your answers with those given at the end of the unit.

i) List the various administrative aspects of the effective utilisation of the computer.

ii) Briefly describe the various types of pupil management. Which of these is most useful and why?

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ii) .....

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1.7 COMPUTERS IN INDIAN EDUCATION

In this section, a case study in computer applications for educational purposes is offered within the context of a developing country. The findings cited here will, we hope, typify certain larger issues endemic to the socio-

economic conditions of developing countries. The computer appeared in selected Indian schools during 1984-85 as part of a national project for developing Computer Literacy and Studies in Schools (CLASS). Thus the computer is a recent device in Indian schools and its history is that of project CLASS itself. For millions of Indian students the computer remains a fanciful and mysterious high-tech electronic device that demands respect and careful handling. The students associated with the project CLASS are essentially an elite minority. The teachers who have received training under CLASS are also few in numbers and are expected to play a key role in providing the multiplier effect. The computer hardware provided to the 750 schools under CLASS was an 8-bit microprocessor with 32k RAM, and 12" colour monitor, 5-1/4" floppy drive and 80 column dot-matrix printer. Surely, a very low configuration system in terms of present day standards.

Project CLASS had four objectives:

- to provide students with a broad understanding of the computer and its use;
- to provide hands-on experience;
- to familiarise the students with the range of computer applications in all walks of human activity and the computer's potential as a controlling and information processing tool; and
- to demystify the computer and to develop a degree of ease and familiarity with it, which should be conducive to developing individual creativity in identifying and developing applications relevant to the students' immediate environment.

Project CLASS was to focus on developing user's skills and not on the teaching principles of the computer sciences. The project adopted a top down approach, and was initially introduced at the secondary and senior secondary level. It is to be extended to middle and primary classes later on, and is to be a part of general education as far as possible.

The schools for project CLASS were selected with the help of state authorities and other agencies like Central Board of Secondary Education, National Council for Educational Research and Training (NCERT), Kendriya Vidyalaya Sangathan, etc. These schools include co-educational, as well as single sex schools. The training programme comprises 330 lectures and 30 practical sessions, each lecture being of 60 minutes duration, while each practical session is for 2 hours. Thus, the entire training programme consists of 90 hours of computer literacy.

Science and Mathematics have a large share in software packages under CLASS. Most of the custodian teachers for the computers have been drawn from Physics and Mathematics. Computer literacy classes have been held for about eight years and the experience has revealed that:

i) the computer as a tool will not be easily available in all Indian schools in the near future;

ii) the computer is now treated as a prestige symbol; possessing it has become more important than using it effectively;

iii) unless adequate precautions are taken right now, practical use of the computer in schools will decrease and computer literacy will become by and large theoretical and lecture-based;

iv) providing experience in programming, though a neglected area, is pedagogically a very important one because programming equips the students with an alternative mode of problem-solving;

v) computer networks and CAL are almost entirely absent in schools and therefore, the use of the computer in the Indian schools is still in its infancy.

The teacher plays a key role in any successful system of education, and his/her role, in this context, means ensuring the effective use of the computer in our schools. The teacher's attitude may not determine the issue of whether to have computers or to do without them, but it does determine the effective use of the computer for educational purposes.

We have talked about computers at the school level because we could provide the example of a definite project. Computers have come into higher education as well; their use and courses in certain top-notch institutions of technological and management education are well known. The situation described here is of the Government or Government aided schools in India. However, in the 1990s the scenario is changing very fast. Most private schools now have computers though they have not been fully integrated in the education process. Computer science is also being taught as a subject at the senior secondary level. Moreover, computers have become a buzzword in schools and colleges, at least in the urban areas of the country. For the higher education sector, the University Grants Commission supplied computers to selected colleges, but their use could not be monitored in the absence of trained manpower. Realising the overall shortage of manpower trained in computers, a number of institutes of technology and management have taken the initiative to produce computer professionals. Even the private sector has taken a lead in this direction. Now, with the recommendations of the Information Technology Task Force of the Government of India, the use of computers in the Indian education scenario is definitely going to improve.

Check Your Progress 5

Notes: *a) Write your answer in the space given below.*

b) Compare your answer with the one given at the end of the unit.

Describe the five salient features of the use of computers in Indian schools.

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1.8 COMPUTER MEDIA IN DISTANCE EDUCATION

So far we have discussed various uses of computers in education. In this section we will try to discuss the use of computers in distance education. Chacon (1992) provides an interesting taxonomy of computer media in distance education. We will make his propositions as the basis of our discussion. In contrast to the six levels of use of computers identified in sub section 1.4.3, he suggests a simpler version of computer use as extension of the learners' and the educators' behaviour. He also identifies three modes of computer use as information processing, interaction and communication. Let us discuss each one of them.

Information processing

The information processing mode of computer use in distance education uses the principle – 'I learn by doing'. It is related to a series of abilities related to intelligence such as recall, ordering, calculation, relationship, matching, reading and writing. The computer is used as a tool for these activities. The learner performs certain external tasks using a computer, e.g. prepares a project report using a word processor, prepares a balance sheet using a spreadsheet, or prepare a design using a set of graphic tools. This signifies that computers can be used in distance education to perform the following pedagogical functions:

- dissemination of information
- development of language skills
- learning foreign languages
- development of procedural skills
- learning problem solving
- learning analytical skills
- learning presentation skills
- learning design skills

In spite of the importance of these functions, the use of computers suffers because of limited access to learners. Before a course designer plans to use computer media in distance education, he/she must consider how the learners will have access to computers. The Home Computing Policy of the UKOU (Open University, United Kingdom), did precisely that before introducing computers in a big way.

Interaction

The interactive mode of computer use in distance education uses the principle — 'I teach something to myself.' Interaction is between a person and a machine. According to Chacon, interactive computing in education takes place when the learner is allowed to establish a dialogue with the computer on which he or she can exert a great deal of control, and receives stimuli in multiple media formats. The interactive mode of computer use is most commonly used for educational purposes. In this mode the computer becomes a resourceful tutor. Examples of this mode are CAI, interactive multimedia and CBT programmes. The pedagogical functions covered by

this mode are: drill and practice, problem solving, procedural learning, tutorials, guided discovery learning and decision making.

Communication

The communication mode of computer use in distance education uses the principle — 'I learn from others'. It envisages interaction among persons through the use of computers. The communication mode application in distance education is perhaps predominant because of its usefulness in providing support to remote learners. The technologies used are E-mail and computer conferencing. The communication mode performs the following pedagogical functions:

- learning verbal communication
- developing skills for analysis and synthesis of textual information
- development of expression and articulation
- developing skills for analysis and synthesis of textual information
- motivational support to remote learners
- development of critical judgement
- participative problem solving
- opportunity for incidental learning
- substitute for direct experience
- presentation of abstract knowledge.

In unit 3 of this block you will learn more about the use of this mode in distance education. However, two successful uses of this mode deserve mention here. The CoSy software designed by the University of Guelph (Canada) for computer conferencing and the FirstClass software used by the UKOU for computer conferencing are excellent examples of the communication mode use of computers in distance education. Apart from this a major usage is that of E-mail and mailing lists that provides person to person and one to many communication. The communication mode provides an excellent opportunity for collaborative learning.

1.9 LET US SUM UP

The key points of our discussion in this unit are:

- The computer is a versatile device under modern information technology, and is being used in a variety of situations. The uses of computers can be grouped under three broad categories — pedagogy, training, and lifelong education.
- Microcomputer, also called personal computer (PC) is more suited to individual users. PC has promoted a number of innovations in distance education. It has changed the process of course writing, source editing, production of manuscripts, etc. It is being used to store and retrieve data related to the students and teachers. Two well-known educational features of the computer are termed CAL and CML.
- CAL provides learner autonomy; a learner has full control of his/her learning here. A student enjoys freedom in planning and executing his/her learning. CAL includes two modes. 'Tutorial CAL' stimulates the interaction between a student and content. In 'simulation CAL' the

computer serves as a laboratory or a field situation, and allows the students to perform experiments.

- CML also provides individualised learning. The computer makes the information stored in it available to the students in order to provide various learning experiences.
- Computer-based training (CBT) packages are becoming common in industrial and business training situations. They are highly useful in providing tutorials, drills and practice sessions and opportunities for learning by doing.
- Multimedia coursewares have entered the educational scenario. These course materials provides an integrated media resource to learners in one single format, as multimedia is defined as the integration of multiple media – such as visual imagery, text, sound, video and animation — which together multiply the impact of any message. These multimedia teaching-learning materials are highly effective in improving student learning.
- There are two main practical aspects of using the computer in education — administration and cost considerations. The administrative aspects deal with installation of the computer, learning management, staff training and software evaluation. Cost is one of the main factors in making the computer inaccessible to the teaching-learning process, since computer-based education is a costly affair in developing countries. However, the cost of computers is decreasing very fast.
- Computer literacy — or the lack of it — prohibitive cost and lack of knowhow or expertise in using the hardware and software are certain major hinderances to the effective utilisation of computers for educational purposes in the developing countries. This point is illustrated by CLASS — a case study from India. But the scenario of computer use in Indian education is going to undergo a tremendous change in the years to come because of the recommendations of the IT Task force, Govt. of India.
- Computers could be used in distance education in three different modes, viz. information processing, interaction, and communication. Each one of the modes has different pedagogical functions, but any use of computer media for a distance education purpose must decide the question of access of computers from the learners point of view.

1.10 CHECK YOUR PROGRESS: THE KEY

1) i) The three basic issues related to pedagogic uses of the computer are

   a) how to help the learners express themselves while using the computer

   b) how to provide individualized learning, and

   c) how to ensure high quality software.

ii) The computer should be used as an add-on device, because it cannot entirely replace the human teacher, and the decisions about when, how and how much to use the computer are to be taken by the teacher.

iii) Changes in teaching strategies.

— changes in selection of instructional content, and

— changes in providing the context of the curriculum.

iv) Any two of the following:

a) increasing learners' motivation;

b) providing new instructional stimuli;

c) activating learners' responses;

d) providing steady and systematic feedback;

e) providing appropriate practice;

f) sequencing learning;

g) providing additional valid information for enrichment learning.

2) i) CAL assumes a more autonomous learner and more detailed and rapidly changing information. CML, on the other hand, provides a less autonomous role to the learner but more individualised learning experiences: it deals with less changing and less detailed information.

ii) **Instructional CAL:** a) provide tutorials, drill and practice; b) lays stress on the form of verbal messages, their transmission and reception.

Revelatory CAL: a) emphasises discovery through simulation;

b) reveals concepts gradually and systematically.

3) i) The advantage of CBT are :

— tutorial support

— drill and practice

— learning by doing

ii) Multimedia is defined as the integration of multimedia — such as visual imagery, text, sound, video, and animation — which together can multiply the impact of any message.

iii) Three issues in multimedia design are :

— learner centred approach

— interactivity

— small chunks of information presentation.

4) i) Four administrative aspects of the effective utilisation of the computer—

a) installation of the computer

b) pupil management

c) staff training

d) software evaluation

ii) Various types of pupil management are

a) whole class,

b) small group, and

c) individual learner.

Small group is the most useful, because it is supported by cooperation and discussion.

5) Salient features of computer use in Indian schools are as follows:

a) The computer came to the Indian school through a national project CLASS during 1984-85. b) About 750 schools spread all over the country use computers. c) The computer is being used in Indian schools for computer literacy and not for CAL or CML. d) Top-down approach has been followed in using computers in our schools. e) Networking is not used in our schools.

UNIT 2 SATELLITE TECHNOLOGY AND DISTANCE EDUCATION

Structure

2.0 INTRODUCTION

We should certainly thank the discoverers of the radio waves, which have revolutionized communication technology throughout the world. Though there is a constant pressure on new technologies to facilitate national and international communication, the usable radio frequency spectrum has its own limitations. For example, television broadcasting needs higher frequencies, the propagation conditions of which are severely limited. The television service should therefore be local in nature, unless a chain of transmitting stations is connected via cables or microwaves. This solution too has its own limitations in application, since chaining transmitting stations is a very expensive and complicated system and the transmitting connections cannot be used over the oceans and long mountain ranges. The need to overcome these problems of distance and cost gave birth to satellite-based communication systems, which combine both space and communication technologies.

In this unit, we shall focus on the reasons behind the importance of the satellite-based communication systems in distance education. We shall discuss the need, status, and potential of these systems and shall also explore ways for the developing countries to use them. The talk-back devices — teleconferencing and the telephone, will be given extended

treatment because of their specific utility in distance education. Having discussed the developments in applying the broadcast and cassette technologies (Block 2) as well as the computer (Unit 1 of this Block) to improve the efficiency of teaching-learning transactions, we now turn to satellite-based communication.

2.1 OBJECTIVES

After going through this unit, you should be able to:

- state the role of space orbit in positioning satellites.
- explain the characteristics and applications of communication satellites in education in general and in distance education in particular;
- distinguish between satellite and the terrestrial communication;
- describe the techniques and types of teleconferencing;
- describe the importance of telephone-mediated instruction;
- justify the need for satellite-based communication in distance education; and
- describe and predict the kind of virtual class that may emerge in future.

2.2 COMMUNICATION SATELLITES

A communication satellite is a spacecraft that receives signals from a transmitter on earth and amplifies these signals, changes the carrier frequencies, and then retransmits the amplified signals back to the receivers on earth. The communication satellites are usually placed in a special earth orbit, which makes them appear stationary to the transmitters and receivers on earth. There are more than a hundred of these communication satellites in orbit around the world, and new satellites are being launched regularly.

The space age started in 1957 with the launching of ***Sputnik*** by the former USSR. Since then, a number of satellites have been launched for various purposes: telecommunications, meteorology, remote sensing, disaster warning, defence and so on.

The key to satellite-based communication is not simply the satellite itself, but other elements as well — a ground based transmission station known as uplink, and a receiving disc known as downlink. The uplink sends signals to the satellite, which amplifies and retransmits them back to the downlink, i.e. the direct receiving disc, which in turn feeds a local station. See Figure 1.

Launching of satellites

A satellite is launched into a geostationary orbit using either an unmanned vehicle or a piloted space shuttle that is reusable. The machine, popularly known as the Satellite Launch Vehicle (SLV), has one or more rocket stages that provide the acceleration needed to launch a satellite into the desired earth orbit. The satellite is normally placed in a circular earth orbit by the

SLV and then transferred, shifted or fixed into a geostationary orbit. A special rocket in the satellite provides the acceleration needed to transfer the satellite from a circular orbit into a geostationary orbit. This special rocket in the satellite is called an apogee motor or an Apogee Kick Motor (AKM).

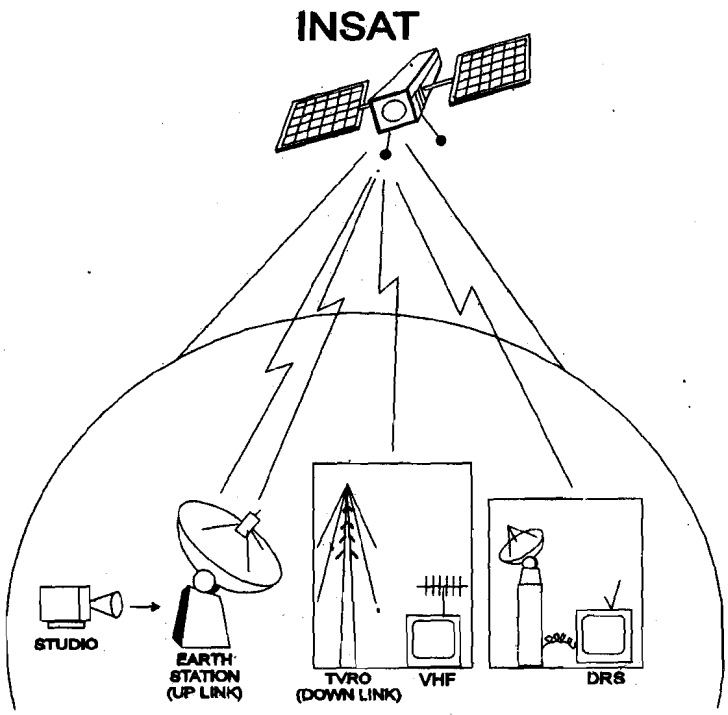

Fig. 1: Transmission Through Satellite

The space shuttle provides an alternative method of launching communication satellites. Launching satellites with a space shuttle is less expensive than using unpiloted launch vehicles because a space shuttle can launch more than one satellite on a single mission and then it can be reused (Douglas, 1988). Once the satellite is fixed in the geostationary orbit, it rotates in the same direction as the earth, at a velocity that equals the rate at which the earth rotates.

In a short span of time, communication satellites have become the predominant carriers of long distance communications. Since 6th April 1965, when the first commercial satellite, INTELSAT, was launched, the satellite industry has grown to handle most national and international communications. The satellite is used for direct broadcasting in many countries.

In India, the first Indian National Committee on Space Research (INCOSPAR) was founded in 1982 for conducting space science experiments. The primary objectives of the Indian space programme are to develop indigenous capability in advanced space technology/engineering; to develop capability for various applications of space technology for national

development; and to build scientific manpower for space science and technology (DOS, 1991-92). The late Vikram Sarabhai, the first head of the Indian Space Research Organization, opined that India, with its vast size and population, and low level of economic development and literacy, should draw the benefits of satellite technology to create a nation-wide television service for instructional, educational, and related developmental purposes (Srirangan, 1985). It took 15 years for Sarabhai's dream to be fulfilled in the shape of the INSAT-A multi-purpose system. At present there are around 40 television satellites around the world (WCR, 1997). Table – 1 gives a overview of some important satellite operators divided in terms of their geographical operation area.

2.3 SATELLITE ORBITS

One of the important factors making the communication satellite useful for specific purposes is the orbit into which the satellite has been fixed. There can be four types of orbits available for positioning satellites in space (Nicholson, 1976). We shall briefly discuss each of them just to have an idea of the basics of the communication satellite.

i) Low orbit: In the early stages of the development of satellite technology, the orbits were close to the earth surface (called 'low' in space technology). In the absence of sophisticated satellite launching equipment, the satellites could not be launched very far into space. Satellites in low orbits pass very rapidly from horizon to horizon and can be used for communication only for a short period. The speed of the revolution of the satellite in the low orbit and that of the earth does not match. Therefore, satellites in low orbits are not very useful for telecommunication purposes.

ii) Medium orbit: As space science progressed, more powerful satellite launching vehicles (SLV) were designed and developed which made it possible to place the satellite in a higher orbit. Satellite orbits ranging from a few hundred to a few thousand kms above the earth's surface is classified as the medium altitude orbits. Satellites in such orbits also revolve rapidly and we need to move earth station antennas to chase the satellite in space. In such cases, at least two antennas are installed: one antenna follows a setting satellite and the other follows a rising one.

iii) Geo-synchronous orbit: At a distance of about 36,000 kms from the earth's surface, an orbiting satellite can move at such a speed that it appears to be stationary to the people on the earth. This orbit is known a geo-synchronous or geo-stationary orbit. These days most of the new communication satellites, both for national and international use, operate in this orbit which is useful for communication purposes. Geo-synchronous orbit satellite systems offer advantages in cost and complexity when compared with the low and medium altitude systems.

Table1: Selected satellite operators around the world

Operators	Organisation	Services	Satellites	Reach
Interanational Operators				
Inmarsat	Founded in 1979 by international maritime Organisation. Co-operation between 179 member states including Japan, Norway, UK and USA.	Telecommunication	Inmarsat 2F1 (1990) Inmarsat 2F2 (1991) Inmarsat 2F3 (1992) Inmarsat 3F1 (1996) Inmarsat 3F3	Worldwide
Intelsat	Co-operation of 134 member states: Preparing to change status from 'international public service to commercial. Part of the organisation will remain in the public domain to ensure regional balance.	Telecommunication, Satellite News gathering	24 satellites in orbit. Approximately 1700 terrestrial stations	Worldwide
Regional Operators				
Asiasat	Asia's first regional satellite, totally financed with private fund. Launched in 1990.	Television broadcast.	Asiasat 1 (1990) Asiasat 2 (1995) Asiasat 3	Asia, Arab states, Eastern Europe
Arabsat	International Group of Arab countries	Transmits Arabic public television as well as International television such as CNN and MBC	Arabsat 1A (1985), Arabsat 1B (1985), Arabsat 1C (1992), Arabsat 1D (1993), Arabsat 1E (1995), Arabsat 2A (1996), Arabsat 2B (1996)	Mediterranean countries and North Africa.
National Operators				
India	Indian Space Research Organisation	Telecommunication, meteorological services, education.	Insat 2A (1992), Insat 2B (1993), Insat 2C (1995) IRS 1A (1988), IRS 1B (1991) IRS P2 (1994), IRS 1C (1995) IRS P3 (1996)	India and neighbouring countries
Brazil	EMBRATEL (National Communications Company)	Data, message, television and voice.	Brazilsat A1 (1985), Brazilsat A2 (1986), Brazilsat B1(1994), Brasilsat B2 (1995), Brasilsat B3A (1997).	Whole of Latin America.

Source : World Communication Report, 1997. (p.160-162).

The great advantage of a geo-stationary orbit is that the earth station antennas do not have to track the satellite, but can instead be mounted in a fixed position. In order for a satellite to remain in geo-stationary orbit, it must satisfy the following conditions:

i) the angle of inclination must be zero (i.e., a special orbit directly above the equator),

ii) the satellite must move in the same direction as the earth's rotation.

iii) the satellite completes a revolution in 23.94 hours to match the rate of earth's rotation on its axis.

Almost all communication satellites are geo-stationary, that is, their orbital period around the earth is 24 hours (23.94 hours to be exact), so they appear, from the earth, to occupy stationary positions in the sky. The Indian National Satellite series (INSAT) are also geo-synchronous satellites positioned in the space. Because geo-synchronous satellites are used for communication purposes, we shall focus on them in our discussion in this Unit.

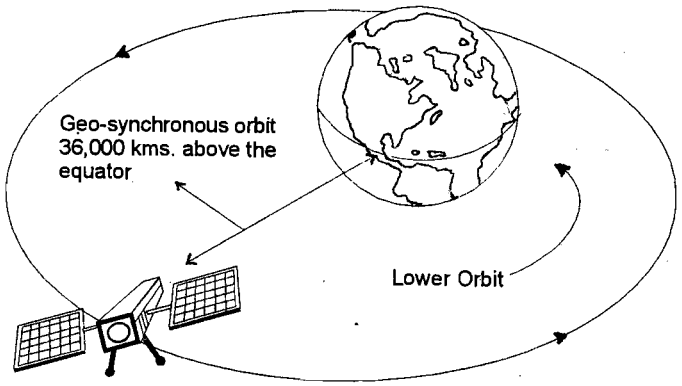

Fig. 2: Orbital Slot

Due to the recent innovations in space technology, it is possible to use synchronous satellites, which are so powerful and large as, to broadcast directly to inexpensive antennas located on the roofs of individual homes. These satellites are not dependent on ground based receiving and retransmission equipment. Because of the absence of an intermediate agent in the reception of signals, this is a type of satellite, which offers the chance of extensive use in the field of education, especially that of remote isolated populations. Besides providing regional and local coverage, it can distribute signals at the national level.

Now we come to the fourth type of satellite orbit.

iv) Special orbit: There are a number of useful specialised orbits in space for certain other services such as meteorology, remote sensing, natural resources, etc. Among these is the medium altitude sun-synchronous polar orbit that provides coverage of the same areas of the earth's surface twice a day. Since such orbits are not useful for communication purposes, they shall not form a part of our discussion in this unit.

Check Your Progress 1

Notes: *a) Write your answers in the space given below.*

b) Compare your answer with the one given at the end of this unit.

Which orbit in space is most suitable for communication satellites and why? Give three reasons.

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2.4 CHARACTERISTICS OF SATELLITES

All communication satellites have some common characteristics, which are as follows:

i) Power: A live satellite does not require conventional power to maintain its position in space, except tiny amounts of energy necessary to correct its position occasionally and check for disturbances caused by the gravitational influence of the moon, the sun and the earth. The power for receiving and transmitting signals comes from the solar batteries built into the satellite. Solar panels, which convert sunlight into electrical energy, are used for the functioning of the satellite system.

The relative positions of the sun, the earth and a geo-stationary satellite change continuously as the earth rotate on its axis and revolve around the sun. The solar panels on the satellite cannot generate power/energy in the absence of sunlight. In such a situation, a satellite eclipse occurs (A satellite is said to be in eclipse when the earth moves between the sun and the satellite and it prevents sunlight from reaching the satellite, i.e., when it is in the shadow of the earth). The satellite must have storage batteries to provide power during this time. These batteries are recharged by the solar cells between eclipses.

ii) Large coverage: Satellite-based communication is independent of distances. Unlike the terrestrial system, which mostly starts from the more central urban areas, satellite-based communication can serve the rural and urban, central and far flung areas simultaneously. It can cater to very widely dispersed populations at a time. This characteristic of the satellite is particularly useful for education at a distance.

Space scientists claim that three satellites in the geo-synchronous altitude orbit can provide communication services to the entire earth on a full time

basis, except for the polar regions, which are not visible from this orbit (Nicholson, 1976).

iii) Multi-purpose uses: Satellites can be used simultaneously for the radio, telephone, television and data traffic. Incidentally, technologists in Canada have successfully received and transmitted three TV programmes using a single ANIK 'B' transponder (a domestic communication satellite of Canada). Although at an experimental stage, it gives us an idea about the extra-ordinary capacity of the satellite (ACCESS, 1980-81).

Multi-purpose satellites offer a wide variety of combinations. Besides serving communication purposes, the satellites are also used for remote sensing, such as is required in soil surveys, flood (assessment of area under water, etc.), forestry (tree resources, tree diseases, etc.), oceanography, etc.

Because a satellite can provide more channels, it can give more and better transmission time for the distance teaching systems.

iv) Cost : The initial investment in the development and launching of a satellite is very high, especially for the third world countries. A multi-purpose satellite such as INSAT, needed a huge financial allocation in its fabrication and launching. But when INSAT-IB was launched and became operational, all demands for communication were met without adding new investment. On the other hand, the terrestrial system, including the microwave, needed additional infrastructure to meet the increasing information needs of a country. Expanding telecommunication infrastructure to provide communication services to different parts of the country is not always an economically rational thing to do. Because telecommunication for educational purposes cannot produce sufficient revenue to cover capital and operational costs, the costs in this case should be counted in terms of social and economic benefits, such as roads, water supply systems, schools, etc.

v) Planning: The implementation of satellite-based communication requires advance planning. It needs more lead time than terrestrial communication does. Therefore, the use of satellites should be linked to the overall socio-economic and educational development of the country. Since it (satellite-based communication) is closely linked with the educational development and economic growth of the country, it should have a base in long term planning.

vi) National and area specific communication: Satellite-based communication has the capability to cater to both the national and the area-specific needs of a country. Though it is considered as a centralised system of communication, it can be regionalised as well. Regional production and distribution centres could provide area-specific service. Educational content can be shared at both the national and regional levels.

vii) Life of a satellite: The use of solar panels/cells decides the life of a satellite. The electrical energy output from a solar cell will decrease with age: after 8 to 10 years, the electrical output from a solar cell will decrease by about 20 per cent. The communication satellite are generally replaced after about 10 to 12 years of continuous service. The life span of INSAT-IA and IB was seven years. Launched in August, 1983, INSAT-IB completed over 108 months of operational service in August, 1992.

Check Your Progress 2

Notes: *a) Write your answer in the space given below.*

b) Compare your answer with the one given at the end of this unit.

A communication satellite is essentially a centralised system of communication. Explain how it can be used at regional levels to meet peoples' information needs.

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2.5 SATELLITE VERSUS TERRESTRIAL COMMUNICATION

From the discussion in Section 2.4 you can infer that satellite-based communication has specific utility for distance learners or for the distance learning system. Right from the advent of the communication satellites, it has been recognized that communication through satellite has unique benefits such as long distance, quality of performance, networking, including one point to multi-points to one-point transmission capabilities. Yet non-satellite systems have a significant role to play in meeting the communication needs of a country. The fact is that the satellite and terrestrial systems supplement each other to make communication more effective. Now let us compare the satellite-based communication and the terrestrial systems of communication.

2.5.1 Satellite and terrestrial communication: A comparison

Satellite and terrestrial systems — as modes of communication — are not opposed to one another. Both systems supplement each other's potential to make communication more accessible and economical.

Satellite	*Terrestrial*
Does not require ground-base, high-power, high-tower systems.	Needs high-power, high-tower systems, (The height of the transmitter at Pitampura, Delhi is 235 metres).
Does not need much ground equipment; direct reception television sets can receive signals directly from the satellite.	Needs a number of transmitters for wide coverage (at present Doordarshan has a network of 529 transmitters spread all over the country).
Cost of equipment is high, however the costs are now falling	Cost of equipment is low.

however the costs are now falling fast.	
Being a highly centralised system it provides more positive pacing and control over the developmental process.	At times difficult because of technical and managerial hindrances in systems coordination. Further, because of the position taken by the local authorities controlling the flow of information at the regional level, it becomes difficult at times.
Use of satellite technology could inspire the teachers, students, and parents for modernisation because it brings the whole world together into a remote village.	Because of limited coverage, it has some drawbacks.
Planning and implementation require more lead time.	Needs comparatively less time.
Effective for a large country or a group of countries.	Suitable for a small country or a part of the country.
Independent of distance.	Limited coverage area.
Independent of the nature of terrain.	Difficult in mountaineous and sea areas.
Can meet the increasing demand of communication without additional cost.	Communication capacity is bound to the regional system installation and requires additional cost.
More effective in meeting the overall needs of people at the national level.	Serves regional information needs better.
A satellite failure can result in the entire system being inoperative which might pose severe readjustment strains on the communication.	Systems failure would not be as disastrous as in the case of the satellite system; readjustment and repair of damage is manageable.
Needs parking spaces for the geo-synchronous satellite which is becoming more and more scarce.	Does not need parking space.
Worldwide network connections via satellite can resolve the problem of unequal educational opportunities and can provide a truly world-wide sharing of educational resources for international education.	Network is possible at the regional level only.

2.5.2 Type of television sets

Different television sets use different technology to receive signals from a satellite or terrestrial transmitter. Depending on the type of broadcasting — satellite or terrestrial, there are two types of receivers used:

- Direct Reception System (DRS)
- Very High Frequency (VHF)

Without going into the technicalities of the two type of sets, we shall see how they functionally differ from each other. Figure 1 will also help you understand the difference between DRS and VHF systems.

DRS: The satellite transmits fairly high-power signals but it is not possible to receive these signals by the normal television sets used for viewing programmes of regular transmission. We need to put in a parabolic antenna and a low-noise pre-amplifier converter. The parabolic antenna is actually a small antenna with a parabolic reflector. The antenna is placed at a focal point of the parabola. A parabolic antenna is often called a dish antenna because of its shape and physical appearance (see Figure 3). Such TV sets that receive signals directly from the satellite are called the direct reception system (DRS).

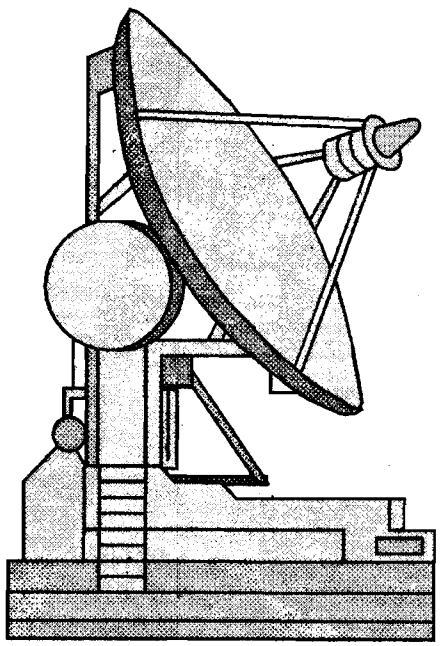

Fig.3: Parabolic Antenna

A DRS set can be installed anywhere in the country in the effective range of the satellite, which is very wide. In India, DRS sets are installed in INSAT areas beyond the effective range of the terrestrial transmitters.

VHF: The other system utilizes the ordinary very high frequency television set, which receives signals from the terrestrial transmitters after the latter have received them from the satellite through TVRO (Television Receive Only device). We all use such TV sets in our houses to view programmes

telecast on the regular networks. You may have noticed that the VHF sets can be installed only in the transmitting range of the terrestrial transmitters.

Check Your Progress 3

Notes: *a) Write your answer in the space given below.*

b) Compare your answer with the one given at the end of the unit.

Distinguish between DRS and VHF sets. Give at least two differences between them.

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2.6 SATELLITE-BASED COMMUNICATION AND DISTANCE EDUCATION

So far, we have mainly discussed the technical aspects of satellite-based communication. Now let us turn to its use in distance education, which is our major concern.

Satellite technology strengthens the capacity of the telecommunication network and the information flow, which among other things gives a boost to the educational development of a country. As we have discussed in this unit, satellite technology is more effective among dispersed populations in vast geographical terrains. That is why it will prove useful for the students of farflung areas who are pursuing their study at a distance. With limited intellectual resources, the satellite can be used more widely to provide opportunities of university education even to those students who live in small islands. For example, the University of the West Indies links its three main campuses situated in three different islands, Jamaica, Barbados, and Trinidad, with smaller extramural campuses on the island nations of St. Lucia, Dominica, and Antigua (Block, 1985).

In big countries the satellite-based communication is an effective alternative to cover many hundreds of widespread isolated locations which are otherwise very difficult to reach from the point of view both of cost and of feasibility. In some of the extremely mountainous and inaccessible regions, the satellite is the only solution. Its main advantage is its accessibility — it reaches every corner. Secondly, because the target audience for distance education courses run by the open universities is large and scattered across vast regions, the high cost incurred can be easily justified. Studies elsewhere have shown that transmission through the satellite has been relatively cheaper and the system is more accessible to all parts of the country on a personal basis (Hogie, 1987, Olof, 1986).

The satellite can be used for education in at least three ways — the telecast of educational and developmental programmes for the general public

(country-wide discipline-based learning); the telecast of pre-recorded programmes for students at all levels of education as a component of the routine/regular learning system; and the live telecast of educational programmes with two-way interaction. In the first two cases the television and radio are used as the general media. We have already discussed these two media in detail in Units 2 and 3 of Block 2. In the third case, the satellite is used to support some of the existing two-way communication systems viz., the computer, videotext, teleconferencing, telephone, etc. Of these, the use of the satellite for teleconferencing and telephone-mediated instructions will be discussed in Section 2.7 and 2.8 respectively.

Telecommunication can be used largely for teleconferencing and telephone-mediated teaching. The communication satellite can increase the reach and effectiveness of teleconferencing and of telephone-mediated instruction.

- *We have given below an unabridged version of a paper presented at the VIII Annual Conference of the Asian Association of Open Universities (Feb. 95). We would like you to go through the material carefully.*

  The primary purposes of this exercise are:

  i) To give a comprehensive account of the developments in this area in the context of a developing country.

  ii) To expose you to an insider's view (the author heads the Development and Educational Communication Unit, ISRO) of the potential and possibilities for harnessing satellite technology for educational purpose.

INTERACTIVE NARROWCASTING FOR DISTANCE EDUCATION

B.S.BHATIA

BACKGROUND

India is committed to the practical applications of space technology with the aim of promoting national development. While this and the objective of self-reliance do necessitate major efforts in hardware development, the emphasis is equally on creating system configurations that address the specific needs of the country. Towards this end a large number of application oriented experiments are organised jointly with user agencies. In the area of use of satellite communication for education, experiments were conducted in satellite broadcasting for rural education in 1975-76. Currently efforts are on in the use of one way video, two way audio teleconferencing networks to provide interactive Narrowcasting Systems for Distance Education. The Development and Educational Communication Unit of ISRO is the focal agency for the conduct of these experiments and for facilitating the operationalisation of the system.

In the field of satellite broadcasting the first major experiment was the Satellite Instructional Television Experiment (SITE) which was conducted in 1975-76. In this experiment 2400 dish antenna were installed in villages spread all over the country and development oriented programmes were transmitted. This was a precursor to the INSAT system, which has revolutionised the TV scene in the country. Today educational broadcasts for school children, undergraduate students and students of open universities are a regular feature of the National and Regional telecast. Besides there are regular programmes for former and rural education.

During the last two years the Development and Educational Communication Unit (DECU) of ISRO has been conducting several experiments in the use of interactive television for distance education and training. This is also called a one way video two-way audio teleconferencing network. Such networks have been found very effective for training and education where the learners/participants are spread over large distances at a number of location. The network is therefore very effective in fields of distance education, training of employees in large organisations and training of rural development functionaries in the government. This paper discusses the experience and plans of utilising the network for distance education.

SYSTEMS DESCRIPTION

While basically the system is a one way video two way audio teleconferencing network, it has been called by several names like "talkback" network, "interactive TV" network or "Interactive Narrowcasting". Some other names like SINET (Satellite based interactive Network) have also been employed by some user agencies. A diagram of the systems configuration is given in Figure.

The system consists of three major elements. The teaching end, the receiving end (classroom) and the spacecraft. The teaching end consists of small studio and an uplink earth station.

The teaching end originates the training material either in the form of "live" lectures or recorded video programmes from a small studio and; uplinks these television signals to a geostationary communication satellite by means of an "uplink" earth station which is located at the teaching end.

The satellite receives, amplifies and retransmits these signals which can be received at any classroom within the coverage area by means of a Direct Reception System (DRS) — a low-cost dish antenna of 8-12' diameter, front-end electronics and an ordinary television receiver. A certain number of these classrooms can be provided with capability to interact with the teaching end by means of a voice link. The voice link can be implemented in two ways. One, through the Public Switched Telephone to specific telephone numbers at the teaching end. These calls are received at the teaching end by a small EPABX located at the teaching end. Two, through a small satellite communication terminal located in the classroom which transmits the processed audio signal via satellite to the teaching end where they are received and processed. Facilities for reception of such satcom signals are provided at the teaching end. Classrooms where such interactive (telephone or satcom) capabilities are provided are known a "talkback" locations. Other classrooms are known as "receive-only" locations. The number of talkback locations in a system are limited by the system's capacity to receive simultaneously, and process question for various talkback locations. The number of receive-only classrooms are not limited by any such considerations.

A talkback or discussion session normally follows delivery of training material, which form the teaching end.

A small studio setup at the teaching end serves two purposes: to originate "live" or recorded lectures and to accommodate the panel of experts who will participate in the talkback sessions. The studio is linked to the uplink earth station in the forward direction for transmission and in the reverse direction for routing calls received from satcom talkback locations to the studio.

Calls received via telephone and satcom are fed to the expert panel at the studio classroom. They are simultaneously fed to the transmit chain at the teaching end earth station. Questions are heard "live" by the experts as well as participants at all locations (talkback and receive-only). Specially devised procedures for putting telephone calls on "hold" and feeding them sequentially to the expert panel one at a time) have been developed. Participation from satcom terminals is invited by visual cuing. An anchor person in the teaching end classroom conducts the talkback sessions and implements the procedures devised for the talkback sessions.

Visual images from the classroom at the teaching end and the audio signal generated by the experts are transmitted by the uplink earth station and received by all classrooms which are equipped with a DRS. Thus even receive-only locations which are not equipped with talkback facilities can receive the training material as well as the entire talkbak session.

A supplementary mode of interaction — through "fax" has also been implemented. Wherein a "fax" connection is provided in the studio flow to the anchor person, Some of the questions received by fax can be answered during the session, while the remaining can be answered in the off-line mode, through mail or other means.

THE IGNOU EXPERIMENT

This experiment was conducted for 10 days from October 4 to 13, 1993. The Teaching Centre for this experiment was located at IGNOU headquarters, Delhi. A small TV broadcast facility (studio)equipped with audio-video teaching aids was established in one of the rooms of IGNOU. The studio was liked through cable with the Transportable Remote Area Communication Terminal (TRACT) of Space Applications Centre (ISRO), parked temporarily in the IGNOU campus to provide uplink as well as down link to the INSAT-IIB satellite.

IGNOU Regional Directorate at the following ten locations, provided with a facility of extended C band receiver terminals to receive the TV signals and a long distance STD (Subscribers' Trunk Dailling) telephone for talkback, participated as Receiving Centres.

Receiving Centres

1.	Ahamedabad	6,	Hyderabad
2.	Bangalore	7.	Jaipur
3.	Bhopal	8.	Madras [Chennai]
4.	Bhubaneshwar	9.	Pune
5.	Cochin	10.	Shillong

Ten days of interactive teaching, orientation, and consultation/ discussion (October 4-13, 1993) was arranged for the students, the Academic Counsellors, and Regional Directors and Assistant Regional Directors. Five hours (300 minutes) of programme every day was divided into four sessions; each having almost one-third of the time devoted for lecture/ discussion and rest two-thirds of the time for question and answer using talkback technology.

Objectives of the ISRO-IGNOU Talkback Experiment

1. To develop understanding about the potential of tele-communication in distance education.
2. To gain insights into the organisation, managerial, and technical constraints and problems in operationalising such a system.
3. To study cost effectiveness and cost efficiency of the system.
4. To provide feedback to the people concerned for making the multimedia approach effective for education/training at a distance.

The target groups were:

1. **Regional Directors :** A total of 10 Regional Directors (RDs) and 10 Assistant Regional Directors (ARDs) from selected 10 receiving Centres.
2. **Counsellors** I: About 20 Academic Counsellors were chosen from Management Studies at each participating centre. This group was to participate for more than four days of the experiment.
3. **Counsellors II**: About 20 Academic Counsellors from Commerce at each participating centre. The second group was to participate for the next three days of the experiment.

4. **Students of Post-Graduate Diploma in Higher Education (DHE):** It was expected at each centre there would be 40 DHE student participants.

The training programme was conducted through live lectures and the discussion mode supplemented by graphics and charts, computer based graphics and a few audio-visual aids and discussions. During discussions, the participants at participating centres used the STD telephone facilities for asking questions in audio mode. The questions were answered using the audio and video mode.

At the Teaching centre there was one Achor person for coordination and one or two subject matter experts (teachers), dealing with the subject, for each session to coordinate the discussions on the subject and answering the questions coming from the participating Centres.

At the Receiving Centres there was one Moderator. In most of the cases the Regional Director or Assistant Regional Director or the Course Director/Coordinator, coordinated in the question and answer session. As the teleteaching was a part of the Extended Contact Programme for the students, after the teleteaching sessions were over, participants were back to their usual ECP programme (course) for the rest of the time in the day.

The IGNOU with its rich experience in distance education organised the whole show of teaching and counselling, managing the studio affairs and handling the interactive communication with the cooperation of Development and Educational Communication Unit (DECU), ISRO.

A study conducted by Prof. P.K. Sahoo* had the following to say: "During teleconferencing, learners from each regional centre were given a fair chance to ask questions. Each centre was given positive reinforcement to ask questions, inspite of communication technology drawbacks. As a result, it was found that during each session at least one participant from each centre got chance to interact with the experts. Each centre got at least two chances in every programme for question-answer activity. From each centre the questions were asked by 1-4 participants. Students' expressions were of different types like seeking clarifications, making observations, expression by reactions etc. They focused on the immediate presentation by resource persons as well as instructional activities /learning experiences of participants. It was also observed that students put counter questions to the resource persons, expressed opinions on the resource persons' views as well as the views of participants for other regional centres."

All the participants and the resource persons made positive remarks about the role of teleconferencing as one of components of ECP. Moreover, teleconferencing worked as a successful networking of ECP activities all over the country. Thus the central level coordination encouraged decentralisation activities taking place in 10 Regional Centres of the IGNOU.

A bird's eye view on the reaction of participants on each programme component would reveal the credibility. The majority of participants have appreciated/ reacted positively to almost all the programmes either to average extent or to a large extent. With regard to content quality it can be witnessed that even though most of the programmes were rated as of high quality, conceptual clarity, logical sequencing, difficulty level of learners from different regions, and content coverage were of average level.

Another evaluative study conducted by Dr. Arbind Sinha and others** made the following observation. The experiment has succeeded its worth in satisfying the participants and giving them new information which the majority of the participants found useful for the distance education and most of them found it ideal for extended contact programme. For the Regional Directors it provided a forum for giving uniform instructions throughout the country and for the Assistant Regional

Directors it provided some opportunity to participate along with the Regional Directors. For the Academic Counsellors as well as the students it provided the best possible counselling and an opportunity to take part in a national event.

ONGOING SYSTEM AND FUTURE PLANS

In view of the effectiveness of the system it has now been decided jointly by ISRO and IGNOU to operate this system on an ongoing basis, and make it available to different organisations involved in Distance Education.

Accordingly the transportable uplink (TRACT) provided by ISRO has been stationed at the IGNOU campus for the next two years and a small studio has been provided by IGNOU. This constitutes the teaching end. One transponder of the INSAT satellite has been earmarked exclusively for this application. This constitutes the space segment. Each user agencies is setting up its own network of receive terminals. Accordingly All India Management Association has set up fourteen receive terminals. The IGNOU is setting up a network of 25 receive terminals. The National Open School has plans for installing 20 receive terminals and the IETE has plans of installing 12 terminals.

All India Institute of Management Association (AIMA) has regularly been using the system for student education and for holding seminars and workshops. It has made its plan for utilising the network every month.

REGIONAL POSSIBILITIES

The nations of the Asian Region can benefit greatly by sharing of experiences, data and information, to avoid duplication, increase cost benefit, help Human Resource Development in the field of distance education in the region.

Satellite broadcasting, satellite based interactive narrow-casting, and data networks are being used to support education and development at the National level. Similar networks could be found useful to support distance education at the Regional level.

Data networking have become universally accessible and acceptable especially by researchers, and professionals of different fields. The establishment of data network in selected fields could be a useful, acceptable and viable proposition.

Regional broadcasting networks for entertainment already exist. However, these are a result of purely private commercial enterprise. Very recently a commercial satellite broadcasting channel, along with a computer training institution offered a computer certificate course on a regional level. Educational institutions can come together and offer instructional programmes that can support sustainable development.

There have been attempts like the one by IDRC, Canada to define a Global Television Service (WETV) to foster free and balanced cultural experience and to create deeper public understanding of the critical issues of sustainable development and the environment. Efforts can be made to define regional satellite broadcast service of similar nature.

Interactive narrowcasting network can be the most effective tool for Human Resource Development and Training. These network have the capability of reaching out to a very large number of selected audience with common interests, and provide them with information and education. It has interactive capabilities and therefore the learning from such networks can be very high. Such networks can have very great potential for Human Resource Development for sustainable development in the region. The establishment and utilisation of such networks at the Regional level needs to be seriously explored.

Some of the possible areas of use of satellite communication networks (including broadcasting, interactive narrowcasting and data networks) to support distance education could be as follows:

— Training / development for teacher education at various levels.

— Multimedia packages for training distance educators and functionaries such as distance teachers, counsellors, academic managers and administrators.

— Brain storming/ information sharing programmes for HRD in distance education by interested institutions in the regions.

— Presentation by distance educators on various themes of distance education.

— Training programmes for non-teaching staff of distance education institutions in the region.

— Development of database to be shared by distance education institutions.

— Development and sharing of software.

— Development of audio-video programmes.

— Sharing the audio-video programmes already available with the institutions in the region.

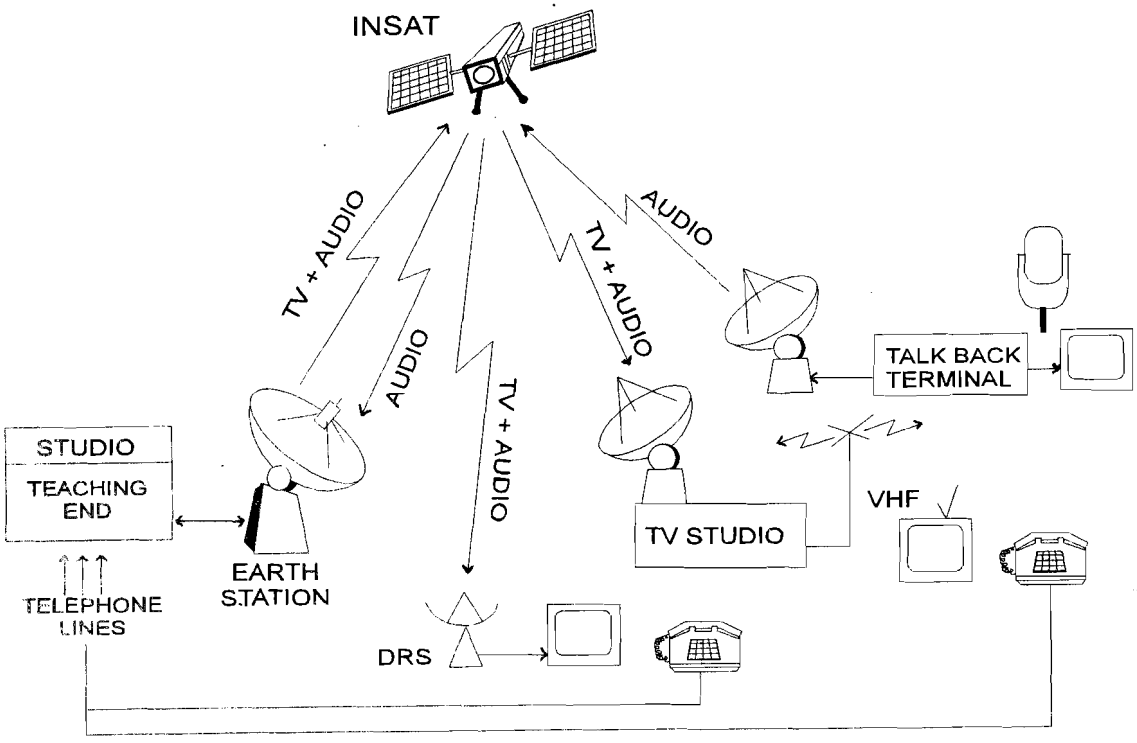
— Exchange of expertise in using teleconferencing broadcasts, E-Mail, fax etc., facilities for educational, training and research purposes.

Besides there could be programmes of common interest like health care, management, rural development, computers, women studies, child labour etc. The network could be used for sharing material, syllabi, and other relevant information on each course. If considered appropriate there could be teachers' training programmes or even certificate courses that could be offered to students.

The possibilities of sharing of experiences and joint working by the Asian Open Universities need to be explored.

* Teleconferencing in Distance Education: IGNOU experiment, P.K. Sahoo, *Indian Journal of Open Learning*, Vol. 3, pp-29-32, January 1994.

** Interactive communication for distance education an evaluative study of ISRO – IGNOU experiment, Arbind Sinha, Devesh Kishore, Jawaid N Hashim, February 1994.



2.7 TELECONFERENCING

Educational teleconferencing can be a valuable medium for distance education. It involves the use of several media and permits interactive group communication by means of a two-way broadcast. Three main types of teleconferencing have been identified: i) audio teleconferencing, ii) video teleconferencing and, iii) computer teleconferencing. We discuss in detail about audio teleconferencing, being the most commonly used technique in distance education institutions.

Till the early 1980, audio teleconferencing was at an experimental stage and was used occasionally. But during the past few years it has grown to be a routine part of the delivery strategies of some distance education institutions. It was found that with the use of this means, the communication costs could be reduced and the quality of service to distant learners improved without compromising the academic integrity of the programmes. The flexibility, and the low capital and operating costs of audio teleconferencing make it a means of communication that is of special interest to institutions serving students who live in small and widely separated communities.

Today, dependence on this technology is accelerating. The interest in using audio and related visual data that can be transmitted over regular telephone lines appears to be related to the growth of distance education.

2.7.1 Technical description of teleconferencing

Teleconferencing is an electronic means which can bring together three or four people in two or more locations to discuss or share the use of two-way and one-way video, both full motion and slow scan, electronic blackboards, facsimile, computer graphics, radio satellite and videotext. However, the most essential part of all forms of teleconferencing is a good quality audio system to help immediate interaction among the participants for information exchange.

Audio teleconferencing requires a multi-telephone line electronic switch or interconnection device called a 'bridge' to which the user can attach a wide variety of data transmission devices and telephones. The normal practice is to connect one device per line to the bridge. Audio equipments used with the bridge are the usual handsets, headsets, speaker-phones, radio telephones, and microphone speaker units (often called 'conveners').

Audio teleconferencing uses regular telephone lines provided by local public telephone companies. If the quality of standard business or household lines is good enough, virtually any line could be used. Effective contact through teleconferencing can be made in any reasonably quiet environment. Occasional users normally purchase their service from the local telephone company, teleconferencing consultants or a major user that is willing to sell available time on its system. Any specialised terminal equipment is usually rented for a week or a month. Consultants normally provide a range of services including all the necessary equipment, long distance toll charges, and user training.

The costs for starting a university or college-based private audio teleconferencing system are not large if the local telephone system has:

i. a relatively quiet line,

ii. ready accessibility, and

iii. acceptable local and long distance rates.

Interactive television in support of distance education

A pilot distance education programme introduced by UNESCO and the International Telecommunication Union (ITU) has been launched in Morocco in collaboration with the Ministry of Education there. The aim is to achieve a link-up between the audio visual and telecommunication sectors and to explore ways in which it can be applied to the country's education system. The project will seek to solve the problem of budgetary constraints and meet the most pressing pedagogical needs. These concerns were voiced at the Jomtein World Conference on Education for All (March 1996). A plan of action was subsequently prepared by UNESCO and ITU in May 1995 to Estimate the potential of interactive television in regard to schooling and teacher training.

The principle of interactivity is vital to learning in that it fosters constant improvement in the training process, as students and teachers learn to adapt. It also triggers interstudent dialogue, thereby creating interest and curiosity. The communication of knowledge accordingly is no longer unidirectional, leading as it does to spontaneous reaction and lively comment on the part of students.

The purpose of the Moroccan project is to furnish an umbrella blueprint for improved teaching by updating telecommunication infrastructures and upgrading teacher training. The introductory phase of the project will concentrate on elaborating and finalising the different stages of educational studies and teaching methodology with the assistance of a representative sample of teachers. It will then be extended to the country as a whole and in particular to southern Morocco with its largely illiterate rural population.

This second phase involves a training programme for some 2,000 teachers, 500 school directors, administrators and technical staff. It also provides for five training centres in each of the main provinces of Morocco. Each centre will be equipped with the latest in technological and information system resources for fifty pupils, and be placed under the supervision of the school of Radio and Television in Rabat, which will circulate and disseminate information. The teaching documentation centres will be linked to a data transmission network for ease of communication with students, principally through e-mail and a CD-ROM system available in a virtual library which teachers may use. The project is to be managed by technicians, engineers and administrators under the supervision of a project chief.

This project will be of three years duration. The first year will be devoted to preparatory work, including staff training and the purchase and installation of interactive equipment. The distance education system will take off in the second year. And finally, by the end of the third year, the teaching methods should be tried and tested and the technological aspects well under control. The system will be extended to all twenty-two provinces of the country by the year 2008. The overall cost is estimated at $ 6 million. Half of this run will be provided by the Moroccan Government, with the other half being paid by international institutions and agencies. Feasibility studies are now under way to assess the possibility of extending the project to other developing countries such as Bangladesh and Cape Verde.

Source : World Communication Report, 1997 (p.106).

2.7.2 Advantages of teleconferencing

There have been a few studies on the effectiveness of audio teleconferencing from the point of view of student learning. These studies show that the telephone is as effective a medium of education as is face-to-face teaching. A study conducted in Canada found that upper level undergraduate statistics students taught through teleconference did as well as or better than most campus based students and had a zero drop-out rate! Traditional correspondence instruction on the other hand reported an average drop-out rate of 40-60 per cent. Satisfaction recorded among the students was high and remote learners thought the course did not lack rigour or suitable contact.

During the 1984 International Symposium of Teleconferencing there was evidence of strong support for educational audio teleconferencing. The support was mainly due to the consideration of the following advantages:

i) ***Effective support for remote learners:*** Teleconferencing can be very useful when most of the potential students are widely scattered among communities that are far apart and when each centre has a thin learner population, say less then ten students, in a given course or programme.

ii) ***Cost effectiveness:*** The cost for starting and operating an audio teleconferencing system is relatively low in comparison with other available methods of serving remote learners.

iii) ***Flexible system:*** The system used can be adjusted quickly to serve large or small groups.

iv) ***Familiar instructional mode:*** The mode of instruction is similar to that of the seminar with the instructor being in charge of the discussion and able to stimulate multi location interaction.

v) ***Easy scheduling adjustments:*** A scheduling adjustment can be made almost as readily as for the on-campus classrooms.

vi) ***Multi-locational access-control:*** Access to the instruction in the programme can be controlled through a limited number of off-campus centres.

vii) ***High-quality instruction:*** The quality of instructional materials can be kept high because of the need for careful and early preparation.

viii) ***Immediate feedback:*** The teleconferencing system provides the facility for immediate feedback to the learners and allows them to convey their reactions to the tutors.

Higher education has proved a fertile area for the use of telecommunications. The need for communications, staff development, and expert resources makes teleconferencing a particularly appropriate and flexible means of teaching for the distance education institutions (Tietjen and Shawrd, 1987). The use of telecommunication to facilitate two-way communication among three or more students located at different venues characterises teleconferencing. The technology of teleconferencing enhances the quality of the interactive process among students and enables them to easily contact the teacher or the expert from a distance. Under this teaching

strategy, the student gets immediate feedback from the teacher and from fellow students as well. Live questions and answers greatly contribute to make teleconferencing an effective learning technique. This interaction, i.e., sharing experience and understanding is a valuable component of distance education, and as a central component, is directly related to certain variables involving students — their characteristics, environment, attitudes, course structure, pedagogy and evaluation.

Highlighting the importance of teleconferencing, some studies in the US concluded that only about 30 per cent of all business meetings required face-to-face contact. With the continuous escalation of travel costs, many business agencies preferred teleconferencing for periodic inter-office discussion and policy planning. Teleconferencing is flexible and easy to arrange if the necessary technical infrastructure is available. Its potential can be increased by the addition of extra equipment, for example, loud speaking telephones (low cost), conferencing bridges (medium cost) and telewriting or graphics facilities (high cost) such as computer graphics, etc.

2.7.3 Types of teleconferencing

You may find the term teleconferencing misleading. Some people interpret the term to mean that television as a medium is a type of teleconferencing, but teleconferencing covers a much wider range of means which are being used in distance education or for other communication purpose. 'Tele' here means distance, i.e., talking to the students at a distance, which makes it useful for teaching at a distance.

Depending on the use of hardware, there can be three types of teleconferencing:

i) Audio teleconferencing: Teleconferencing where the audio medium is used as a two-way communication, is known as audio-teleconferencing. Most audio-teleconferencing communication is auditory. The use of audio-conferencing is rapidly becoming a preferred instructional medium in advanced countries. Two-way audio communication is a more economic method of academic interaction. For example, the University of Calgary is involved in the creation of a system using audio telephone conferencing, strictly as a teaching tool known as 'educational teleconferencing'. There are some other universities in the developed countries using audio-teleconferencing for educational purposes, but such cases are today limited in number.

There have been a number of studies on the effectiveness of audio-teleconferencing from the point of view of the students' learning (Ellis and Chapman, 1982). Concluding his research findings, Rothe (1985) states that since audio-teleconferencing is rapidly becoming a preferred instructional medium, it is time for the researchers and practitioners to analyse it in a more conceptually precise way. This would discourage the present *ad hoc* analyses, and would surely add to future research and planning and give rise to experimentation, which might come up with a feasible model to suit our socio-economic and cultural milieu.

Audiographics

An effective variation of audio conferencing technique is the use of data/graphics simultaneously along with sound. The system is called as *audiographics*. A typical audiographics set up consists of an instructor site and a number of remote sites. The instructor site consists of a speaker phone, high powered PC-based microcomputer, modem, flatbed image scanners, and high–resolution monitor. The remote sites have one or more speaker phones and a computer along with a monitor to receive images. Such a set up enables the instructor to teach in a real-time mode, showing graphics through the computer screen. Figure 5 represents a typical audiographics arrangement.

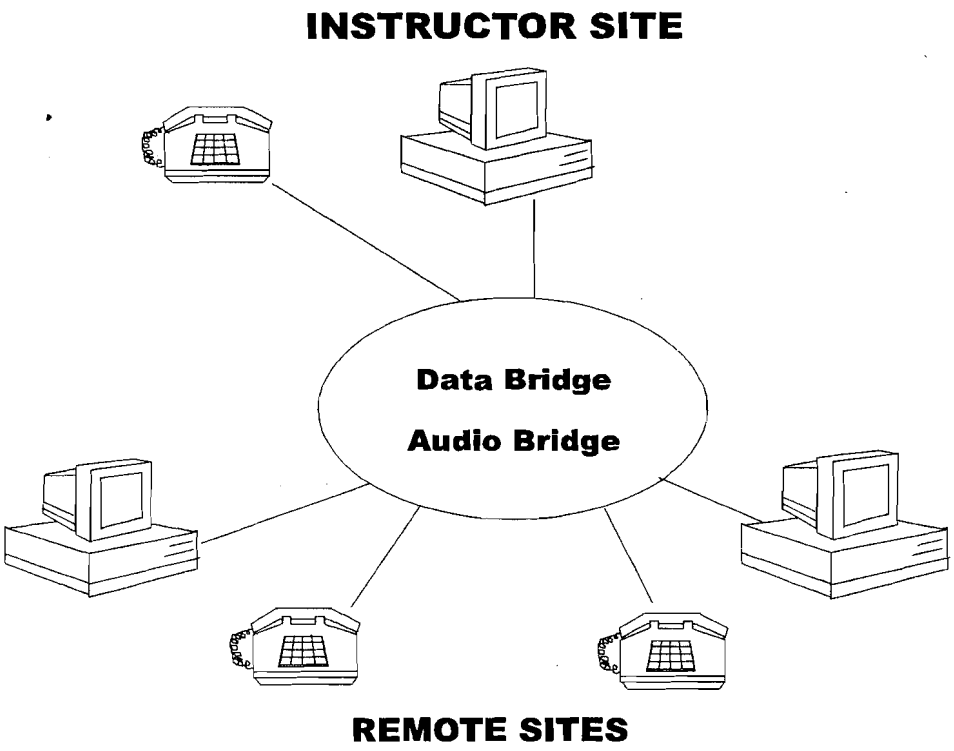


Fig. 5: Audiographics Setup

ii) Video teleconferencing: This type of teleconferencing is arranged by combining two-way video media. This technology is in limited use in education due to its high cost and various other problems such as the linking of multiple locations by the medium of video, availability of hardware, etc. Video teleconferencing, however, has advantages over audio-teleconferencing because of its visual component. Video teleconferencing increases the quality of interaction because both the teacher/expert and the student can see each other and can share their feeling and experiences. But

the problem is to justify the cost involved in arranging two-way visual communication. Video teleconferencing needs, besides budgetary provision, the most sophisticated technology at both the source and receiving ends. Uplinking facilities at the receiving end are required to make it a two-way interactive communication system.

Taking all these constraints into consideration, we can find a moderate way to make use of video teleconferencing, that is, we can use one-way video with audio return connection using the satellite uplink from the receiving end. This arrangement is also difficult to make in our context because of both financial and technological constraints. Some short-term experiments using satellite have however been undertaken by the Indian Space Research Organisation. The studies proved that one-way video and two-way teleconferencing is an effective method of education and training at a distance. The IGNOU-ISRO Training and Development Communication Channel is currently running regularly for education and training by IGNOU and other organisations. More about TDCC in section 2.7.6.

iii) Computer teleconferencing: It is the most effective way of teleconferencing but at the same time involves a lot of cost, infrastructure, etc. With the adequate facility of suitable hardware, information can be sent and received at the convenience of both the teacher and the student with the use of computers. Computer conferencing can be text-based or full video based. More about this in unit 3 of this Block.

2.7.4 Organising teleconference sessions

As a distance educator you may be given the responsibility of organising teleconferencing for your students. It is therefore, very important for all of us to clearly understand the techniques of organising teleconferences, particularly in the context of a developing country.

The process of teleconferencing consists of four stages, which follow systematically one after the other.

i) Planning: As in any business meeting, careful advance planning is of vital importance for the success of teleconferencing. First of all, decide the content of your session. Right from the initial stages, you need to be well aware of the possible issues to be involved in the discussion, and the needs and attitudes of the students participating.

You need to know the number of students and the duration of each session. Check all the necessary requirements, viz., demonstration of equipment including a trial of microphones, etc. At the same time you need to have, on the location, discussions with the technical staff involved in the operation of teleconferencing — every operational detail has to be discussed with them to avoid mid-conference failures.

ii) Preparing materials: After initial planning, prepare supporting materials for the students. Educational teleconferencing should be enriched by the use of printed materials, including charts and diagrams. Printed guides should reach the students well in time so that they can use these materials during the teleconferencing session and can actively participate in the discussion.

iii) Preparing students: Preparing the students for active participation in teleconferencing is an important function of the distance educator incharge of the conference. The students should know in advance about the content being discussed, objectives to be achieved, and about the teleconferencing system. They should be psychologically ready to learn through talk-back facilities and the preparatory activities should not take much time.

iv) Conduct in the actual session: After preparing the students, the actual teleconferencing starts. The sessions should be interactive so that all the students can actively participate and learn as much as they can from the conference session.

While conducting the session, you have to keep some do's and don'ts in mind. They are as follows:

- The expert should have a good audible voice and sound communication skills, and should undergo a simple audition test before being involved in a teleconference, i.e. the expert(s) should be selected carefully.
- The expert should speak directly into the microphone rather than to any one side. By doing so (s)he will be able to speak directly to the students. As far as possible, each student should be addressed by name, if the number of learners is small enough.
- Like the self-instructional materials, the discussion should be informal. There is a need to add human touch and humour as and when required, provided it does not disturb the educational value of the discussion.
- It is important to set aside sufficient time for questions, answers and discussions so as to make the sessions as interactive as possible.
- Each student should be encouraged to actively participate in the discussion.

v) Feedback: After the conference is over, you should co-operate with the students to satisfy their specific needs and requirements. Therefore, they should be given sufficient time to react to the quality of the conference. At the same time the feedback session must help the students know about their performance. Almost equal time should be given for preparing the students for teleconferencing and collecting feedback from them.

For the students' convenience, the teleconference sessions could be recorded on audio cassettes and be made available at the study centres for those individual students who could not, for any reason, participate in the conference. By doing so, you can make optimum use of the discussion held during the conference.

Towards the end of the sessions, you should motivate the students to send either personally or through letters, their reactions to and ideas about the overall effectiveness of the teleconference. The reactions thus collected can be used as inputs to improve the quality of the conferences to be held in the future. Systematic evaluation of this type provides further inputs of use to the teleconference organizers, distance teachers and experts in planing and conducting better teleconferences.

Check Your Progress 4

Notes: *a) Write your answer in the space given below.*

b) Compare your answer with the one given at the end of this unit.

You are given a one-hour teleconferencing programme. If the minimum conferencing programme conditions, such as the despatch of supplementary materials, topic outline, physical facilities, etc, are provided, how would you plan for a one hour teleconferencing programme? Take three activities — preparing the students, conducting the actual teleconferencing session and collecting feedback — into account. How much time will you allot to each component?

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The effectiveness of teleconferencing depends on the appropriateness of the content being discussed and the resourcefulness of the expert invited to conduct the discussion. An eminent scholar/expert can be brought into teleconferencing from anywhere in the country to give a live presentation to the participating student.

2.7.5 Limitations of teleconferencing

Teleconferencing has certain inherent limitations, due to which it is not in frequent use in distance education. Some of these are as follows:

i) Teleconferencing requires a huge and very efficient telephonic, radio and television network throughout the country.

ii) The chances of technical breakdown are quite high.

iii) The telephone charges are very high, which all the educational institutions cannot afford.

iv) Teleconferencing is a costly technique of instruction. It requires sophisticated technology and expert human power.

v) Teleconferencing is a mode of group communication, so the willingness of each participant is an essential requirement, but this is generally lacking especially among distance learners.

2.7.6 Training and Development Communication Channel

With the success of the experimental phase of one-way video and two-way audio teleconferencing (described in section 2.6), it has now become a regular practice at IGNOU. The Training and Development Communication Channel (TDCC) started by ISRO is being jointly operated from the Electronic Media Production Centre, IGNOU. Apart from IGNOU, it is

currently being used by a variety of user groups such as Govt. agencies, ministries of state governments, public sector banks, and professional bodies. There are around 200 reception centres of TDCC all over the country. IGNOU itself has more than 150 receiving centres. The TDCC is being used at IGNOU for the following purposes.

- Telecounselling to student groups;
- Training of study centre counsellor and co-ordinators;
- Administrative interaction with Regional Centre functionaries;
- Extended Contact Programmes (ECP) with students.

Special features of TDCC

- Offers economics of scale as a single resource person at the teaching-end can interact with any number of participants dispersed across the country.
- Helps in improving the quality of training and instruction as top level experts can be involved.
- Reduces communication gaps in organizations/institutions having multiple branches, which are geographically dispersed.
- Real time interactivity provides a human face to distance education.
- Promotes participatory decision making and empowerment of gross-root functionaries by establishing a direct linkage with the higher echelons of the hierarchy.
- Enhances the quality of teaching and learning through a wide range of visual support, viz. slides, transparencies, photographs, video clips and computer data.
- Asynchronous mode of communication is also possible as the system permits the recording of the entire session both at the teaching-end and at the receiving end. These programmes can be used in other teaching learning situations (IGNOU, 1997).

Since the use of one-way video and two-way audio conferencing system has proved to be a major success for quality teaching at a distance, we reproduce below the guidelines provided by TDCC for its effective utilization. We hope this will be of equal value to all intending to use such a system in their organisations.

Tips for Effective Utilization

The teleconferencing system provided by TDCC essentially lays emphasis on interactive and participatory teaching-learning. Hence, the pedagogic strategy adopted by the user organisation has to be appropriately devised to minimise one-way lecturing to give enough scope for active participation from the receiving–ends. The visual nature of the medium is also to be borne in mind so that appropriate visuals and effective use of teaching aids are incorporated into the sessions. Here are a few tips for making your teleconferencing more interesting and fruitful.

- Plan the sessions into 1-1 ½ hour slots with 15-20 minute intervals in between.
- An anchorperson is to be included wherever more than one resource person is envisaged in a single session. It is preferable to have an anchorperson with

subject expertise so that s/he can interpret the questions emanating from the receiving–ends better and coordinate between the resource persons.

- In any session restrict the lecture portion to about 15 minutes or so in which salient points regarding subject matter, issues involved, problem areas needing deliberation or points for collective decision making can be highlighted. Soon after this, the session should be thrown open for questions/ discussions/ interactivity from the nodes.
- A maximum of three resource person is advised per session in order to give each person sufficient time. In fact, the standard seating arrangements on the dais in the studio provides for three resource persons and one anchorperson.

Make sure to seat the resource person nearest to the caption scanner to facilitate convenient manipulation of visual materials, if any.

Dress : Totally black and white clothes are to be avoided. Pastel colours have a better impact. Also avoid wearing very closely striped clothes. Dry, non-greasy hair enhances one's looks.

To the Anchorperson

The anchorperson is responsible for initiating the session and conducting it effectively both content-wise and presentation-wise. Time management, ensuring adequate interaction from the nodes, coordinating among the resource persons, providing a connecting-link wherever needed and eliciting feedback at regular intervals are some of the skills expected of an anchorperson. Knowledge in the subject matter concerned will be a definite advantage.

In particular, the anchorperson has to:

- welcome all the participants;
- introduce the theme and resource persons for the session;
- announce the telephone and Fax number for interaction;
- instruct the viewers from time to time as follows:

  - watch the TV set, wait for the name of your station to be announced;

  - when the telephone line is through, announce the name of your station as well as your name;

  - turn off the sound of the TV set to avoid feedback;

  - advise all concerned to use the fax mode for interaction during the lecture and the telephone after the session is thrown open for discussion;

- filter out unwanted repetitive questions and decide the order of responses;
- in case of a delay in responses from the receiving–ends, keep the session going by generating theme based questions and engaging the resource persons in discussion;
- keep track of time and end by summing up the session, thanking the experts and the participants;
- announce the theme and time of the next session.

To the Resource Person

Resource persons are advised to structure their content with appropriate visuals to suit the medium and to conduct themselves in an informal style to keep the distant participants at ease. It will be useful if they get familiar with the studio environment beforehand. In particular:

- Adopt an interactive and conversational style.
- Establish eye contact with the viewers by looking into the lens of the camera assigned to you (not into the floor monitor); Please note that the camera

represents the distant audience. In case there are audience in the studio as well, look towards the local audience or the camera depending on the context.

- Of the two cameras shooting action within the studio, please note that the camera with its 'tally light' [red light] on is the one which is active for the moment concerned.
- Please be brief in your lecture to leave enough time for interaction. In case the subject so demands, you may consider segmenting the content into a series of capsules with intervals for interaction.
- Please prepare all the graphics material in A4 size paper [broadside] leaving 2 cm margin on either side and 1 cm margin in top and bottom. This will make your graphics fill the TV frame correctly with adequate safety margin.
- For textual material, the font size should be sufficiently big [font size 20]. Lower font sizes may not register clearly on the TV screen. Limit the number of lines to about eight in a single frame.
- Choice of colours for graphics is not restricted. However, please make sure to draw the lines sufficiently thick and in good contrast.
- The caption scanner provided in the studio takes hard graphics and normal printed material. Hence, OHP transparencies are not required However in case you have the transparencies, they can be shown through the caption scanner by keeping a white paper below them.
- Use a thin pointer for pointing while describing the graphics. The pointer should be kept steady and not randomly shifted across the graphic to avoid the viewers getting distracted.
- Video tape inserts, if any, may be handed over to the Producer in advance of the sessions. Also give him/her clear instruction regarding the same. The control room facilities provide for playback of video tape in any one of the formats namely VHS, U-Matic highband, Betacam.

To Coordinators at the Nodes

It is important to have a coordinator at each node to facilitate the appropriate seating of participant and regulating interactions. Please ensure that,

- well before the start of a session, the participants are supplied with the necessary background materials.
- the operation of TV set, telephone, fax is checked for proper working.
- the teaching end is informed at the earliest opportunity of the status regarding the number of participants and their profile. This can be best done innocuously through the fax mode.
- when the interactions begin, they are regulated the same is regulated by prioritizing. Keep the length of queries short and crisp to save on STD time and also to make room for other receiving locations to participate.
- in case of telephone disconnection etc., send back-up information to the teaching end by fax.
- the value of the TV set is toned down while using the telephone to avoid feedback of the sound on the channel.
- after the session is over, feedback of participants is collected both informally and in writing and is promptly faxed to the teaching end.

2.7.7 Some low cost options: The Video class

In the units in Block 2, we presented to you a picture of educational television along conventional lines. In other words, educational television in that context has been very much an offshoot and extension of commercial television. Therefore, even while we listed its advantages, most of us were burdened by the thought of meeting high costs, requirements of technical expertise and infrastructure. In this subsection we will take a look at a nonformal use of television for educational purposes — the video class. At first, this resulted in a good deal of surprise and wonder for us, and we are sure it will have much the same effect on you. But then you must know why. Here are some reasons:

i) The video class system challenges some basic premises regarding the role of television in instructional design.

ii) It establishes rather unequivocally that effective teaching rests with the teacher who should be knowledgeable, dynamic and competent. The frills of commercial production are just what they are — peripherals to the business of teaching.

The video class system, as we mentioned earlier, takes a stand against certain conventional, and by now popular, notions about television as a medium and educational television. Let us take a brief look at how this is done.

- Television as a medium is considered

  — expensive

  — a mass medium

  — a visual mode of communication

  — best in the hands of professional producers.

Interestingly enough, the video class system proves all of the above wrong. The points that we should take note of are:

- commercial production is expensive but this is not really a necessity for effective teaching
- the role of television as a mass medium is of greater relevance to commercial programmes
- the visual side of television programmes is highly overrated
- commercial producers are not an integral part of the business of teaching.

At yet another level, the video class system proves that:

- A plain lecture format can be a very effective teaching tool.
- The 'interactive nature' of educational programmes is highly overrated. It has two sides — positive and negative — and sometimes interaction could be a distraction from effective learning.

- It is unrealistic and unproductive to expect teachers to conform to the norms of commercial production. We need 'teacher-friendly' studios and operational environment.

In short, the video class system delivers a quality classroom experience in an affordable, convenient and timely manner. The option thus recommends itself both on pedagogical and operational grounds.

Check Your Progress 5

Notes: *a) Space has been provided below for your answers.*

b) Compare your answers with those given at the end of this unit.

i) Write down three advantages of teleconferencing for distance education.

ii) List any three reasons why the video class system is relevant today.

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2.8 TELEPHONE-MEDIATED INSTRUCTION

In the previous section, you read about teleconferencing as an application of satellite-based communication. Another example of satellite-based communication is telephone-mediated instruction.

The telephone as a medium of instruction can be of immense value to distance education. Many of the constraints or limitations of the distance mode of teaching, such as isolation, remoteness, lack of peer group interaction, etc. can be overcome by the use of the telephone. The use of the telephone by distance educators for instructional purposes is the most personalised use of telecommunications in distance education. The telephone is being used extensively for pedagogical interaction by some open universities in developed countries such as the U.K., Canada, etc. And it is becoming popular both with distance students and with distance teachers. India of course has certain limitations, more specifically a telephone infrastructure that is inadequate for the purpose of instruction. Due to this reason, telephone-based instruction has not been popular in India. In other words, the potential of the telephone is yet to be exploited for educational purposes in India.

The telephone can be used to assist and direct the students in place of face-to-face teaching. The telephone facility, if available, can motivate the distance students to contact their teachers or academic counsellors as and when required, or to do so at specified timings, usually in the evenings. The teachers, in turn, can assist them in academic and personal concerns on a individual and regular basis. This is one of the common and effective uses of the telephone in distance education. Thus, interaction through the telephone may be the key factor in breaking through the hurdle of individual isolation in distance education.

Telephonic conversation is also very useful for distance counselling. You may recall from ES-313, the role and significance of counselling in support services. The telephone is an effective tool in the provision of counselling. If adequate infrastructure is available, telephonic communication has no barrier of distance and time (telephone through satellites has no barrier of distance).

Telephone-based teaching is particularly helpful in various components of language learning — grammar, vocabulary, oral examinations and pronunciation. In other words, the telephone can be an effective medium in teaching language skills and in correcting grammatical errors.

The advantages of telephone-mediated instruction are as follows:

- Interactive
- Multi-site linkage
- Immediate
- Personal
- Cost effective (cost-effective in the sense that the system needs simple equipment and can be easily operated by the students.)

Not much research has been done on telephone-based pedagogic interaction so far. Experience, along with the findings of a few projects undertaken in the developed countries reveals that the telephone has never been found worse than face-to-face teaching and indeed has sometimes proved better in facilitating an effective dialogue.

The satellite has added to the effectiveness of the telephone system in the country tremendously. Now it is possible to bring the entire country together through the numerous lines offered by the satellite. "The use of space for extending telecommunication facilities through the satellite has made it possible to provide an effective and powerful media of reliable telecommunication crossing international borders and vast stretches of ocean and land territories. The use of satellite media has great significance for a country like India not only for establishing international telecommunication facilities but also for providing connectivity to its vast network of facilities sprung in far-flung, remote and backward areas within the country" (Pilot, 1992, on the World Telecommunication Day).

Although telephone tutorials with the tutor are very desirable, one-to-one two-way telephonic communication on a large scale is just not practical. To make telephone-mediated interaction between the teacher and the students practically possible as a method of delivery of information, a group of students could come together and contact their teacher by phone to satisfy

their individual needs. This could be an effective use of the telephone interaction in distance education.

If we wish to reach out to, and teach, scattered and isolated students, telephone-mediated instruction is a way of providing the two-way interactive tutorial, but India does not have a telephone system widespread and reliable enough to be put to such use. The telephone network in the rural locations (the area that could benefit most from the telephone) is very poor. Similarly, the open university and all the study centres are not connected through the telephone network even today. India is very concerned about strengthening and expanding telephone network in rural areas, and telecommunication in the country has undergone a metamorphosis during the last few years. It is also expected that by the year 2001, the number of telephones in India would be 26.44 million (Narain & Gupta, 1989). Taking the population of the country into consideration, that would mean approximately three telephone connections per 120 persons. It would then obviously take us a long time to witness any significant application of the telephone for distance teaching in India.

Check Your Progress 6

Notes: *a) Write your answer in the space given below.*

b) Compare your answer with the one given at the end of the unit.

What are the two major weaknesses of the telephone-mediated instruction in the Indian context?

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2.8.1 Voice mail

Voice mail is emerging as an effective computer based telephone mediated instructional strategy in distance education. It is currently in use in business and industrial settings. It is essentially an elaborate system of 'mailboxes', each like an individual answering machine where digitized voice massages are delivered and retrieved at the convenience of the user. Each individual on the system can have a personal computer space through which messages are delivered and retrieved. Messages of a general nature can also be broadcast to all users. Normally software for voice-mail is tailored to the specific requirement of the users. In distance education, voice mail could be very useful for disseminating general information to the public as well as to the students. The system can also be made interactive so that the learner can use his/her touch tone telephone at home and can know the status of his /her assignment, grades received in term–end examinations, etc.

2.9 EMERGENCE OF VIRTUAL CLASS

You might at times have come across the phrase "virtual classroom" or "virtual university". In this section, we will elaborate on the concept of "virtualisation" of education and how it could influence the distance education scenario in years to come. Though many of the "virtual" issues are the hybridization of a large number of technologies, including computers, cognitive sciences and artificial intelligence, we have included, this in Unit 2 and not in Unit 3. This is primarily because of the initial stage of development and its relation to teleconference. However, the concept of "virtual class" is not specific or limited to satellite technology alone. Now let us discuss what virtual class means.

The word 'virtual' means in effect but not in fact. Therefore a virtual class is also a class in effect but not in fact. How is it possible? For a classroom to exist, there must be a student, a teacher, physical components like a building, furniture, a blackboard etc. and certain knowledge to be taught and learnt. Here, we are thinking of all these 'in effect', and not in its natural settings. Let us consider what we discussed earlier about teleconferences. In a teleconference class, all the components of the class are at different places, giving the effect of a teaching-learning situation. Therefore, many scholars describe the teleconference as a means of organising "virtual classrooms". As in a classroom, an ideal teleconference allows the following (Tiffin & Rajasingham, 1995: 107) communication to take place, thus giving the effect of the classroom and functioning as a virtual classroom.

- Everybody should be able to hear and talk to one another.
- Everybody should be able to see the person who is talking.
- Everybody should be able to see what is on a whiteboard and be able to draw and write on it so that everyone else can see.
- Everybody should be able to see any audiovisual materials used such as video or slides or multimedia presentations.
- Everybody should be able to handle and interact with any object, machine or equipment that relates to the class.
- Everybody should be able to take away a copy or record of what was studied in the class.

In essence, the teleconference provides us with the first virtual taste of the classroom. However, as it has been indicated earlier, it is not limited to this purpose alone. We can say that with the teleconference, the virtual class has emerged. But still all the components are 'in fact' at different places, while to be called 'virtual' they should be 'in effect'. This is possible with the emergence of 'Computer Generated Virtual Reality' (CGVR). The developments related to parallel processing, artificial intelligence and telecommunication, promises the use of virtual reality in education. The development of the World Wide Web (discussed in Unit 3) also promises a great deal towards the "virtual class". As such universities have come up in the WWW, which can be accessed by anyone, anywhere in the world with the necessary technological facilities. Apart from reading text and viewing

recorded video presentations, as a learner you can chat with your teacher in real–time mode, or even see a live presentation of the lecture, ask questions and participate in a global discussion. The possibilities of learning in the virtual way are enormous. However, this is just the beginning. Mukhopadhyay (1999) has reviewed the issues related to virtual reality in education, and concluded that the issue of virtualisation in primarily based on computer technology. Though virtual classrooms have largely been developed around satellite based communication through interactive video, audio, computer communication and combinations of more than one interactive media, effective virtual learning environment make use of a large number of technologies including, computer, multimedia, television, voice-mail, e-mail, CD-ROM, Internet and WWW.

2.10 LET US SUM UP

The discussion in this unit focuses on an introduction to satellite technology-communication satellites as a vehicle to promote the dissemination of knowledge/information. The key points may be summarised as follows:

- Communication satellites
  - — A dominant force to revolutionise the telecommunications system in the world.
  - — It is a spacecraft which receives signals from an earth station and retransmits them back to the earth for social applications.
  - — There are four types of orbits — low orbit, medium orbit, geostationary orbit and special orbit for positioning the satellites in the space. Communication satellites are usually placed in the geo-synchronous orbit.
- Common characteristics
  - — They generate power with the help of solar panels.
  - — They have large coverage and can be used for multiple purposes.
  - — Initial investment for the fabrication and launching of satellites is high.
- A comparison of satellite and terrestrial communication systems.
- Teleconferencing and telephone-mediated instruction as educational aids.
- The emergence of the 'virtual class' has paved the way for a new paradigm of learning.

2.11 CHECK YOUR PROGRESS: THE KEY

1. The geo-synchronous orbit is most suitable for communication satellites. A satellite in this orbit moves in such a way that it appears stationary to

the people on the earth. The services of such satellite are available for all the time to the people concerned.

2. Area specific programmes (ASP) produced at a regional production centre can be telecast through satellite. Doordarshan telecasts ASPs through INSAT for local audiences in their own languages.

3. DRSs receive signals directly from the satellite while VHF sets can receive signals from the terrestrial transmitters only.

   DRSs can be installed beyond the effective range of the terrestrial transmitters while VHF sets are to be installed within the effective range of the terrestrial transmitters.

4. Your answer may be something like this:

   i) Preparing the students -- 15 minutes

   ii) Presentation of the content -- 30 minutes

   iii) Feedback -- 15 minutes

5. i) Advantage of teleconferencing

   - most of the widely scattered students can be approached through teleconferencing.
   - many different topics can be covered.
   - scheduling adjustments are easier.
   - constant contact with the teacher.

iii) Three reasons, why the video class is relevant today are:

   (a) The video class system challenges the basic premises on which the role of educational television is defended.

   (b) By doing this, it opens up the possibilities of low-cost, teacher-friendly uses of the medium.

   (c) This offers a new perspective in the use of television from the point of view of instructional design and infrastructural and production costs.

6. There are some weaknesses of telephone-mediated instruction, such as:

   - The telephone based one-to-one interaction with a large number of students is very difficult.
   - Use of the telephone for education is a costly affair.
   - It requires close co-ordination.
   - In India basic infrastructure required for this purpose is not adequate, nor is it efficient.

UNIT 3 INTERNET FOR DISTANCE EDUCATION

Structure

3.0 INTRODUCTION

This is the last and final unit of this course. In the earlier two units of this block we have already discussed computers and satellite in distance education. This unit deals with the application aspects of both, which has resulted in a worldwide network of networks, called the Internet. The pace of development of the Internet is so fast that it is really difficult to be up-to - date in print. However, we intend here to familiarize you with the potential of the Internet for distance teaching and learning. As the developments in this field take place faster than books can be written on them, we will be limiting our selves to basics that would help you to use the technology, if it is available to you. Also, as new courses are being made available on the 'online' mode over the Internet, it becomes imperative for you, as distance educators, to adopt this technology as early as possible in order to be

competitive and to provide quality education in keeping with the philosophy of distance education.

3.1 OBJECTIVES

After having read this unit, you should be able to :

- explain the concept of the computer network;
- describe the advantages of computer networks;
- enumerate data communication channels and network topology;
- discuss different network types, viz. LAN, WAN, MAN, etc.;
- explain how the Internet works;
- depict the growth of the Internet;
- list the services on the Internet;
- use the World Wide Web (WWW);
- appraise the implications of the Internet for distance learning; and
- outline the skills for using the Internet.

3.2 COMPUTER NETWORKS

Have you ever been amazed at the thought that you can dial a remote telephone number in your own locality, country or abroad and instantly get a reply? Perhaps not! The fact is that we have grown up with such technology and have been using it for such long periods that we have taken it for granted. Telephones are connected either by wires or through a satellite, which expedites connection between two telephones.

Unlike telephones, the computer was developed as a 'stand alone' device to be used in certain situations by an individual or group in isolation. Once the machine was developed it was felt that connecting different computers either in close proximity or placed at a distance from each other could provide access to powerful computing capability and information which would be very helpful in making computer communication possible. This facility can and has been of great help in completing tasks requiring group efforts. Different people can keep working on their own terminals and compile the work on a common computer remotely placed. The facility of working from different sites provides the opportunity to work at flexible and convenient hours.

The linking of two or more computers, terminals and peripheral devices is termed *a network of computers*. Computers are networked for on-line data-communication and sharing of resources such as common printers, hard-drive space, modems, CD-ROM drives; exchanging files and sharing databases. The resources shared in a network may be physical devices or information kept in databases. On-line data communication supported by a network facilitates not only a highly interactive mode of communication but also the quicker transmission of information. Distributed databases and distributed data processing are also very important features of networking. A network reduces the cost of maintaining databases and specialized softwares.

3.2.1 Advantages of computer networking

Some major advantages of computer networking could be as follows:

Resource sharing

All computer users do not have the best computer facilities available on a stand-alone computer. Acquiring a main-frame computer can never be a cost feasible option for an individual or a small organization. Similarly, expensive peripherals like sophisticated printers, large hard disks etc. can not be attached to individual computers for the same reason – that of high costs. But if we can interconnect (network) the small computers and terminals with a powerful processor, secondary storage, printers, etc., then all these small computers can utilize the powerful resources interconnected through a network.

Global database

When different computers are interlinked and can share resources then there is no need to store the same or similar information on the storage areas of individual computers. Data that needs to be shared by different users can be stored and maintained at a global storage area and users can be given access to it with their user-ids (user identification code kept for unique recognition of the user by the computer) and passwords (used for protecting a user's data from other users). For example, if some study material or reference material is prepared for many students, it can be stored in one computer storage area and made available through a network to all those who need it.

Powerful communication medium

We are all aware of the rate of growth of information and the use of up- to-date information, primarily in education and research, and also in other areas of life. Traditional means and media of information creation and dissemination like print, recorded audio and video devices are cumbersome and very slow. The information stored and disseminated through networks has recently become the most popular means because of the simple editing process and the facility of fetching data from all the different sites in the world. Some other means of communication may be equally fast but they are both very expensive and incapable of carrying big databases. In the DE the students can log on to the databases of the universities and benefit from them in various ways, e.g. be informed about the latest in research, navigate through one information topic to another, have an online explanation of different topics.

Information management

Management of information in a global database is also easier in a networked setup. Any database in such a setup will not have a duplicate copy and so editing, updation, deletion, etc. are all required to be done at one place. This is in contrast to the systems of maintaining local databases where one information may have duplicate entries in different individual databases, and in order to change any component of the information, all the databases keeping that component must be changed accordingly. Failing to do so will give rise to ambiguous and hence incorrect information, In a network, data is also protected from any unauthorized use.

Online information exchange

It is already stated above that a network facilitates an online information exchange. Now we have to understand what are the advantages of this on-

line exchange of information. Any information is kept for people to use in any way they want to use and when ever they want . Using a computer attached to a network, one can easily and quickly access information in the right format, which can be used for further work and timely decision making .

Saving money

All the above stated properties — resource sharing, global information maintenance, rapid information exchange – of a network system reduce the cost of information storage and interchange. Although the initial setup cost of a network may appear high, the overall running and other future costs in totality save money. Also, a bigger network system may be planned but it can be built in phases starting with a smaller setup, such as adding an extra, which node, which is not at all a problem, if planned in advance. This will reduce the initial setup cost, if arranging for finance is a problem.

3.2.2 Data communication channels

In a network all the computers and other devices are joined through data communication channels. These channels are of two types – one which uses some physical medium for the transmission of data e.g. a pair of twisted copper wires (like telephone lines), coaxial cables (like television cables) and optical fiber cables; and the other one which uses the property of microwaves and communication satellite systems (discussed in unit-2).

A pair of **twisted wires** is the most common medium. Two copper wires are twisted together to reduce electrical interference from similar pairs lying close by. The twisted pair can transmit both analog or digital signals. It is the cheapest transmission medium in use.

Coaxial cables comprise a stiff copper core surrounded by an insulated cover, which is in turn encased by a woven mesh of conductor. The whole structure is covered with some plastic material. It has a higher speed of transmission and better shielding.

Optical fibres are very high transmission channels. They are most expensive of all the physical mediums and the detectors. When there is a pulse of light it is sensed as **1** and the absence of light is taken for **0**. Refraction of light occurs whenever there is a change in the density of the medium in which light beams are passing. By total internal reflection light is trapped inside the fiber and travels a long distance at the speed of light.

3.2.3 Network hardware technology

There are two types of technology for the transmission of network, point-to-point and broadcasting. In a **point-to-point** network, the connection is between individual computers whereas in the **broadcasting** type of transmission there is a single channel used for transmission of data in packets. All the data packets sent by any machine are received by all the other computers and the address part of the packet is checked by the receiving computers. If it is meant for them it is used and otherwise simply ignored.

The structure of the linking of computers using data communication channels is known as a **topology of network**. It can be of many different

styles but a few standard structures are used in computer networks. Let us discuss the four topologies of networks.

Star Topology

There is a central computer (called the host) in the star network, which is linked with all the other computers (called nodes) in the network and all the nodes are connected to each other through the central computer alone. Adding and deleting a node in this network is much simpler as connection is setup/deleted only between the host and the node. The initial setup cost of such network is also low. The biggest disadvantage of this topology is that the network fails if the host breaks down (Fig.1).

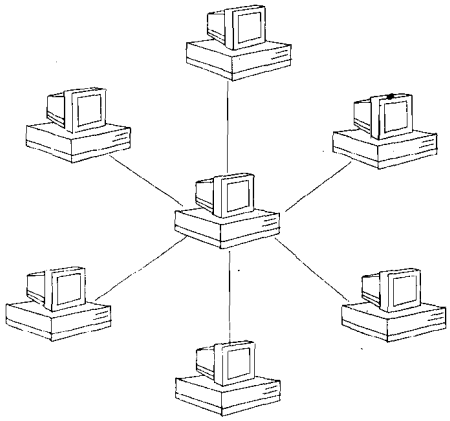


Fig. 1: Star topology

Ring Topology

In the ring topology all the computers in the network are connected to two other computers. The shape of the network is like a ring, as shown in the diagram below. The data transmission in the ring topology is bi-directional for any individual machine. So, even if a connection fails for a particular machine it has another side for connecting to others, although the ring structure breaks. The initial setup cost is low and adding/deleting nodes is easier (Fig.2).

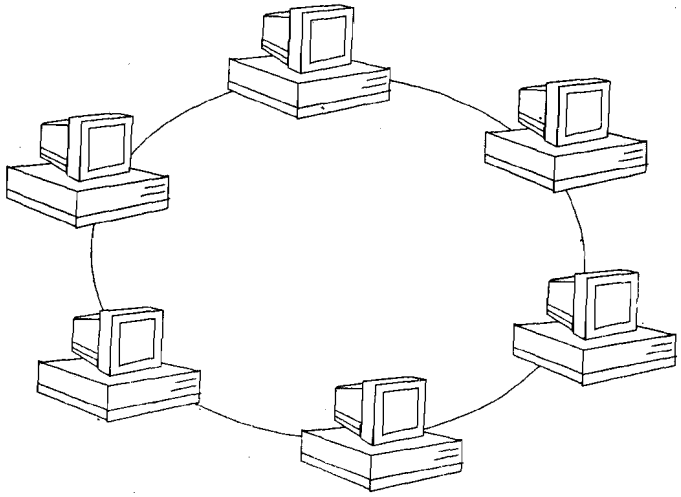


Fig. 2: Ring topology

Bus Topology

It is also known as the linear connection network. It is the broadcasting type of transmission used in Local Area Network (explained in the next section). Only one machine is allowed to send data at a time. If two machines try to send data at the same time both have to wait individually for different random times (Fig.3).

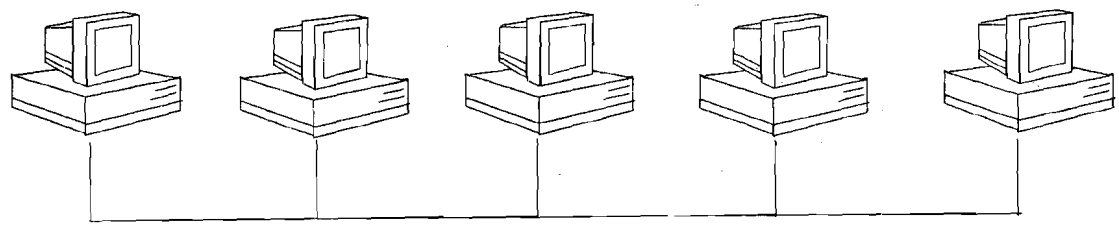


Fig. 3: Bus topology

Fully-connected or Mesh Topology

In this type of technology each computer is connected to all the other computers. Adding/deleting a node in such a network is costly. The initial setup cost is also very high. But the communication in it has high reliability, as each computer has many lin! s (Fig.4).

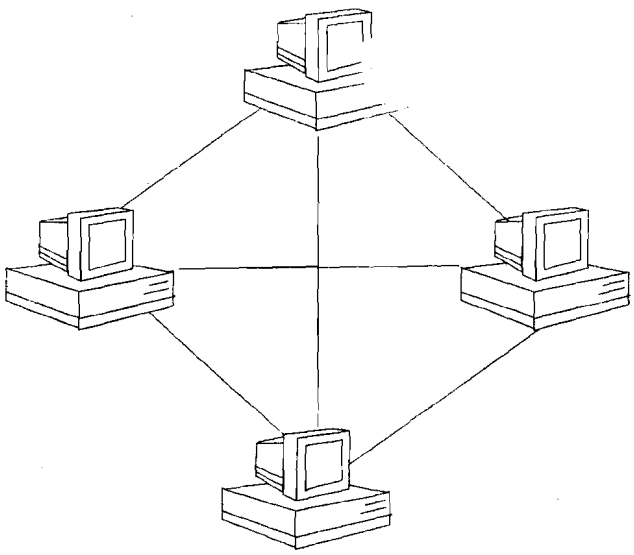


Fig. 4: Mesh topology

3.2.4 Network types

Networks can connect two computers on the same desk or connect computers around the world. Based on the usages and geographical coverage area of the network, a network can be classified as:

- Local Area Network (LAN)
- Metropolitan Area Network (MAN)
- Wide Area Network (WAN)

Local Area Network connects computers and electronics devices within a limited geographical area e.g. a building of some functional unit of an organization, R & D unit, etc. Normally, a LAN functions within a range of 10 kms. area. It may have different types of computers, mostly microcomputers (PCs), and peripheral devices attached with a variety of data communication wires or cables.

Different departments or sections of an organization may like to share information to expedite their jobs. For example, in a university set-up, the examination department may like to have information about the total number of students admitted to a particular course, to arrange for the examination. Similarly information about finance, degree distribution etc. may be sought. It will be of great help if all the information is available at one place without requiring the person to go from one department to the other.

The facility of LAN has become so popular that since 1987 all Macintosh and now all computers produced by different companies, are produced with the built in capacity for networking. The networking software has now become part of the operating system. Vishwanathan (1992) lists the following six advantages offered by LAN:

1. Unlike a large centralised system, a LAN may evolve with time. It may be put into operation with a small investment, and more systems may be added as the need arises.
2. Since LAN is a set of multiple interconnected systems, it offers a good back up capability in the event of one or two system failing in the network. This, in turn, enhances the reliability and availability of the systems to users.
3. LAN provides a resource- sharing environment. Expensive peripherals, hosts and databases may be shared by all the LAN users.
4. A LAN adhering to a certain standard permits multi-vender systems to be connected to it. Thus, a user is not committed to a single vendor.
5. In LAN, the systems are generally so chosen as to meet most of the user requirements locally and the network is used only for resource and information sharing purposes. Due to this, each user gets a better response then would be the case in a centralised system. LAN tends to exhibit an improved performance.
6. LAN offers flexibility in locating the equipment. Most computers on a LAN are physically placed at the user table, which is most convenient for working and improves the productivity significantly.

Metropolitan Area Network usually covers a geographical area spanning a distance of 5-50 kms. Network topologies used in MAN are similar to LANs: Star, Bus, Ring. As such MANs are extentions of LANs. The transmission media most suitable for MANs applications are broadband coaxial cable and optical fibres.

Wide Area Network is a large area network, which covers different cities or countries. A WAN uses a point-to-point transmission technology. Local area networks may be connected to wide area networks by a common processor called the *gateway,* which is used as a common interface. As mentioned above, there is no satisfactory definition to explain a WAN but it seems to have one definite quality and that is it must make use of a telephone line. WANs tend to become quite complicated and so they are losing their popularity to Intranet and Internet.

3.2.5 Internetworking

Different types of networks, topologies, and machines bring in the problems of internetworking. To solve the problem of internetworking standard protocol architectures are used. These are called standards or protocols. LAN can be interconnected using various kinds of devices – *Bridge, Router, Brouter* and *Gateways. Bridge* is generally known as a Data Link Bridge. It interconnect networks using compatible devices locally or remotely. *Router* can connect two different networks with different protocols. It is capable of linking two different media types, e.g. linking Ethernet with Token ring. A multiple router that includes bridging capabilities is known as *Brouter.*

In a LAN system it is very common to have different vendors' machines to have cost-effective solutions for networking. The result of this is problems of incompatibility not only in exchanging the simplest files, but also of differing screen and keyboard layouts in a network environment. There are three options open — to get dissimilar equipment connected in a LAN to communicate sensibly by adopting standard protocols-*Emulator Software, Protocol Converter 'Gateways'* or *by OSI standards.*

Check Your Progress 1

Notes: *(a) Write your answer in the space given below.*

(b) Check and compare your answer with the answer given at the end of the unit.

a) What are the advantages of computer networks?

.....

.....

.....

.....

.....

b) Which of the following statements are true and which false?

(i) The twisted pair cable can transmit both digital and analog signal ☐

(ii) In ring topology, the breakdown of a system causes failure of the network ☐

(iii) The geographical coverage of a MAN is usually within 5-50 kms. ☐

(iv) Interconnection of networks and devices is done through standards and protocols. ☐

3.3 INTERNET

Internet is an open non-participatory computer communication infrastructure that reaches every corner of the globe, carries information on every topic and is available to users round the clock. Technically it is a global collection of interconnected networks. It allows computer users to share equipments, programmes and information available in different sites. It is sometimes referred as the ultimate "information superhighway".

3.3.1 The Beginning

The history of the Internet began at the peak of the cold war in the 1960s. The Defence Advanced Research Project Agency (DARPA) of the USA was funded to find ways for scientists and laboratories to share expensive computer resources. The outcome of the research manifested in the form of the Advanced Research Project Agency Network (ARPANET) which went online in 1969. People at the Rand Corporation, The Research and Development unit of the American Army, were quite worried about the probability of a communication breakdown in the event of a nuclear attack. The communication networks at that time were based on point-to-point connections, which were linked in chains. Functioning of these types of networks rely largely on the links between each pair of points in the communication system, and a breakdown at any point in the network would subsequently halt any communication through networks.

To tackle the problems associated with the point-to-point network, an idea for a new kind of connection in the network was conceived by the Rand thinkers. The new type of network was more like a spider net which connected different points through different channels. In the event of a breakdown in one of the sections, the communication could be carried on through other routes. The first real Internet connection was established between four US universities namely Stanford Research Institute, UCLA, UC Santa Barbara and the University of Utah.

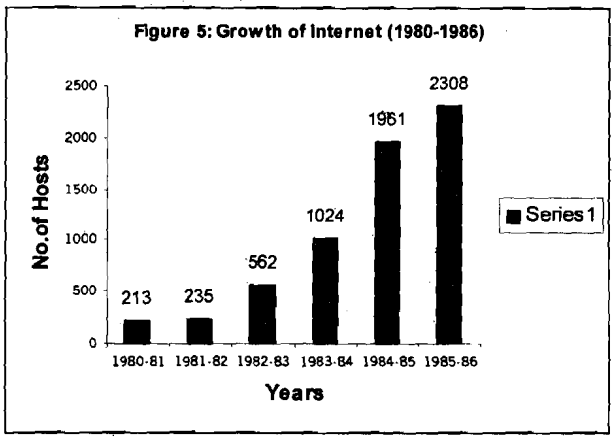
3.3.2 Growth of the Internet

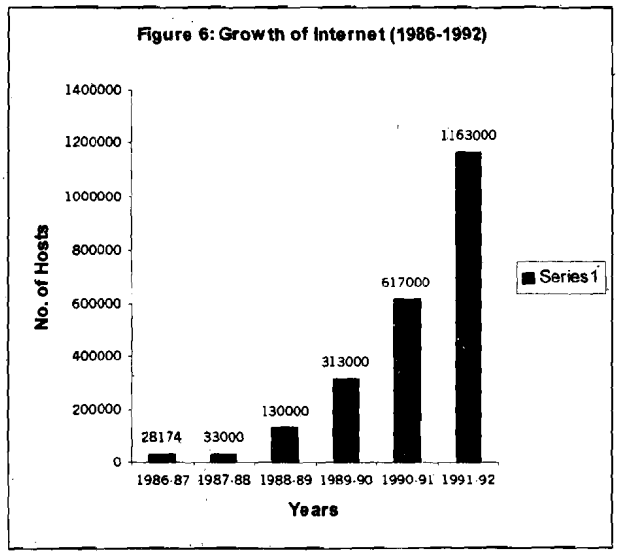
In 1973 the ARPANET provided, for the first time, international connection to agencies outside US, viz. University College in London, England and the Royal Radar Establishment in Norway. As maintained earlier, the Internet is an international network of networks where different types of computers are connected for purposes of communication. Unlike the earlier LANs where the platform of network was homogenous we have now heterogenous platform having IBM main-frame, VAX machines, various LANs with microcomputers etc. for communication. All the machines in the Internet are glued together with the Transmission Control Protocol/Internet Protocol (TCP/IP) reference model and TCP/IP protocol stack. A machine can be connected to the Internet, if it can run the TCP/IP protocol; has an IP address and has the ability to send IP packets to other machines on the net.

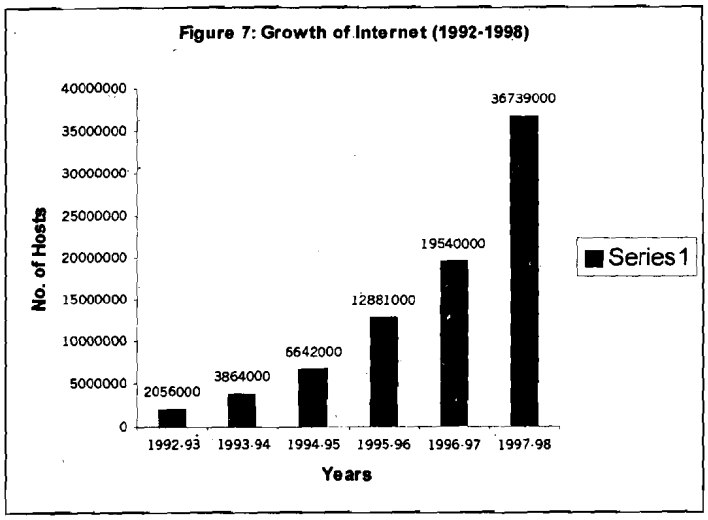
The Internet has grown very fast over the years. From only 4 hosts in 1969 in the DARPANET, it had grown to include 37 computers in 1972. Later the name changed to ARPANET. By 1983 it had more than 500 hosts and thus the military research component was moved to another network called

MILNET. Figures 5, 6, and 7 show the extraordinary growth of the Internet, which consists of more than 36 million hosts at present.

However, the growth is not equally distributed and has taken place mainly in North America and Europe.







In the initial period, DARPA wanted to initiate a research program to investigate techniques and technologies for connecting packet networks of various kinds. DARPA ultimately wanted to develop communication protocols that would allow networked computers to talk freely across different platforms and networks. And so ARPANET was born.

ARPANET, which came to be known simply as the Internet, developed a set of protocols known as TCP/IP. The Internet continued to support a few hundred Government scientists for over a decade until 1986 when the US National Science Foundation (NSF) initiated the development of the NSFnet which even now, provides a major service for the Internet.

Even though the entrance of NSF on the scene was a major factor in the development of the Internet, the biggest turning point came in 1991 when NSF dropped its funding of the Internet and lifted the ban on commercial traffic. Up to 1991 all NSF traffic came from Government and educational institutions in the US.

In India, the Internet is presently popular only in the big and metropolitan cities. However, it is expected to reach all district Hqs. by 2000 A.D. India tops the list of developing countries in Internet use. Growth of software development industries, satellites is the main reasons behind its rapid development, besides the liberal policies of the Government. The non-commercial use of the Internet has been available in India since the late 1980s. Commercial service was started in 1995 by VSNL, through Gateway Internet Access Service (GIAS). It started with a membership of 703 customers with 64 customer lines and 4 Internet nodes. By November, 1998 VSNL had 42 Internet nodes and 1,50,000 subscribers. The main Gateway is in Bombay and connects the Indian Internet to the US and Europe through submarine cables and satellite. The remote Internet Access nodes are already there at Pune, Calcutta, New Delhi, Bangalore and Chennai. These nodes are connected to the main Internet Access Node at Bombay through intercity links provided by DoT.

3.3.3 How it works?

The Internet works on the Transmission Control Protocol (TCP) and Internet Protocol (IP). These two are collectivity called TCP/IP. For sending data into another machine TCP divides the data into little packets and IP puts the destination address on each packets. The Internet addresses have two forms — one for the understanding of the user and the other for the machine. Typically, an address on the Internet looks like this:

Username @host.subdomain.domain

Where *username* is the log in name of the user, *host* is the local network server grouped into domains. The *domains* are classified as geographic and non-geographic. Table-1 shows the list of domain names.

Table –1: Domain names in Internet

Geographical		Non- Geographical	
.in	India	.com	Commercial organisation
.au	Australia	.net	Networks
.de	Germany	gov	Government
.jp	Japan	.mil	Military networks
.uk	United Kingdom	.edu	Educational institute
.ca	Canada	.org	Organisation

The Internet address stride @del2.vsnl.net.in indicates the *user group* stride in the *host* del2 server amongst the *servers* of vsnl which is a *network* organisation situated in *India*. In terms of machine understandable address the del2 server of vsnl has an IP address 202.54.15.30.

3.3.4 Who governs it?

By now, you must be thinking 'Who owns the Internet?' or Who governs the Internet? The answer to this million dollar question is: no one. The beauty of the Internet is that it has grown up and evolved as an open system where individuals and organisations can join and become online. In terms of technology of the Internet there are several bodies that look after the technical standards. The following organisation oversees the development of the Internet.

Internet Society. Established in January 1992 as the authority for the development of the Internet, it comprises individual and organisational members charged with maintaining the long-terms viability of the Internet.

Internet Architecture Board. It joined the Internet Society in June 1992 to oversee the architecture and protocols used by the Internet.

Internet Engineering Task Force. Started in 1986, the TETF oversees the complex and detailed work of developing and standardising the Internet Protocol suite.

Internet Engineering Steering Group. It provides management of the Internet standard process.

World Wide Web Consortium: Founded in 1994 to develop common standards for the evolution of the web.

3.3.5 Internet service providers

To be hooked to the Internet, you need a service provider. A direct Internet connection would cost more for organisations and individuals. There are a number of service providers with a high level of popularity. These are America Online (AOL), Compuserve, Prodigy etc. However, every country usually has its national Internet Service Provider (ISP). In India, Videsh Sanchar Nigam Limited (VSNL) was the only commercial ISP till recently. According to an estimate China has 30 ISPs, Japan 1300 ISPs, South Korea 15 ISPs, HongKong 90 ISPs and Singapore 3 ISPs. The major ISPs in India are:

a) Education and Research Network (ERNET) : based on terrestrial lines and VSATs, serving more than 50,000 users from 800 organisation with non-commercial access;

b) National Informatics Network (NICNET) : mainly satellite based, exclusively for government organisations, allow upto 2.2 mbps and covers 850 centres including 650 organisations;

c) Gateway Internet Access Service (GIAS) of VSNL: based on terrestrial lines and satellite with a user base of 15,0000.

d) SOFTNET: mainly sattelite based and serves the requirements of six 100% export oriented software technology parks (Sublea Rao, 1997).

There will be many more ISPs for commercial application in the near future, as the Governmental policies have become liberal in this respect. As of now, VSNL holds 95% of the connectivity and all ISPs have to go through its gateway.

Check Your Progress 2

Notes: *(a) Write your answer in the space given below*

(b) Compare your answer with the answer given at the end of this unit.

Identify the different parts of the following Internet address.

rse @pcquest.com

ignou @gaisdl01.vsnl.net.in

.....

.....

.....

3.4 INTERNET SERVICES

The Internet is a goldmine of information, expertise and resources. It offers scholars and practitioners the flexibility to confer with colleagues from all over the world, discuss new findings, locate resources, and use remote libraries. The Internet provides many services: to send and receive mails (e-mail), support for special interest scholarly lists and newsgroups, remote login to a computer (telnet), and file transfer from remote locations (FTP). In this section we will discuss some of these services.

3.4.1 Telnet

One type of utility protocol is telnet, which enables a computer on a network to log on to another computer and read the information stored on it if it has an account on the other machine. This was the first commercial version of the ARPANET made available to the public during 1974. This is also known as 'remote log in'. In Telnet the computer of the user is known as the 'local' computer and the computer logged on to is known as 'remote' or 'host' computer. Once the connection is established the instructions given are executed on the remote computer but the effect in the form of information display is on the local computer. The physical distance between

the local and remote computers is of no consequence. They may be only a few feet apart or thousands of miles away. Users can Telnet into a huge database, which is part of the host computer, to do research or even Telnet into libraries around the world to get information about a certain document. When you telnet to a remote computer, the power of your personal computer becomes insignificant. However, most of the systems connected to the Internet are UNIX or LINUX based and therefore, to work on these you need to learn the commands of these operating systems.

3.4.2 File transfer protocol

File Transfer Protocol (FTP) is a program used for copying files from one machine in the Internet to another. People who like to share their resources, such as articles, databases and other information, put them at FTP sites and in this way they become available to others for viewing and also for downloading. The biggest advantage of FTP is that the information is available in electronic form. Logging on to an FTP server is similar to connecting to a telnet server. FTP is a fast, efficient, and reliable way to transfer information. There are billion of files stored on the Internet at FTP sites. It is not possible to access all of them, as many are accessible to authorised persons. However, a vast majority of the FTP sites are anonymous, which can be accessed by any one. To search for FTP sites on Internet some programmes are used. These are Archie, Gopher and Veronica.

Archie – *Archie* is a collection of servers used for searching files at several different anonymous FTP sites. Archie servers use a huge shared database for pooling information, which is updated from time to time. A keyword is given for the search.

Gopher - Gopher is a menu driven utility that allows its user to search for the information in various information libraries or servers around the world. It is different from *Archie,* which only lets users know where the information is found whereas *Gopher* actually gets the information and puts it on the screen.

Veronica – Very Easy, Rodent-Oriented, Net Wide Index to Computer Archives (*Veronica*) is a program that can be accessed through *Gopher*. A keyword is entered for *Veronica* to search for files, *Veronica* then searches for and gets all the files matching the keyword and stores them on a temporary *Gopher* menu that the user can browse through.

3.4.3 Electronic mail

Electronic Mail (E-mail), as the name suggests, is a mailing system which uses various data communication devices as its medium . The E-mail is the ability to compose, send and receive mail via electronic media. It is a highly popular facility of Internet used for massage exchange.

It was not one of the aims of DARPA to develop an E-mail system but no sooner was the ARPANET in use, then, the scientists took no time to develop it. Ever since, there has been no looking back. Unlike telnet and FTP, E–mail is not required to log on to the host computer to send a mail. The computer on the Internet finds paths through the Internet Protocol Address and gets forwarded quite expeditiously. Today, E-mail is undoubtedly the most widely used service on the Internet.

Components of E-mail

The basic format of any E-mail is:

—the recipient's address

—the sender's return address

—the subject of the message,

—the body of the message, and

—enclosure consisting of one or more file (optional). The data can be sent in any format in the form of an attachment but the recipient must have the required software to run the attached file.

To send or receive e-mail, you need an electronic mail programme or software. All e-mail softwares have similar structures having a message header, body of the message and optional file attachment. The message header has the following:

To:	The address to which the message will be sent, e.g. stride @del2. vsnl. net. in.
From:	This includes the e-mail address of the sender. This is automatically filled in by the e-mail programme.
Subject:	This is optional, but it is always better to give a subject to your message to help the receiver to decide whether to read or not.
CC:	This stands for carbon copy. In a computer environment, it is the addresses of the additional recipients of the message.
Bcc:	This stands for blind carbon copy. This is just like sending a copy of a letter to someone without the recipients' knowing who the sender is.
Attachments:	Some E-mail programmes keep it separately. This allows the sender to post files of different formats.

E-mail etiquette and emoticons

The body of the E-mail messages are sent as simple text files and thus they don't allow formating of messages in italics, bold type etc. However, over the years, for the sake of brevity and clarity certain abbreviations and emoticons are used in e-mail messages. Also as the messages cross national boundaries, net-etiquette has become very important. For example, typing in capitals is the equivalent of screaming and is seen as offensive. Some abbreviation and emoticons are:

	Abbreviations	**Emoticons**
BTW	By the way	:-) smiling
IMO	In my opinion	:-i semi-smiley
RE	Regarding	:)) Big smile
FAQ	Frequently Asked Questions	:(Angry
FYI	For your information	:-o Surprised
OTOH	On the other hand	

Personal E-mail accounts

Your ISP will provide you with one E-mail account. But, if in your organisation, everybody requires a personalised account, this is still possible with one Internet address. There are many web-based E-mail services available absolutely free on the net. The address of some of these are:

Hotmail	www.hotmail.com
Yahoomail	www.yahoo.com
Rocketmail	www.rocketmail.com
Rediffmail	www.rediff.com

3.4.4 Internet chatting

Internet permits interpersonal chatting through talk program where you can chat with one or more persons in the real time environment. Imagine a big party where you are participating and talking to one person or to a group and then leaving to join another group or to whisper into the ear of some one very close to you. The chance to do this online is provided by the Internet Relay Chat (IRC). IRC was developed in Finland in 1988. In IRC the client has to be connected to a nearby server and all the servers are connected in turn. When you connect to the IRC you are connected to a group of 'chatters' from around the globe chatting 24 hours a day. To avoid chaos new joiners are supposed to choose a channel from a number of different channels. The name of channel start with # and there are a number of channels, some on specific topics and some open to discussing any and every subject that arises. You can check up with your ISP to know what software they recommend. IRC clients are available at FTP sites. The easiest way to find one is to use a search engine (e.g., Infoseek) and then download it. Chatting is also possible on the web. Some of the chat programmes are ichat (www.ichat.com) and French kiss (www.anes.com). Now *Yahoo Messenger*, *MSN Messenger* and AOL's *Instant Messenger* too provide chat facilities.

3.4.5 Mailing lists

These are lists of E-mail addresses with similar interests, known as *listserv*. LISTSERV, newsgroup and E-mail develop functions on the time-delayed communication, i.e the communication does not take place in real time but at a time convenient to the users. Even though all the users of that group are members, because of the nature of the group interacting and responding at the user's convenience, the group is a 'virtual group'. Such a group can be of a very great help in distance education because the users can answer the queries and read responses to questions at their own convenience.

As the name suggests the mailing list is a list of names/address of people with common interest area. Anyone from the group or outside can send a mail/message to the group and each member will receive a copy of it. The response from any member can again be sent to all the members of the group. We may also like to think of the list as a class of students pursuing similar programmes. And, just as classes have a monitor, each mailing list has a 'list owner' (or sometimes more than one list owner for large groups). The list owner decides on the objectives, forms the rules, gives membership to the members and replies to the queries made to the group. There are more

than 12,000 such groups and they can be seen as the most up-to-date encyclopaedia on most topics. The messages transpiring amongst the members are saved in a file named 'list archives'. In fact all messages are sent to the LISTSERV which redirects the messages to all members. These archives can be requested for and read at any time in the future. The search can be made period-wise, like for June 1998, or topic-wise. There is also the possibility of requesting the whole volume of transactions by asking for 'digest'.

LISTSERV are quite fast and it can be expected that messages sent to a LITSERV should reach its members within a few minutes to a few hours. Some LISTSERVs redirect the mail without editing of whereas some edit the messages. Those who don't moderate are known as an unmoderated list and those who edit are known as a moderated list. Practically anyone who has E-mail facility can join LISTSERV and exchange messages. LISTSERV acts as a fileserver and keeps just about any type of file. These files are distributed on request from users. The names of files are maintained in separate 'filelists' quite similar to computer directories. Information regarding the type of file; who can order a copy and how to do so and the name of the persons who is in-charge of updating it or the file owner, is also available.

You can find out about a mailing list (also called discussion group) through word of mouth (from friends) or by sending an E-mail message to LISTSERV @waynest1.bitnet by typing LIST GLOBAL in the body of the message. There is also a list search engine on the web, which is very comprehensive (http://www.liszt.com). You can subscribe to a list by sending E-mail to the listserv/administrator. The normal procedure is to type subscribe list name space your name. However, if you check up with liszt.com, specific guidelines for each listserv would be available.

You can also create and moderate a discussion list for yourself and your friends. A free service available on the web is http://www.makelist.com. Some of the interesting mailing lists on open and distance education are as follows:

- DEOS-L Distance Education Online Symposium (listserv @lists.psu.edu)
- DE-L Forum for instructors of Distance Education (listserv @pdomain-uwindsor.co)
- Itde Instructional Technology and Distance Education List (listserv@pulsar.acast.nova.edu)
- Networking One-way list covering post-secondary Distance Education (listserv@ node.on.ca)

3.4.6 CU-SeeMe

Cu-SeeMe — pronounced "See you, See me" – is a videoconferencing system developed at Cornell University. It works on the Internet or on any network that uses Internet Protocol. CU-SeeMe users can connect directly to one another in a point-to-point manner, or they can connect to a group conference by connecting to a reflector software. The software for this videoconferencing system is available at ftp site:

ftp://CU-seeme.cornell.edu/pub/cu-seeme. It can provide real-time interactivity on the Internet, where a learner can see, listen and interact with his/her teacher.

3.4.7 World Wide Web

The *World Wide Web (WWW)* began in 1989 at The European Centre for Nuclear Research (CERN) as an application based on Hypertext, meaning a system which can link various documents spread over millions of machines connected through the Internet. However the application became operational only in December 1991. The next landmark development in *WWW* was a strong Graphically User Interface (GUI) — *Mosaic* which was released in February 1993. *WWW* makes it possible for a site to set up a number of pages of information containing text picture, sound and video with links to other pages. The *WWW* helped the Internet become a common person's information tool. In fact this took the Internet out of the hands of the Govt. and academic agencies, and brought it to the common public for commercial, entertainment and other purposes. The *WWW* is a set of protocols that allows you to access any document on the net through a naming system based on URLs (Universal Resource Locators). Web protocol has three defining characteristics, which are:

- The use of URLs as addressing system (a typical URL starts with http://);
- The Hypertext Transfer Protocol (HTTP) by which the delivery of requested information is transacted; and
- The Hypertext Markup Language (HTML) through which the links between documents and parts of documents are made.

Mason (1998) outlines the following exciting features of the web that makes it useful for students and help it function as an appropriate course delivery mode:

- Functionality for supporting animation effects, thus making documents more dynamic;
- Facilities for handing forms, and input to forms which are useful for course registration, evaluation, and other kinds of questionnaires and tests;
- Support for presenting tables, footnotes and mathematical symbols;
- Features to simplify page development and editing;
- Improvement to the search facilities; and
- Greater functionality for the communication systems linked to web pages.

In the next section we will discuss more about the World Wide Web. But before that, try to do this exercise.

Check Your Progress 3

Notes: *(a) Write your answer by writing T or F in the box.*

(b) Compare your answer with the one given at the end of this unit.

Identify which of the following are True or False.

i) Telnet is used to connect to a LAN ☐

ii) FTP is a programme to download files from remote computers ☐

iii) While sending E-mail messages capital letters should be avoided ☐

iv) Internet Relay Chat is a time delayed communication ☐

v) Listservs are great ways to communicate with people of similar interests on the net ☐

vi) WWW is capable of multimedia facilities ☐

3.5 USING WORLD WIDE WEB

The whole network of WWW is held together by hypertext links. The World Wide Web Consortium (W3C) and the Internet Engineering Task Force (IETF) together make sure that the technology of WWW works and that users worldwide are able to use the services without getting fragmented into local groups. To connect to the *WWW* you need a web browser. Common web browsers available are Internet Explorer and Netscape. These browsers allow you to navigate in the world of web documents. For reaching a specific page or document, you need to know the Universal Resource Locator (URL) address of the page, which need to be typed in the browser. The browser then searches for the document and makes it available on your screen.

As has been mentioned, the documents on the WWW are connected through links, which means that any document placed on any site can be linked to any other document placed on any other site. These documents are called pages in the jargon of WWW. Pages have links, which are pointers to other pages in the Internet and by clicking on the links, one can travel from one page to another pointed by it.

As mentioned earlier, the Internet is a goldmine of information on any subject. If you do not know the address of a page, but know the subject, you can use the directory and search engine facilities available on WWW. One of the most popular web directories as well as search engines is **YAHOO** (http://www.yahoo.com). It categorises information into different groups and also provides briefs about the pages. This allows you a structured navigation of the net. Though Yahoo can satisfy most of your search requirements, you need to use sophisticated search engines for specific queries that could not be categorised easily. Moreover, not all webpages are indexed by a single directory. Therefore, the use of search engines is recommended when you need to find specific information.

3.5.1 Search engines

Search engines are automated retrieval tools for finding information from the Internet in an easy way. They allow searching through the use of word

strings and operators (and, or, not, near etc.). There are six most widely used search engines.

These are Altavista, Excite, Infoseek, Lycos, HotBot and Webcrawler. Table.2 depicts a brief summary of these search engines.

Table –2: Search engines

Search Site	URL	Summary	Pros	Cons
Altavista	http://www.alta-vista.com	Large as well as fast	Returns many hits; option for advanced search	Low relevance
Excite	http://www.exite.com	Launched in 1995. It is a web directory as well. It is fast, current and large.	Concept search technologies, personalised option.	Delivery of duplicates
Infoseek	http://www.infoseek.com	Started in 1995, along with a directory. Easy to use.	High relevance	Limited database size.
HotBot	http://www.hotbot.com	Launched in May 1996. High speed. Strong product information	Drop down menu for search options; high speed.	Delivery of duplicates
Lycos	http://www.lycos.com	One of the oldest search engine dating back to May 1994.	Also searches graphics, sounds and video	Slow
Webcrawler	http://www.webcrawler.com	Started in April 1994, it has a large database.	Easy to use, relatively fast	High number of hits; low relevance.

The WWW is a great consumer of time. With its exciting navigation facilities, very often users tend to hop from page to page and waste a lot of time in the process. In order to save time it is advisable to use the search engine to find out the needed information. Recently the development of push technology has made the search engine more personalised. You can specify your requirements and then wait for the regular posting of search results to your screen by the push technology.

However, once you find your desired information you may want to have a copy of it. At this stage, one must be sure of the copyright requirements. If copying is allowed from the specific page you can *download* it on to your hard disk or on to a floppy. It is a simple process. You can go to the file option in the web browser and save the document to a desired destination.

3.6 IMPLICATIONS OF INTERNET FOR DISTANCE EDUCATION

It has been mentioned earlier that a network eliminates the need to purchase copies of software or information by its users. In DE the learners can access and use resources available on the Internet. DE students have very flexible times of study because distance learners are mostly working people. Learning through Internet is not constrained by rigid timing. Learning can be done at any time convenient to the user. The timing of the library, interaction with teachers or peers is not rigid. They can be approached at one's own convenience.

Information disseminated through printed books takes considerable time to be updated as the process of bringing out new editions of books is

cumbersome. Similarly information provided through audio or video media also takes a longtime to be updated. Retrieving information through the Internet not only provides access to information instantaneously and at low cost but also provides access to the latest information as updating online courses is much easier and relatively inexpensive. The Internet and *WWW* provide opportunity for collaborative learning; makes web based teaching possible; and facilitates interactivity for learning. Now let us discuss each of these in detail.

3.6.1 Web based education and training

The World Wide Web (WWW) has become one of the most popular delivery methods for distance learning programmes. As mentioned earlier, the web has the ability to deliver multimedia materials, and this quality makes it highly suitable for distance learning courses. An education website can help learners to read, see, hear, and interact with, web-based information. It can also allow communication amongst learners. The web enables the trainer/educator to design chunks of information as modules for the learners. A good web-based course allows learners to do the following:

- Easily move among chunks, both within a single web site and among web sites;
- Browse through the information by scrolling, or through links (including buttons, menus, hypertext links, and icon);
- See the relationship between chunks of information and not get lost in cyberspace (for example by using a directory, table of contents, list of links);
- Upload and /or download information; and
- Understand where information is located and how to work with it (Porter,1997).

At present a large number of courses are available online in the web. It is not necessary here to outline the courses available, as these will soon become dated. However, what is important is the design and development of web based courses. While designing web-based courses, the following issues should be looked into critically:

Administrative questions

1. Who should be given access to full materials?
2. Who should be given access to samples?
3. How will the access be limited?
4. Who will update the information on the website?
5. Who will monitor the website?
6. How long will the course be available?
7. What should be the entry and exit points?

Academic questions

1. What type of materials (text, graphics, audio, video,animation, quizzes) should be included?
2. How will the materials be linked to internal and external resources?

3. How often will the materials be updated?
4. How will the learners work with the materials on the website?
5. What kinds of communication will the learners have ?

Some educational web sites are as follows:

IGNOU, India	http://www.ignou.org
USQ, Australia	http://www.usq.edu.au
Athabasca University, Canada	http://www.athabascau.ca
IET, UKOU	http://www-iet.open.ac.uk/iet
NIIT Netversity	http://www.niitnetversity.com

3.6.2 Interactivity and collaborative learning

The Internet provides to learning a much-needed interactivity. Also, being interactive it allows collaborative learning opportunities to the learners, who can interact with their teachers as well as with peer groups or co-learners. The nature of this interaction could be real-time, through a system like CU-SeeMe or IRC. It could also be through mailing lists and e-mail. Whether delayed or real-time the quality of interaction is important in the process of learning. The learners have some control over the time and pace of their study and they can ask question at anytime. Web based courses also provide instant feedback on tests. Thus the check your progress exercises of the print medium could be made more interactive, since learners can now submit assignments online and can receive comments immediately too. However, what is most important for online courses (which are global in nature because of a diverse stu t group) is the possibility of collaborative learning for the global student body. Collaborative learning through computer mediated communication enhances team performance through tools for communicating each person's ideas structuring group dialogue and decision making, recording the rationale be d choices, and facilitating collective activities (Dede, 1996). Students omplete group projects and assignments over the network. The Internet provides the learner with constructivist experiences through collaboration and facilitates comprehension, long-term retention and the ability to generalise instructional materials.

Check Your Progress 4

Notes: *(a) Write your answer in the space given below.*

(b) Compare your answer with the one given at the end of this unit.

a) How would you find material on distance education in WWW?

b) Identify the three most important implications of the Internet for distance education.....

.....

.....

.....

3.7 STRENGTHS AND LIMITATIONS OF THE INTERNET

So far, we have discussed the possibilities and opportunities that the Internet provides for the next generation education and training. Now, we try to summarise its strength and limitations.

Strengths

- *Wealth of information resources*: The Internet provides a wide range of information resources in almost all fields of knowledge.
- *Multimedia capabilities*: The multimedia capabilities to store, process and disseminate information in a variety of formats make it highly convenient for education and training.
- *Ease of use*: The simplicity and ease to access and use is the hallmark of the system.
- *Fast and up to date*: It provides a fast and reliable communication infrastructure that provides up-to-date and almost real-time information.
- *Number of people reached*: At present the Internet has more than 36 million host computers. This indicates the wide reach of the Internet to a large number of people.
- *Affordability*: As the technology matures, the cost also goes down. Even the cost of computers is moving at a faster rate. As such, Internet access cost ranges from $1 to $ 10 per hour in addition to telephone charges. In India, at the current rate it costs around Rs. 30/- per hour in addition to set up cost and telephone charges.
- *Technology support*: A worldwide community of experts is working on this technology round the clock. Many are also working in an individual capacity. So technology support in this area is clearly excellent.

However, there are some limitations to the use of the Internet, at which we should take a look.

Limitations

- *Junk e-mail*: Institutions connected to Internet are flooded with useless and unwanted e-mails. This consumes a lot of the subscriber's time.
- *Security*: Internet security is a very important issue. As messages travel across several backbone infrastructures, there is the possibility of hacking and leakage of sensitive information over the network.
- *Computer virus*: Internet e-mail and downloaded files from the WWW have been reported to contain viruses. This demands every computer should be installed with anti-virus software.
- *Less serious issues discussed*: As the Internet is a public forum, every one can join it and share their views. Many a time the discussions are not too serious.

- *Lack of support to rural people*: The Internet is still an urban phenomenon, at least for developing countries at present. So it increases the divide between the haves and the have-nots.

3.8 COMPUTER AND COMMUNICATION SKILL FOR TEACHERS

The developments in computers and communication systems requires a new set of professional teachers (distance teachers) who can adapt to the changes very fast and deliver courses on demand in the 21st century. Teachers in the information age will be subject experts with additional roles. They will fulfil the roles of information consultant, team collaborator, learning facilitator, education adviser besides course developer. To accomplish all these roles successfully and efficiently, teachers in the 21st century need to possess some basic skills (Kook, 1997). They should be able to:

1. Navigate desktop environments in windows.
2. Use WWW services; copy and transfer files.
3. Read and write HTML files.
4. Use compressed and decompressed files.
5. Participate in computer conferencing.
6. Use a web–phone and talk.
7. Send and receive mail via national and international communication networks.
8. Learn a few of the necessary computer programming languages for example, Java, available in the networking environment.
9. Use authoring tools.
10. Make and use a CD-ROM title for instructional courses or materials.
11. Operate laser optical devices: CD-ROM, DVD and Videodisc.
12. Create a product with desktop publishing.
13. Make a product in Draw and paint and animated graphics.
14. Make a home-page for students, teacher, and schools.
15. Create a product in HyperCard.
16. Access Bulletin Board Services via modem.
17. Participate in one way and two-way interactive satellite classes on a PC.
18. Send and receive e-mail.
19. Use the Internet for FTP files.
20. Talk in the IRC.
21. Search a CD-ROM for specific information.
22. Use an optical scanner.
23. Use a LCD projection system.
24. Prepare a video lesson for use in a presentation via computers.
25. Use a word processor in DOS and WINDOWS.
26. Use databases and spreadsheet programmes.
27. Load and install software.
28. Use graphic programmes.
29. Install cards in ports, and connect and disconnect peripheral devices and cables modems.
30. Use groupware software participation by teams.

3.9 LET US SUM UP

In this last unit of the block/course, we have discussed a very important subject that has high significance for distance educators, distance learners and distance education. As the evolution of distance education progresses from being a largely print-based medium to becoming a multimedia technology based system, the role of the Internet will be more predominant. The unit at the end also signifies, that the Internet is going to decide the future of distance education. However, it is difficult to predict anything very specifically, since technology is developing faster than books can be written about it.

In this unit we have tried to familiarise you with the concept of computer networks; their advantage in resource sharing, communication, information management, global database search etc.; data communication channels; network hardware technology and network types. With this background, we have discussed the growth and development of the Internet, which had just 4 hosts in 1969. Now it has more than 36 million hosts in almost all the countries of the world. In India, the Internet service, for commercial purposes are provided by VSNL, which has by now a userbase of only 150,000 (and growing). However, the recent liberal policies of the Government of India will bring about dramatic changes in future. We have also discussed how the Internet works based on the TCP/IP standard. The Internet domain naming system has also been explained. The Internet being the gold mine of information has a number of services.

We have also discussed telnet, file transfer protocol, electronic mail, Internet chatting, mailing lists, CU-SeeMe, and the World Wide Web. Having discussed and explained how these services are provided, and used we have elaborated on how to use WWW through browser and search engines. The implications of the Internet for distance education have also been identified as Web-based education and training, interactivity, and collaborative learning. And, finally, the strengths and limitations of the Internet have also been discussed. Towards the end we have outlined the future skills expected of teachers. These skills will be very much required in the 21st century as, the demand for courses using computer and communication networks will increase tremendously. Therefore, distance education professionals have to train themselves to gear up for meeting the challenges of the 'information age' in order to remain in the 'business' of distance learning.

3.10 CHECK YOUR PROGRESS: THE KEY

1) a) The advantages of computer networks are :

- Resource sharing
- Access to global databases
- Powerful communication
- Improved information management
- Interactive information exchange
- Time and money saving.

b) (i) True (ii) False (iii) True (iv) True.

2) rse@pequest.com ignou@goisdl01.vsnl.net.in

rse = User name ignou = User name

pcquest = Host gaisdl01 = Host

Com = Domain vsnl = Subdomain

net = network and in = India.

3) (i) F, (ii) T, (iii) T, (iv) F, (v) T, (vi) T

4) a) From the web browser, the address of one search engine will be typed and then once the search engines gets activated the term 'distance education' will be given as a string to find the desired material.

b) The three most important implications of the internet for distance education are :

- Web-based education and training;
- Interactivity; and
- Collaborative learning.

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